

Initial Environmental Examination

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July 2015

PAK: Provincial Road Improvement Program: Rehabilitation of the Mirwah to Naukot Road

Prepared by the Engineering Consultant International Pvt. Ltd. (ECIL) for the Sindh Works and Services Department and the Asian Development Bank.

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Abbreviations

ITEM	UNITS	DEFINITION
ADB		Asian Development Bank
ADB SPS		Asian Development Bank Safeguard Policy Statement 2009
CEWP		Construction Environmental Work Plan
CO	mg/m ³	Carbon monoxide
dBA	dB	Decibels (A measure of audible noise)
EARF		Environmental Assessment and Review Framework
EIA		Environmental Impact Assessment
EMP		Environmental Management Plan
ES		Environment Specialist of Project Management Unit
GRM		Grievance Redress Mechanism
GFP		Grievance Focal Person
IEE		Initial Environmental Examination
IRI		International roughness index
km		kilometres
Km/h		Kilometres per hour
m		metres
mm		millimetres (1/000 metre)
masl		metres above sea level
NEQS		National Environmental Quality Standards
NO ₂	mg/cm ³	Nitrate or Nitrogen Dioxide
PEPA		Pakistan Environmental Protection Agency
PMU		Project Management Unit
PPP		Public Private Partnership
RAP		Resettlement Action Plan
RoW		Right of Way
SNEQS		Sindh National Environmental Quality Standards
SO ₂		Sulphur dioxide
SPS 2009		ADB's 2009 Safeguard Policy Statement
SSEMP		Site Specific EMP
TPM	micrograms /m ³	Suspended particulate matter, with particles ≥ 10 microns in size, and a danger to lungs. Also referred to as PM ₁₀
S-EPA		Sindh Environment Protection Agency

Executive Summary

The Government of Sindh (GoS), through its Work and Services Department (WSD), aims to provide an affordable, safe and sustainable road network in the province. To help achieve this, GoS sought assistance from the Asian Development Bank (ADB) to reconstruct or rehabilitate up to 400 kilometres (km) of deteriorated roads .

The road sections to be reconstructed or rehabilitated were selected from an initial list of 700 km of roads, then ranked in order of importance (primarily based on the traffic volume) and road condition. The initial technical ranking was adjusted to ensure a more even distribution of roads across the province resulting in a short list of six roads totalling 391 km of which 328km will be reconstructed or rehabilitated under the ADB loan. Reconstruction involves the removal of the asphaltic pavement base layers and granular sub-base layers, building up and widening of the sub-base layers where necessary to achieve the desired profile and providing new granular and asphaltic concrete sub-base base and riding surface. Rehabilitation involves roughening or applying a tack coat to the current riding asphalt layers to improve adhesion if it has become polished; and providing an overlay of new asphalt base and riding courses.

This report is Initial Environmental Examination (IEE) for the reconstruction of road number 6, the 64 km Mirwah to Naukot Road which links the N120 National Highway at Mirpurkhas district with the Naukot District Tharparkar. The report has been prepared pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014 and ADB's Safeguard Policy Statement (SPS 2009).

The proposed activities will be confined to the existing road right-of-way (RoW). For the purposes of this IEE, potential impacts were considered within a corridor extending some 15 meters on either side of the road centreline. Both rehabilitation and reconstruction within the existing carriageway are ADB category B works, requiring an IEE.

Most of the environmental impacts such as shorter travelling time, better access to market, fuel savings, and less dust are positive and do not require mitigation. The social and poverty impacts of the rehabilitation project are addressed in detail in a separate Land Acquisition and Resettlement Plan report. However there are some adverse impacts during project preparation construction and operation.

Preconstruction Period: Environmental assessment documentation and the Environment Management Plan (EMP) are prepared and approved during the preconstruction period and translated into the local languages for distribution to all stakeholders. The EMP's mitigation (EmiT) and monitoring (EmoT) tables (Annex -1) identify actions to be undertaken by the Sindh Works and Services Department (WSD) and

the Construction Supervision Consultant, including a task to brief the selected maintenance staff of the WSD and any contractors on the EMP and the actions to be undertaken. WSD will provide a briefing to contractors on the contract and implementation requirements of the EMP.

Construction Period: Construction phase EMP actions focus mostly on contractor activities, the management of worksites and contractors' equipment and people. Specifically this part of the EMP focuses in defining ways to minimize effects such as dust generation, emission from vehicles and air quality, disposal of spoil and solid waste, noise and vibration from construction machinery, quarry and borrow material transport and disposal, contamination of surface and groundwater resources and work camp management.

Many of the culverts are blocked, damaged or poorly sized. Where the road is widened, the culverts will need to be extended. To gain access to the culvert or to provide for a new culvert, it will be necessary to provide a temporary road diversion, or to close one side of the road at a time and institute traffic controls. Repair of the road once culverts are replaced will follow a specific procedure defined in the EMP. It may also be necessary to provide temporary diversion for the water around the area being worked. Ideally the work will be undertaken in dry season when water flows are minimal.

Any mosques, graveyards and other cultural sites that could potentially be affected by the work were identified. In the event, only one mosque, located at chainage 4+200-4+300, will be marginally affected. There should be no damage to other cultural sites or to any archaeological sites. Only three trees need to be cut, while trees on the embankments need not be disturbed.

Appropriate mitigation protocols are defined in this IEE. A detailed inventory of the sites showing the approximate location of the structures is provided in the IEE. By applying careful highway design all other potential impacts can be avoided. However care will need to be taken during construction activity.

Operating Period - Operation period actions focus on confirming that the contractor has completed the EMP tasks required and that the operation of the improved road does not aggravate existing problems such as road safety. Speed limits will need to be monitored by traffic police.

The project has been discussed with local people, government officials and NGO as recorded in the IEE annex. There was general support for the project, with no serious issues raised. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust during construction. There was also a concern about safety, during construction, but generally a view that improved road conditions would improve safety.

A schedule of activities associated with reconstruction has been prepared and the potential environmental impacts of each activity assessed. For each activity, recommended mitigation and monitoring actions have been identified. These are covered in the EMP. All impacts are minor and able

to be mitigated. This IEE study authors concluded that the proposed road project will not lead to significant adverse environmental and social impacts. Careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements. The environmental safeguard implementation will have to be monitored by concerned agencies, including the Contractor, the Environment Specialist from the provincial environmental safeguards unit, the PMU and WSD. Due diligence, with mandatory coordination among various stakeholders will further ensure mitigation of any adverse impacts.

The estimated cost of implementing the EMP is Rs 35,223,892 for the contractor including a 10% contingency.

I. INTRODUCTION

A. The Project

1. The Government of Sindh (GoS), through its Work and Services Department (WSD), aims to provide an affordable, safe and sustainable road network in the province. To help achieve this aim, GoS requested a loan from the Asian Development Bank (ADB) to reconstruct or rehabilitate up to 400 kilometres (km) of deteriorated roads.
2. The worst sections of the project roads will be reconstructed, involving the removal of surface pavement, building up and in some cases widening of the sub-base layers and providing a new asphaltic concrete base and riding surface. Other sections will be rehabilitated; involving scarifying the current riding asphalt layers and providing an overlay of new asphalt base and riding courses.
3. The road sections to be reconstructed or rehabilitated ([Table 1](#)) were selected from an initial list of 700 km of roads by ranking the roads in order of importance (primarily based on the traffic carried) and condition. The initial technical ranking was adjusted to ensure a more even distribution of roads across the province. A road map of Sindh showing the selected roads is shown as

Table 1 List of Selected Roads

Road sections	Km	Km under ADB loan
Kandhkot – Jacobabad (01)	77	77
Jacobabad – Ratodero (02)	55	32
Khyber – Sanghar (03)	64	64
Sanghar – Mirpur Khas (04)	64	64
TM Khan – Badin (05)	67	67
Mirwah – Naukot (06)	64	53
Total	391	238

4. A separate IEE has been prepared for each road. This IEE is for Mirwah to Naukot (road number 6).

B. Purpose and Scope of the IEE

5. The purpose of this IEE is to identify potential impacts during all stages of the road reconstruction and rehabilitation project, list actions that will prevent or at least mitigate any negative effects of the work and specify a monitoring programme for implementation by the Works and Services Department (WSD), ensuring that the actions discussed in the IEE are carried out in a credible and timely manner

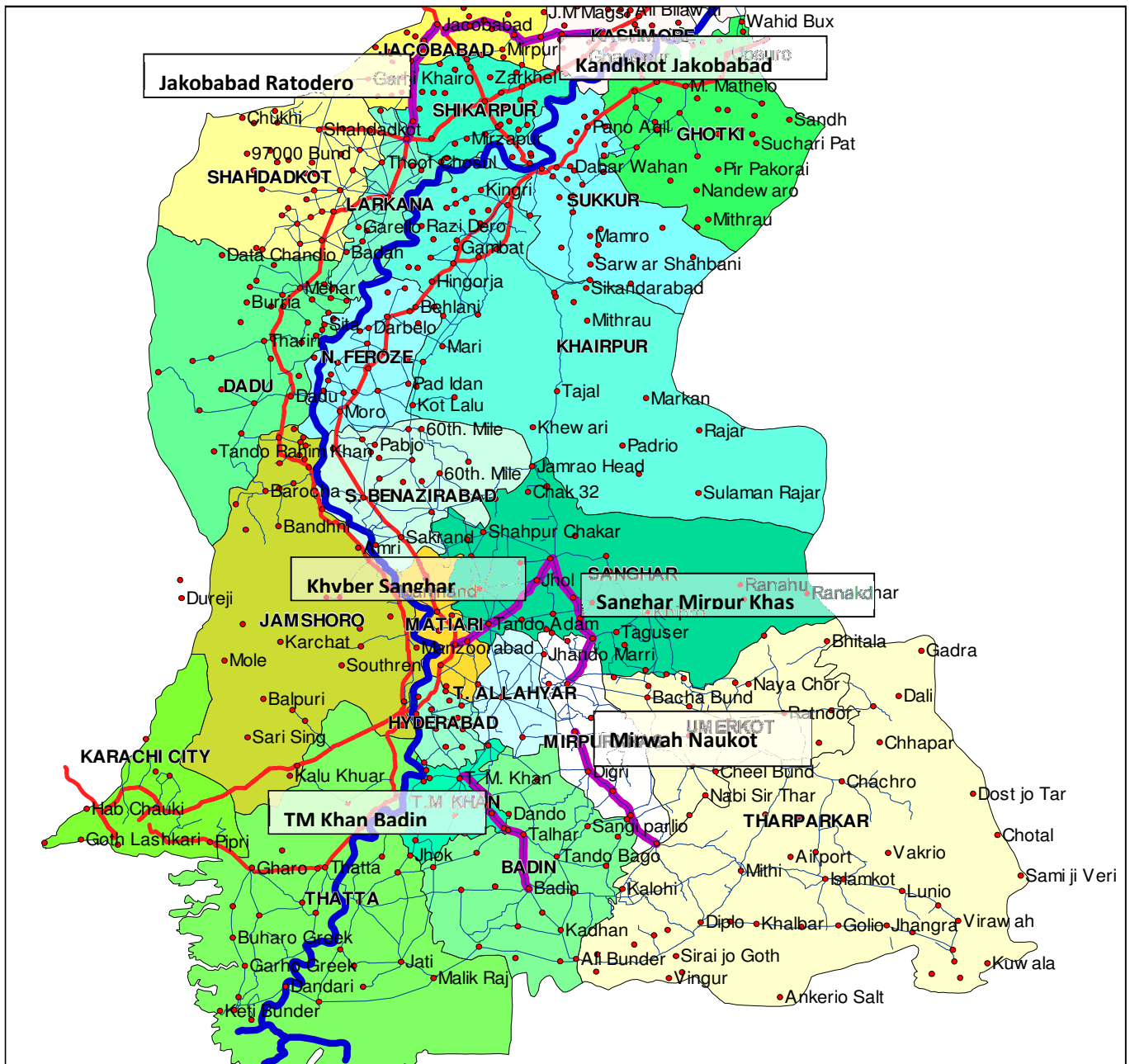


Figure 1 Sindh showing Project Roads; Project Roads in purple.

6. This IEE has been undertaken pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014 and ADB's Safeguard Policy Statement (SPS 2009).
7. The social and poverty impacts of the rehabilitation project are addressed in detail in a separate report.

C. Regulatory Framework and Environmental Classification

1. Pakistani Regulations

8. The Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000 (“the PEPA regulations”), together with section 12 of the Pakistan Environmental Protection Act 1997 requires that every new development project in Pakistan is preceded by an environmental examination, leading to either no further action, an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the magnitude of the project and severity of impacts anticipated during construction and once the project becomes operational.. The PEPA Regulation classifies all road rehabilitation and reconstruction, including reconstruction of existing paved roads as Category C, meaning that no environmental assessment is necessary and only a short justification statement need be submitted to the Sindh Environmental Protection Agency (S-EPA).
9. Other Pakistani regulations that apply are: the National Environmental Quality Standards (NEQS) 1997 and various amendments which makes it illegal to discharge any effluent or emit air pollution or noise exceeding the National Environmental Quality Standard; the Sindh Wildlife Protection Ordinance 1972, the Wild Bird and Animal Protection Act 1992 and various other amendments which make it illegal to undertake any project activity inside a protected area (national park, wildlife sanctuary, or game reserve) or to hunt or poach wildlife without special permission; the Cutting of Trees (Prohibition) Act 1992 which makes it illegal to cut or chop down trees without the prior permission from the Forest Department; and the Antiquities Act 1975 which prohibits new construction in the proximity of a protected antiquity and empowers the GoP to prohibit excavation in any area that may contain articles of archaeological significance. These Acts must be well understood by contractors, who must ensure compliance by their workers.

2. ADB Safeguard Policy and Project Classification

10. ADB’s Safeguard Policy Statement (SPS 2009) consists of three operational policies on the environment, indigenous people and involuntary resettlement. SPS 2009 provides information on good practice approaches to implement safeguards. Overall this policy aims to avoid or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process.
11. An initial screening of the project roads was undertaken to assess the potential impacts and risks. It was concluded that there will be limited, generally site-specific and reversible impacts that can be readily addressed through mitigation measures. In line with SPS 2009, this project is therefore classified as environment Category B and this IEE (including its Environmental Management Plan (EMP)) has been prepared consistent with ADB requirements for a category B project.

D. Methodology

1. Baseline Physical, Environmental and Social Data

12. The first task was to assemble all existing data on the road's physical condition and the proposed maintenance and rehabilitation actions to be applied. Using this knowledge, the project's corridor of impact – generally considered to extend 15m each side of the carriageway centreline – was identified and the existing ecological and social condition recorded. These data formed the baseline against which possible changes due to construction were defined.
13. The environmental assessment team completed a number of site visits to the road corridor to collect baseline environmental (physical and ecological) and social data.

2. Literature Review/Baseline

14. Legislative and regulatory requirements pertaining to the project were reviewed along with other available data and previous IEE/EIA studies conducted in the region. Studies reviewed included the following:
- Hyderabad Mirpurkhas Dual Carriage way Road Environmental Impact Assessment Study (Final Report); Prepared by Project Procurement International; October 2009.
 - ADB Assisted Flood Emergency Reconstruction Project (FERP), Upper Sindh Package Loan 2742-Pak, Initial Environmental Examination (IEE) Prepared by ECIL for Sindh Works and Services Department Government of Sindh, November 2011.
 - National Highway Development Sector Investment Program-Tranche3; Assisted by ADB; Environment Impact Assessment Study of Hasanabdal Havelian road Section E-35; Draft Report March 2012.
 - Road assessment Program India; Initial Environmental Examination report Assam; Project no 37066; Prepared by Ministry of Rural Development for ADB; June 2008.
 - Asian Development Bank, Safeguard Policy Statement Guideline; June 2009.
 - Sindh Water Sector Improvement Program: Environmental Impact Assessment for Works on Khipro and Mithrao Canal. September 2012.
15. In addition, the following web sites were reviewed and relevant information is included in this report.
- <http://www.meowweather.com> date visited: September 2014
 - www.pbs.gov.pk date visited: September 2014
 - <http://dearsir.pk> date visited: September 2014

3. Impact Identification

16. The activities to be undertaken in conjunction with or arising from the reconstruction or rehabilitation of the Project road were enumerated and the environmental impact of each action was assessed, taking into account the road's location and the existing environment. This included pre-construction activities, reconstruction and operation of the rehabilitated or reconstructed road.

4. Mitigation Measures and Environmental Management Plan

17. For each action with potential impacts, a mitigative measure, and action to either prevent or minimize negative effects, was identified and a monitoring requirement specified. These were compiled into a comprehensive Environmental Management Plan (EMP) which also identifies where and when actions will need to be undertaken and who will be responsible.

18. The list of activities, impacts and mitigative measures is included in the EMP (Chapter **Error! Reference source not found.** and Annex 1.

II. PROJECT DESCRIPTION

A. Project Description

19. The project is to reconstruct the provincial highway that links the N120 National Highway at Mirpurkhas district with the Naukot District Tharparkar. The road passes two provincial towns, Digri and Jhudo. When reconstruction is complete, the road will form a new provincial highway linking Tharparkar to the N120 for traffic to or from Umerkot, Mirpurkhas, and Sanghar Districts.

B. Existing Condition of Project Road

20. The road is in reasonable condition as far as Digri (18 km) and between Naukot and Mithi (47 km) but the middle 45 km is mostly in bad condition, which requires urgent renewal.

21. A typical cross section also showing the existing road is shown as **Error! Reference source not found.**

C. Re-Construction & Rehabilitation to be Undertaken

1. Scope of Work

22. The project design has allowed for the entire length of the Mirwah to Naukot road to be reconstructed with new sub-base, base and wearing course. It may be possible in some places to limit the works to pavement rehabilitation. The final decision will be made by the site engineer. This section describes the steps required for both rehabilitation and reconstruction, and the EMP provides for either or both actions to be taken. A full list of maintenance, rehabilitation and reconstruction actions, impacts and mitigations are included in the EMP

23. The proposed activities will be confined to the existing road right-of-way (RoW). For the purposes of this IEE, potential impacts were considered within a corridor extending some 15 meters on either side of the road centre line. Both rehabilitation and reconstruction within the existing carriageway are category B works.

2. Reconstruction of existing carriageway

24. Reconstruction work involves the removal of the asphaltic pavement base layers and granular sub-base layers, building up and in widening of the sub-base layers where necessary to achieve the desired profile and providing new granular and asphaltic concrete sub-base base and riding surface.

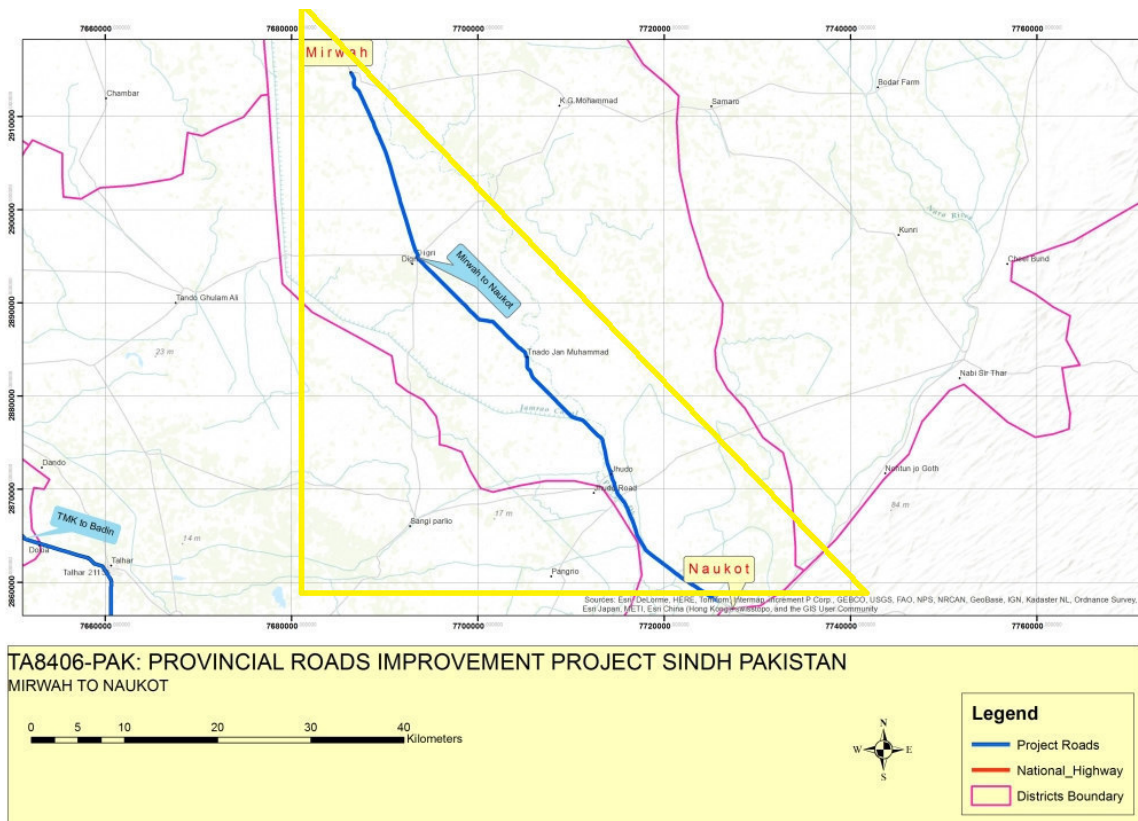


Figure 2. Pakistan showing the location of the Project road

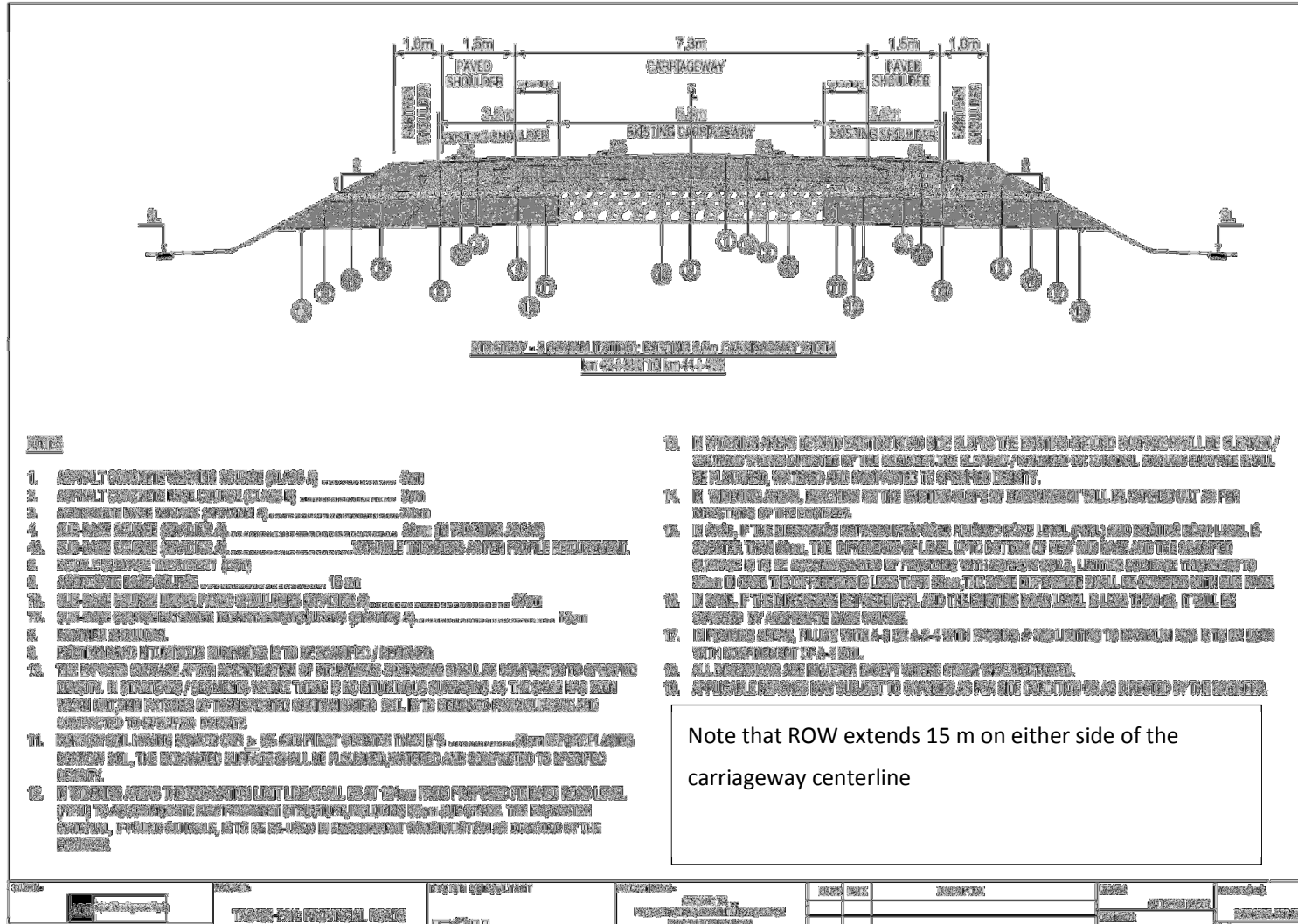


Figure 3 Typical Cross Section

25. The main steps involved in reconstructing a section of road are:

- i. Clear vegetation on the existing shoulder and 40 cm beyond the base of the shoulders (widened if required) to provide clear access to the construction site.
- ii. Remove and dispose of existing bituminous surfacing. Unsuitable or contaminated base and sub base material is also to be removed and transported to an approved disposal site.
- iii. Use borrow materials to repair the existing earthen shoulder. The shoulders shall be graded, watered and compacted to a specific density.
- iv. Use recycled or new crushed aggregate to provide a compacted aggregate base course over the width of the pavement (depth may vary as per profile)
- v. Lay an asphaltic concrete base course (depth may vary as per profile)
- vi. Lay a 50 mm asphaltic concrete wearing course
- vii. Place 150mm aggregate base course on the earthen shoulders and grade and compact to level with the top of the wearing course.
- viii. Apply road markings and install signage and safety barriers as applicable
- ix. Undertake any planting as appropriate

3. Rehabilitation (Overlay)

26. Rehabilitation involves scarifying the current riding asphalt layers and providing an overlay of new asphalt base and riding courses. The key steps are:

- i. Clear vegetation on and up to 40cm from the base of the shoulders to provide clear access to the construction site
- ii. Use borrow materials to repair the existing earthen shoulder. The repaired shoulders shall be graded, watered and compacted to a specific density.
- iii. Any localized potholed cracked, distressed stretches / areas the patch work in full depth of existing bituminous layer(s) will be carried out before laying of new asphalt concrete layer.
- iv. Scarify existing bituminous surfacing. Material removed is to be transported to an approved disposal site.
- v. Lay an asphaltic concrete base course (depth may vary as per profile)
- vi. Lay a 50 mm asphaltic concrete wearing course
- vii. Place 150mm aggregate base course on the earthen shoulders and grade and compact to level with the top of the wearing course.
- viii. Apply road markings and install signage and safety barriers as applicable
- ix. Undertake any planting as appropriate

4. Rectification of Bridges

27. The process for bridges is as follows:

- Preparation of a complete bridge inventory
- Cleaning of all concrete surfaces including girders and transoms.
- Providing plaster to guardrails and posts including curbs wherever necessary.
- Cleaning expansion joints.
- Repairing training works wherever necessary
- New Deck construction (as & where required depending upon the deteriorated condition of Deck slab).

28. Only one bridge requires repair, this is located at chainage (44+685).

5. Reconstruction and Rehabilitation of Culverts

29. Many of the culverts are blocked, damaged or are inadequate. Where the road is to be widened, the culverts will need to be extended. To gain access to the culvert or to provide for a new culvert, it will be necessary to provide a temporary diversion or to close one side of the road at a time and institute traffic controls. Restitution of the road will follow the steps outlined in section II.C.2 above. It may also be necessary to provide a temporary diversion for the water channel. Ideally the work will be done in dry season when water flows are minimal.

30. The steps for repairing or replacing culverts is as follows:

- All vegetation shall be removed from culvert inlet and outlet up to 5m, from either side.
- Where water channels have to be diverted or construction, this will be done during the dry season and new culverts will be placed on a 30 cm thick sand cushion.
- Where culverts needs extension, provide a 300 mm sand cushion and place lean concrete as a base,
- New reinforced concrete slab culvert to be provided as per the drawings, Re decking of culverts as and where applicable
- The masonry side walls shall be deep pointed including replacement of parts of masonry which has deteriorated and re-laid with good quality bricks and mortar.
- In the base slab all pitting shall be rectified by providing bonding agent and a 75mm thick concrete cover with 10mm diameter bars placed at 250mm centres. Anchor bars shall be drilled into the base slab. The anchor bars shall be 13 mm diameter placed 600 mm centres and drilled 150mm into the base slab.

- The top slab shall be examined for any cracks which shall be repaired with epoxy injection.
- Where the concrete cover has broken and steel reinforcing is exposed, the area shall be marked and all rusted reinforcement shall be removed and replaced by better quality new steel of the same size and area and nailed to the concrete surface. In such areas, concrete shall be chipped to at least 75mm in thickness, a bonding agent shall be applied and concrete shall be applied in the form of plaster. Steel rods 15mm in diameter shall be drilled into the old concrete at 450mm centres and grouted.
- After rectification work is carried out all the areas shall be coated with a polymer reinforced cementitious waterproofing compound.
- The roadway and shoulders shall be restored following section II.C.2 above.

D. Construction Materials

31. Construction materials require transportation from the source to the work site as follows.
32. **Stone** -Stone for base course is available at Kotri quarry which lies at a distance of 130 Km from the NH5 end of the road at Hyderabad and N120 end of the road at Mirpur khas and towards provincial road Tharparker. It can be supplemented from Ganja quarry which is at a distance of 130 km from Mirwah
33. **Bitumen**- The National Refinery Karachi (255 km from Mirwah) is major supplier of bitumen for Pakistan, and supplies will have to be trucked to the local-area asphalt plant. There will be no problem in its procurement right from the source
34. **Cement** - There are quite a few cement factories in the vicinity of project road, namely Pak Cement Factory in Hyderabad (95 km from Mirwah), Lucky Cement Limited and Power Cement Factory in Nooriabad (185 km from Mirwah)
35. **Sand**-Good quality of sand is available at Bollori which is 15 Km beyond Kotri quarry as well as from Jamshoro which is in the vicinity of Hyderabad (102 km from Mirwah)There are other quarry sites available in the sub-project area which can be utilized. These are all within 115 km of where road maintenance and rehabilitation will take place.
36. **Steel Reinforcement (Rebar)**- The main Steel Industry of Pakistan is in Karachi. In addition, the following steel mills are being run in Hyderabad, and can supply rebar, but only after proper materials testing:
- Mehran Mills
 - Islam Mills
 - Hyderabad Mills

37. The distance from Hyderabad mills to Mirwah, the project start location, is about 95 kilometers.
38. **Aggregate and Concrete** - Crushed stone aggregate for concrete is available in Nooriabad, Jamshoro, Petaro, all between 130 and 170 kilometres from the road.
- Crushed Aggregate for Asphalt Concrete Petaro Quarry
 - Sub Base (Muram) Kotri Quarry
 - Aggregate Base Course Petaro Quarry
 - River Sand From Indus River Basin
39. **Bricks**- The existing bridges and culverts have masonry abutments and piers constructed using locally manufactured bricks. There are many brick kilns along this project road.
40. **Water** -The Project road crosses a number of watercourses, minor and major canals. The Contractor will be able to use canal water for general construction purposes with the permission of State Irrigation Department and Sindh Irrigation & Drainage Authority. While the amount of water required is considerable, it is should be negligible when compared with the amount available. According to residents along the road, well water suitable for drinking is available at a depth varying from 12 to 14 meters.
41. **Reuse /Recycling of scarified material from the road surface** The material from the scarification / removal of the existing road surface is judged by the material engineer as being not suitable for use on the Project road due to its poor quality and the small quantities involved which makes recycling uneconomic. This leaves the following options.
- Option 1:** Waste material that meets required specifications will be used as fill when constructing or repairing the shoulders.
- Option 2:** Waste material can be used to refill borrow pits and covered with topsoil¹
- Option 3:** Scarification materials can be spread on earthen link roads, and compacted with rollers, improving the road surface as well as reducing road dust.
42. The total quantity of material to be disposed of is estimated to be 30,461 m³.

¹ A detailed investigation by T. Townsend (1998) on the leaching characteristics of asphalt road waste found that such material was safe to use in any non-agricultural use setting, i.e. as soil material in fields, etc.

III. DESCRIPTION OF ENVIRONMENT

43. The description of the environment of the project roads requires baseline data on the following:

- Physical Environment
- Ecological Resources
- Socioeconomic Environment

A. Physical Environment

1. Topography

44. Sindh can be divided into four distinct parts topographically: (a) Kirthar range on the west; (b) a central alluvial plain bisected by the Indus River; (c) a desert belt in the east; and (d) the Indus delta in the South. The Mirwah to Naukot road lies in the central alluvial plain.

2. Soils

45. The soils of the Project area are of recent alluvial origin and are basically suitable for irrigated agriculture. Although, stratification is complex, the majority of soils are within the range of fine sandy loam to silty clay loams with the latter being most common. Sandy soil can be found in the desert and sand mixed clay loam 3 -5 m in depth laid over sandy soils in project area. All soils contain calcium carbonate and most contain gypsum. Salinity is wide spread, but generally ephemeral: with adequate water and drainage, most soils can be reclaimed by simple leaching.

46. The alluvial deposits date back to the time when the Hakro River (Eastern Nara) flowed through this area during the Sama and Soomra period 1298-1520 CE² in Sindh.

3. Climate

47. The seasons in Pakistan can be best classified as

- Winter, from December to March
- Pre-monsoon (summer), April and May
- Monsoon, from June to September
- Post-monsoon, from October to November
- Summer season runs from April until October and winter runs from November to March.

² site visited on dated 18.01.2015

<https://thesalientfeaturesoftheruleofsoomradynasty.wordpress.com/category/soomra-dynasty/> site visited on dated 18.01.2015

48. Sindh lies between two monsoon zones, the southwest monsoon from the Indian Ocean and the northeast or retreating monsoon deflected toward Sindh by the Himalayan Mountains, but largely escapes the influence of both, resulting in a rainfall of only 150 to 180 mm per year.
49. For the Mirwah to Naukot road, the minimum and maximum mean monthly temperature, precipitation and relative humidity are given in [Table 2](#).

Table 2 Average Air Temperature and Precipitation in Mirpurkhas³

Month	Mirpurkhas		Precipitation (mm)
	Temperature °C		
	Minimum	Maximum	
January	5.42	26.49	0.62
February	8.71	29.16	1.96
March	14.29	34.52	4.55
April	20.12	39.12	3.50
May	24.50	41.49	2.97
June	27.17	39.72	19.74
July	26.82	36.19	79.03
August	25.73	34.51	74.59
September	23.88	35.70	82.95
October	18.54	37.12	2.07
November	11.89	32.98	3.57
December	6.62	27.95	0.90

4. Air Quality and Noise

50. The Mirwah to Naukot road is located in a rural area and human activity is primarily related to agriculture with the major air quality issue being particulate matter (PM10) due to heavy dust which occurs due to the very dry and windy conditions. The situation is aggravated by human activity such as cultivation of the fields. Some dust is generated when vehicles overtake on unpaved shoulders. The incidence of this happening should be reduced with the Project.
51. Since WSD has not yet established its own environmental monitoring capacity, there is no comprehensive air quality and traffic noise monitoring data available. However, data are available for the Hyderabad- Mirpurkhas road, between 25 and 50 kilometres to the south of the project road ([Table 3](#)).

³ <http://www.meoweather.com> site visited September 2014

Table 3 Ambient Air Quality – Hyderabad – Mirpurkhas road⁴

S.NO	Test Method	Parameter	Units	Sample Location		GoP Standards (NEQS)
				Tando Allahyar	Tando Jam	
1	By Analyzer	Particulate Matter (PM ₁₀)	mg/m ³	0.967	0.539	0.150
2.	ISO-4221	Oxides of sulfur (SO _x)	mg/m ³	0.023	0.036	0.120
3.	ISO-6768	Oxides of nitrogen(NO _x)	mg/m ³	0.031	0.045	0.040
4	By analyzer	Carbon dioxide (CO ₂)	mg/m ³	546	701	----

52. Traffic volume is low and the adjacent land use is primarily agricultural. Both road and ambient noise levels increase when the project road enters into a town. Data is available for Tando Jam and Tando Allahyar two small to medium towns on the Hyderabad – Mirpurkhas road (Table 4) a nearby provincial highway that are considered typical of the expected conditions (Table 4). These noise levels are exceed for commercial area NEQS / GoP Standard in day time limits but are within the acceptable range for transport corridors as defined in Pakistan.

Table 4: Noise intensity in medium-sized towns⁵

Location	Noise intensity dBA	NEQS/GoP Standard	
		Day	Night
Tando Allahyar	72	65	55
Tando Jam	82	65	55

5. Hydrology

53. Sindh province is mostly irrigated through the Indus river system (canals and tributaries) and large aquifer sources of groundwater underline the Indus basin. They form an important source of water supply throughout the Project Area with many tube wells, motorized pumps and hand pumps in use. Groundwater in the Indus Basin is, however, of variable quality and tends to be non-saline only near the surface. Aquifers are recharged by means of seepage during flood season. The depth of the groundwater table varies from 3 meters to 25 meters along the route. Mirpurkhas district is irrigated by canals from the Guddu and Sukkur barrage system or by tube wells in areas not served by the canal network. There is one major canal, two minor canals and thirty water

⁴ EIA Mirpurkhas-Hyderabad dual Carriageway Units converted from ug/m³ and ppm to mg/Nm³

⁵ EIA Mirpurkhas-Hyderabad dual Carriageway

courses crossed by the Mirwah-Naukot road. These water sources run the entire year and are the major source of drinking water as well as water for irrigation.

54. Excessive irrigation and seepage from canals has caused water logging and salinization problems near Sanghar. Recent floods have exacerbated this problem, since farmers have converted inundated fertile agricultural lands into large aquaculture operations, whose waters generally evaporate, bringing salts to the soil surface.

6. Seismicity

55. According to the seismic zone map of Pakistan, the Project Area lies in the zone where minor to moderate damage can occur as shown in [Figure 4](#)

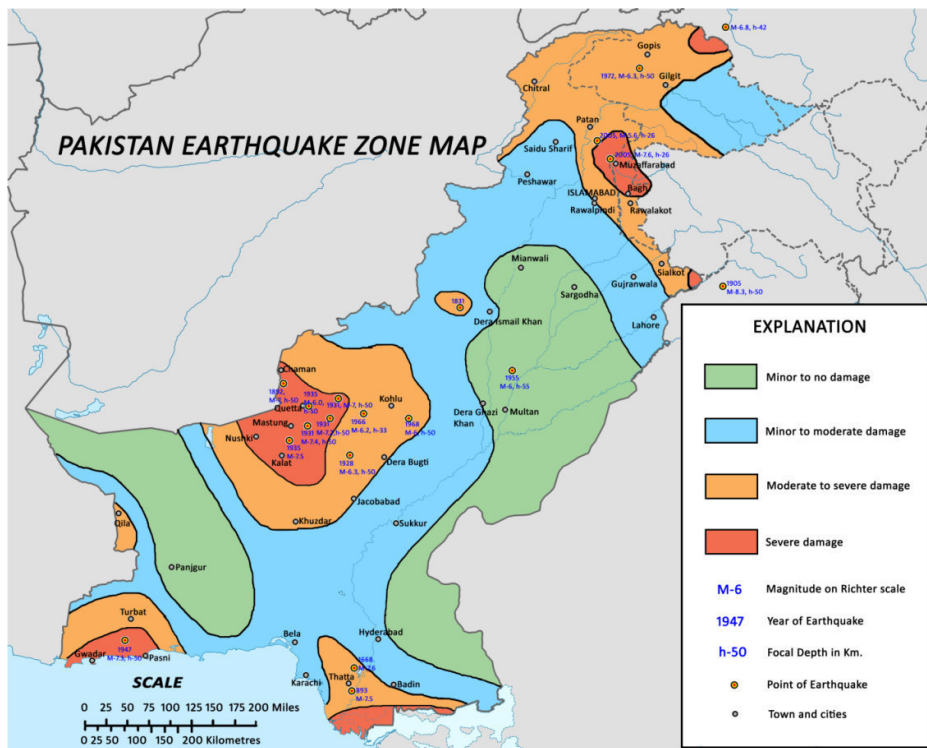


Figure 4 Pakistan Earthquake Zones

7. Archaeological and Cultural Resources

56. In order to identify potentially sensitive community structures, a survey of the Project impact area was undertaken between June 2014 and Sept 2014. Structures were identified through direct observation and by interviewing those living within the project area. Most of the structures were located near towns and urban areas.
57. Mosques, shrines and graveyards are of historical, cultural and religious importance for the people. Eleven mosques, two shrines and three graveyards were identified as being potentially affected by the proposed work on the Mirwah--Naukot road. A detailed inventory of the sites showing the approximate location of the structures is provided in

[Table 5](#). By applying careful highway design all potential impacts were avoided. However care will need to be taken during construction activity.

Table 5 List of Archaeological and Cultural Resources impinging to the ROW

S#	Road name	0-10			11-20			21-30			31-40			41-50			51-60			61-70		
		M	S	G	M	S	G	M	S	G	M	S	G	M	S	G	M	S	G	M	S	G
3	MW- NK	1	0	0	0	0	1	0	0	1	3	2	1	3	0	0	3	0	0	1	0	0
	Total	Mosque =11 , Shrines 2 and Graveyards 03																				

B. Ecological Resources

58. Due to the high intensity of human settlement, land cultivation and industry, undisturbed natural habitats are very limited. There is nevertheless still significant plant and animal diversity.

C. Flora

59. The Project Area falls within the Tropical Thorn Forest ecosystem, however much of the natural vegetation has been replaced by agricultural crops, mainly rice, sugarcane, cotton, maize, mong, mash, millet and sorghum sown in April-June and harvested during October-December; and wheat, gram, lentil, tobacco, canola, barley and mustard, planted in October-December and harvested in April-May.

60. The dominant trees in lower Sindh are babul (*Populous euphratica*), ber (*Zizyphus numularia*) and several varieties of *Tamarix* such as plai (*Tamarix gallica*) and jhao (*Tamarix diocia*), talhi (*Dalbergia sisoo*), kri (*Tamarix gallica*), karir (*Copparis aphylla*).

61. Of more concern would be damage to old plantations of *Azadirachta indica* (Neem), *Albizia lebbek* (Shrin), *Ficus religiosa* (Peepal), *Acacia nilotica* (Babul), *Cordia myxa* (Lasura) and *Ficus benghalensis* (Borh), and recent plantation of *Cornucopias*. These trees have significant medicinal value or are important culturally.

62. Among the grasses; Lumb (*Arislida depressa*), Chemmer (*Eleusine compressa*), Gorkha (*lasiurus indicus*) and Kana (*Saccharum bengalensis*) are found in the Project Area. Koondeor Dib (*Typha augustata*) is found along the water ponds scattered on both sides of the road.

D. Fauna

1. Mammals

63. Many decades ago, the project area was rich in wildlife but these have been depleted due to conversion of habitat to agricultural lands. Jackal, squirrel, fox, rats, mongoose and several species of bats are still found in the area.

64. Domestic animals including goats, sheep, camel, cows, donkey and buffalo are the dominant users of the land and have severely degraded wildlife habitat.

2. Reptiles

65. Reptiles include snakes such as cobra (*Naja naja*), rattlesnakes (*Crotalus horridus*) and rat eater snakes (several varieties). Small and medium sized lizards are also a common sight in the area. These include monitor lizard (*Varanus* sp.), spiny tailed lizard (*Uromatix hardwickii*) and fringed toed lizard (*Acanthodactylus contoris*). Turtles are also present in the area especially in the vicinity of moist lands, ponds, canals and during rainy seasons.

3. Birds

66. Important bird species found in the project area are the common crow (*Corvus brachyrhynchos*), common mynah (*Acridotheres tristis*), house sparrow (*Passer domesticus*) and common teal (*Anas crecca*). These birds are frequently visible along the roadside. Grey and black partridges (*Perdix perdix* and *Melanoperdix niger*), though present in the area, have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian roller (*Coracias benghalensis*), crested lark (*Galerida cristata*), vultures (several varieties) and quail. White heron (*Ardea alba*) and black heron (*Egretta ardesiaca*) are also plentiful and inhabit the ponds located on both sides of project roads. Water birds, including white stork (*Ciconia ciconia*), white pelican (*Pelecanus onocrotalus*), little brown dove (*Spilopelia senegalensis*) and white throated king fisher (*Halcyon smyrnensis*) are most often found using the roadside ponds as feeding areas.

E. Ecosystems

67. There are no wildlife sanctuaries or national parks or game reserves located in the project area.

68. The Sindh Wildlife Department recognizes 13 game reserves in Sindh province, the closest is Khipro forest game reserve, some 75 km north west of the road.

69. The Nara desert provides refuge to a large number of wildlife in Sind province. The Nara Canal Area, a chain of some 200 small, permanent and seasonal, freshwater, brackish and saline lakes and marshes stretching for about 150 km along either side of the Nara Canal from Sorah in the north to Sanghar in the south is known to be of great importance for wintering waterfowl and other wildlife. The Nara desert area is 30 kilometres to the north of the road and reconstruction of the project road will have no impact.

70. The nearest wetlands area is the Chotiari water reservoir, some 90 kilometres north-east of the road corridor.

F. Socio-Economic Environment

1. Road Transport

71. A traffic study was conducted to estimate the likely traffic on the road. Data were collected using video cameras, data logger and manual field observation. These data show the number of vehicles by type. Twenty four hour traffic counts for the subproject road are given in [Table 6](#).

Table 6 Twenty four hour Traffic count (number of vehicles) along subproject road

Location	Motorcycle	Car/ 4wd	Rickshaw	Vans/ PU	Mini bus	Bus	Trucks 2 Axle	Trucks 3 Axle	Trailer 4 Axle	Trailer 5 axle	Tractor trailer	Total
Mirwah - Digri	1689	275	988	153	173	21	99	50	3	1	264	3713
Digri - Jhudo	1689	275	988	153	173	21	99	50	3	1	264	3713
Jhudo - Naukot	4489	755	792	229	198	41	196	73	6	11	25	6814

72. The Consultant was advised that traffic levels can be significantly higher during the sugar and cotton harvesting seasons. The Consultant met with sugar refineries and cotton ginning mill operators to determine the annual loaded movements, the traffic catchment areas and the main destinations. Based on these discussions, the average annual daily traffic was estimated to be approximately 593 heavy vehicles a day (mainly 2 axle trucks and tractor-trailers); twice the number surveyed in June.

2. Structures Affected

73. During the topographic survey it is revealed that there will be no structures affected, including residential, religious and cultural sites. As per LARP recommendation section 2.1 and Table 2.1, except one small commercial structure will be partially affected. This encroachment is illegal but if people are moved or cultivated land is taken, compensation under SPS 2009 and ADB's Involuntary Resettlement Guidelines is nevertheless required. Resettlement is the subject of a separate land acquisition and resettlement plan (LARP).

3. Drinking Water

74. During the survey it was learnt that the water supplied by municipal authorities in the project area is generally not suitable for drinking due to inadequate treatment. Most

drinking water is surface water, but some communities and villages are totally dependent on ground water. The characteristic of ground water varies from location to location, with areas close to irrigational canals having comparatively better quality water while water in some other areas is saline.

4. Industrial and Commercial Activities

75. There is no heavy industry in the project area. There are a number of secondary industries within the district that support the agricultural economy such as rice husking, a sugar refinery, Cotton ginning and flour mills. There are also some brick kilns.

5. Employment and Income Sources in Project Area

76. Nearly all employment in the project area is in the agriculture or agriculture product processing sector. Most common jobs involve harvesting, picking, threshing, animal rearing transport driving and guarding. Local labourers commonly gain employment during the sugarcane harvesting season for crop harvest, loading and transport. Sugar mills in the surrounding area also employ skilled and unskilled labour. Various sugar mills and cotton gins create employment and continue to contribute significantly to the local economy.

77. Agricultural lands are owned by landlords and farmers work for a share of the crop. They live in the fields in small houses made from wet soil, cow dung and palm leaves. They graze cattle and grow vegetables for food.

78. Market places are typically located adjacent to the main roads where economic activity is highest. The grain and cattle markets are open every day except Fridays. Shops in the market places are mostly grocery shops and small hotels and are typically owned by local people. Smiths, workshops, hardware commodities and other house-hold items are available from stores in these markets.

79. Those not employed in agriculture include cobblers, carpenters, blacksmiths and barbers with lower incomes. Their daily wage is between Rs. 400 and 500, however, economic opportunities are limited and people face difficulties finding employment other than irregular temporary work. They are usually uneducated.

80. Agriculture is the most widespread source of income in the project area (65% of all income). Thirty percent of the population earn income as shopkeepers and kiosk holders, small business and as labourers in the sugar, cotton and rice industry and 5% are in government jobs in departments such as the agriculture department, forest department, post office, police, transport and the Pakistan army.⁶

⁶ Project of Sindh irrigation and Drainage Authority EIA report for Works on Khipro and Mithrao Canal; September 2012

6. Demography

81. The project road is located in the Mirpurkhas district, and the demography is diverse ([Table 7](#)).

Table 7 Demography of the Subproject road Mirwah to Naukot⁷

Factor	Mirpurkhas
Area sq.kms	2925
Population (Persons)	905935
Male	471096(52.00%)
Female	434839(48.00%)
Sex ratio (M:F)	108.3:100
Population Density	309.7 per km ²
Urban Population	300175(33.13%)
Rural Population	605760(66.87%)
Avg Household size (People)	6.1
Literacy ratio 10+	36.0%
Male	45.99%
Female	25.05%

82. Tribal people include Arain, Butt, Bheel, Chandio, Jamali, Khoso, Kolhi, Junejo ,Leghari, Memon, Malik, Lashari, Rind, Burdi, Syed, and Rahoo. Sindhi language is commonly spoken as mother tongue of majority of the communities in the project area. However, Balochi, Urdu, Punjabi and Siraiki languages are also spoken and understood.

7. Archaeological, Cultural and Historical Resources

83. There are no archaeological, cultural or historical resources in this corridor and none will be impacted by any of the work activities.

⁷ www.pbs.gov.pk

<http://dearsir.pk>

IV. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Design and Pre-Construction Phase Impacts

1. Lack of Environmental Capacity

a) Description

84. During the field surveys it became clear that the provincial and district government officials who will be charged with overseeing the construction are unfamiliar with the environmental impacts associated with road repairs and EMP implementation. As a result the likelihood of the mitigative and monitoring measures being implemented is low.

b) Mitigation Measure

85. During the preconstruction period and once the contractors have been selected the proponent, working with the Construction Supervision Consultant will complete a one day workshop to inform government agencies and contractors on environmental safeguards, the implementation of the project EMPs and credible environmental reporting. The workshop will be based on the presentation of examples and provision of templates for contractors and agency officials/inspectors to use

2. Lack of Integration of IEE/EMP Requirements into Construction Bid Documents

a) Description

86. The Bidding documents should reflect the requirement to select a qualified and experienced contractor. Bidding documents has greater emphasis on the methodology on the protection with regards to environmental and social worksite management. The bidder's environmental, social and safety methodology shows material deviation, reservation or omission towards environmental, social and safety specification.

b) Mitigation Measures

87. PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.

3. Loss of Vegetation and Trees

a) Description

88. There are various trees located on the both sides of the Mirwah to Naukot road. Trees close to the traffic lanes are a road safety hazard. Hence while from the topographic survey it appears that tree cutting can be avoided, it may nevertheless be necessary to meet road safety standards. There will be loss of vegetation in some locations, but

always within the road ROW According to the LARP report section 1 Table 1.1 Eight mature trees will be cut to pave the way for the required width of carriageway

b) Mitigation Measures

89. Loss of vegetation cover shall be minimized and the carriageway will be aligned so as to avoid the need to cut down trees if possible. New plantations will be included in the design of the right of way and trees will be replaced at a ratio of three trees planted for every tree cut down ,and which is more than 10cm Diameter Breast Height (DBH) .

4. Top Soil Erosion

a) Description

90. The top soil of RoW needs to excavate for reconstruction of the proposed project structure. It will erode and cause disruption local community and vehicle traveller as soil particles displaced and transported easily in air, water and may affect wide range of community assets.

b) Mitigation Measures

91. Sindh WSD will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation with and compensation of landowners.

5. Disturbance to Archaeological and Cultural Sites

92. There are no cultural or archaeological sites found in the Mirwah to Naukot road and thus no mitigation measures are required.

6. Material Haul Routes

a) Description

93. Hauling of material have significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the town road ways.

b) Mitigation Measures

94. Construction vehicles hauling materials along urban roads and anywhere where there are road side residence will be limited and the WSD will establish a route plan to minimize this disruption.

7. Consultation Plan with affected roadside landowners

a) Description

95. The road side and landowner may come across in relation to the road side schedule in installation of new fence, rubbish dumping, weed control and feral animal control which may cause disruption to the road side landowners.

b) Mitigation Measures

96. Rehabilitation work will result in access from a business and residence to the road being cut off or limited at times. To prepare for this inconvenience, WSD will define a road work information exchange procedure requiring the contractor to contact roadside landowners of the work, the period of access restriction and the measures taken to allow movement around the construction work.

8. Contractor's Environmental safeguards Capacity

a) Description

97. The responsibilities of safeguards unit reviews and finalize the document relating to environmental issues. Contractor with less capacity of safeguards do not comply with workplace environmental, social and safety regulations.

b) Mitigation Measures

98. Unfortunately contractors have a very poor record with complying with workplace and environmental safety regulations. To address this WSD will require the contractor to define a Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment

B. Construction Phase Impacts

1. Dust Generation: Transport of Materials

a) Description

99. A small increase in particulate matter (dust) is expected within construction air shed. Dust from vehicles hauling construction materials to the work sites will be a problem for roadside communities during the dry season, and has been known to impact people as far away as 200 m from the roadside.

b) Mitigation Measures

100. The Contractor will be required to have an approved (by The Construction Supervision Consultant) dust control program. This will involve i) regular sweeping of haul roads passing through settled areas if spills of material have taken place, ii)

spraying of water on unsealed roads and work areas within villages and past houses located close to the road, iii) sealing road surfaces in urban areas as a first priority and iv) storing construction materials close to the work site to minimise haul distances.

2. Dust Generation: Quarry and Batch Plant Operations

a) Description

101. All quarry operations generate dust primarily during the crushing operations to create aggregate. Batch plant, require cement and dry sand a gravel to be fed into a mixing chamber, and the addition of water to make concrete. Considerable fine dust in emitted when bagged cement is loaded manually into the batch plant hopper, as well as with the conveyor system bringing the materials to the plant.

b) Mitigation Measure

102. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or which can be easily retrofitted

3. Topsoil Erosion

a) Description

103. Excavation will expose bare soils that may erode. This will include sites such as; borrow pits, quarries, road embankments, culverts, bridge abutments and road diversions.

b) Mitigation Measures

104. Excavation of earth fill will be limited to an appropriate depth of 20cm. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in agreements between the land owner and contractor.

4. Emissions from Vehicles Exhaust

a) Description

105. Increase in air pollution from vehicular and machinery exhaust due to operation of construction machinery and increased movement of construction trucks will occur but will be minimal. The road repair and reconstruction work in relation to the existing traffic will generate relatively minor emissions.

b) Mitigation Measures

106. The Construction contractor will be required to keep equipment in good condition and to repair or replace vehicles producing visible black smoke and provide evidence that three vehicles have been given an emission inspection with twelve months of the start of the work. Secondly no construction vehicles will be left idling for more than two minutes.

5. Disposal of Spoil and Solid Waste

a) Description

107. As part of the reconstruction process, the asphalt layers of the existing road will be removed, together with base course material that is unsuitable for re-use. There will also be unused construction material (sand, crush), empty drums, concrete waste and waste from work camps.

a) Mitigation Measures

108. The asphalt and base course removed from the existing road will be recycled⁸. It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverised, spread on access roads and compacted.

109. The contractor will identify dumping locations for construction debris and non hazardous solid waste with respective Taluka Municipal Association (TMA) Mirpurkhas, and EPA Mirpurkhas.

110. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor under the section 13 of Sindh Environment Protection Act 2014.

6. Noise and Vibration

a) Description

111. Sources of noise include improper silencing of vehicles and equipment used on the road construction site, aggregate crushing facilities as well as batch plants. These will impact on local communities and will be most pronounced close to or within urban areas.

112. Vibration will occur during compaction when vibratory rollers are used to compact subgrade materials. This is unlikely to cause permanent damage.

⁸ A detailed investigation by T. Townsend (1998) on the leaching characteristics of asphalt road waste found that such material was safe to use in any non-agricultural use setting, i.e. as soil material in fields, etc.

b) Mitigation Measures

113. The Contractor will need to ensure that; (i) machinery has installed working noise attenuation equipment such as sound mufflers, and (ii) machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between the contractor and the local communities. Any aggregate crushing facilities within 500m of any residential or commercial areas will be required to install noise attenuation measures such as baffles or barriers 2 m high and located between the plant and the noise receptor. Noise will be measured as per Sindh Provincial and Pakistan National Environmental Quality Standards limits. Exceedances of these standards will require immediate noise reduction measures such as baffles and barriers.

7. Quarry /Borrow Material

a) Description

114. Transport of construction material (aggregate and fill) may raise environmental and social issues with the possibility of damage to bridges and pavements if vehicles are overloaded.
115. Borrow pits may cause problems such as damage to agricultural land or drainage, water ponding, loss of vegetation and crops. Problems may arise if the contractor extracts material from borrow areas without the permission of the Landowner.

b) Mitigation Measures

116. The Contractor will need to ensure that loaded trucks do not exceed bridge and pavement axle load specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected by the construction supervision consultant.
117. The contract documents shall require that the contractor obtains fill and other construction material from authorized/licensed quarry sites. Borrow material must be taken only with the consent of the land owner and if the contractor is found to be in violation, will be fined in addition to having to completely rehabilitate and re-vegetate the site(s).
118. The contractor will ensure that the use of productive and agriculture land and the loss of vegetation is minimised.

8. Contamination of Water Resources (Surface and Ground)

a) Description

119. Lubricants that enter the ground environment can render the area unusable and may pollute groundwater. Agriculture fields, aquatic systems, community owned stream channels and canals can be polluted by fuel and lubricants entering these systems.

120. Materials brought onto the site will generate a range of possible environmental pollutants for water resources. The main concerns will be from containers such as bitumen drums and plastic that may be brought on site as wrapping material if they are not properly disposed of.

121. During rehabilitation work on culverts and bridges the canals and water courses crossed the Mirwah to Naukot road, could become polluted by accidental discharge of cement and other chemicals like epoxy and paints.

b) Mitigation Measures

122. Fuel and oil storage areas should be located at least 250m away from any watercourses and be provided with a concrete platform and be bounded with interceptor traps so that any fuel leakage is retained within the site. Wash down water from machinery repair areas also needs to be directed into this system and held in retention areas for treatment. Refuelling should, wherever possible, be carried out at the fuel storage area and not be permitted within or adjacent to watercourses. When the facility is no longer required the contractor will need to remove the structures and also excavate and remove any contaminated soil for disposal at an EPA approved site. New soil should be brought in as required so that the ground surface is re-established.

123. Asphalt should not be applied during heavy rain so as to avoid it being washed into watercourses.

124. Water channels must be diverted properly and a protection mechanism provided. Alternatively construction should be undertaken during the dry season.

125. Water channels will be monitored for their quality against “irrigation water quality standards” of Water and Power Development Authority, WAPDA. Ground water quality will be monitored against National Drinking water quality standards.

9. Damage / disturbance to Utilities Services

a) Description

126. Utility services within the RoW may include electrical cables, telephone lines and gas pipelines. It is possible that road widening and reconstruction will disturb/damage these.

b) Mitigation Measures

127. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.

10. Traffic Disturbance

a) Description

128. Construction work will require traffic to be diverted around areas, or delayed while work is being done.

b) Mitigation Measures

129. A traffic diversion plan will be developed by the contractor and approved by the Construction Supervision Consultant. Proper warning signs and flags will need to be displayed at the commencement of any road construction or diversion section so as to alert drivers to the changed road conditions. Old signage should be removed to reduce confusion, as soon as the work is done. This will be the responsibility of the Contractor.

11. Health and Safety Concerns

a) Description

130. Poorly constructed or maintained work camps can be unhygienic and affect worker health. Stagnant water that may remain in borrow pits and in discarded waste such as plastics, old tires and metal containers can create breeding habitats for mosquitoes and rodents.
131. While unlikely, because generally local people will be hired for the project, there is a possibility that concentrations of workers will result in the transmission of communicable diseases (such as STI's and HIV/AIDS) to the local community.
132. Accidents will inevitably happen, but are more likely if safety procedures and practices are not in place.
133. Secondly inadequate precautions during the handling of construction materials such as bagged cement, could lead to serious health problems among workers. Cement dust is very fine and highly corrosive to lung tissue and can lead to permanent damage if breathed in. Since much of the transfer of cement to the batch plant is still done by manual labour pouring the 30kg bags into hoppers, the risk to workers not wearing protective gear is high.

b) Mitigation Measures

134. Where possible, work camps shall be kept remote from settlements, however all camps shall be provided with septic sanitation facilities and potable water. A solid waste collection program must be established so that no garbage is left on the ground or let enter streams where it can affect downstream water quality, aquatic environments and human health.

135. Local labour will be actively sought out by the contractor, thereby reducing the need for work camps. Local labour can reduce social concerns as these people will return to their villages at night and act in accordance with accepted community norms.
136. The Contractor will need to have an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully. This will include mandatory wearing of dust masks for any cement handling operations or at any area where cement dust is in the air.
137. Monitoring will be required for the solid waste disposal at camp site and to ensure that the health and safety plan based on contract specifications is followed. Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.

12. Interruption/ Contamination of Water channels

a) Description

138. There are thirty three watercourses crossing the project road: details were given in table 5. Repair or replacement of the crossing will often require temporary diversion of, or work within, the watercourse. This could affect the water supply to agriculture land of communities living nearby, and could lead to contamination.
139. Temporary traffic diversions disrupt and can be a danger to traffic.

b) Mitigation Measure

140. Where water crossings are being repaired. The water channel should be diverted or a protection mechanism provided to avoid contamination. Where possible, construction will be made in dry season.
141. The contractor should provide an adequate sized diversion so that there shall be no disturbance to water flows of canal /water course.
142. A traffic management plan shall be provided by the contractor. Signage and lighting may also be provided to reduce the likelihood of accidents.
143. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed

13. Burden on Local Resources

a) Description

144. A labour force that is not properly supplied with adequate rations or cooking/heating fuel will aggravate demands on local supplies of fuel wood and wildlife.

The project labour force can impose a burden on community water supply and sanitation systems.

b) Mitigation Measures

145. Where possible, local labour will be hired for the project so there will be no additional impact on natural and social resources and services. At all times workers must be supplied with the required daily rations or a living allowance as per their contract and at the same time contractors will be required to inform employees in writing about the consequences of illegal hunting, including the loss of a job and possible detention by local authorities.

14. Inadequate Camp Site Good Housekeeping

a) Description

146. While the use of local labour should minimise the need for on-site worker accommodation, there will nevertheless be a need for a work camp with office accommodation, catering, ablutions, prayer area, etc

b) Mitigation Measure

147. The contractor will be responsible for the construction, management the operation of the construction work camps to minimize the impact of construction activities on land; ensure adequate provision of waste disposal and health and safety of construction workers. The contractor will carry out the following activities to manage the disposal of construction waste.

- Train work force in storage and handling of materials
- Fire fighting
- Camp sewage will be treated in pit latrines or septic tanks which will be drained and sewage taken to a sewage treatment plant for processing. The treatment/management will be done according to the provision defined in the Pakistan EPA-specifications, which the contractor will have to become familiar with. Disposal will be recorded in a table and submitted as part of the semi-annual reporting to ADB.

148. Contractor will prepare as part of site specific EMP the following special sub-plans:.

- Traffic management plan-addressing construction related delays and a protocol for day-to-day management. Traffic management is also addressed in the contract specifications for the engineering works.
- Waste management plan specifying the treatment and disposal of garbage, sewage and oily waste at the contractor's camps and yards.
- Borrow site management plan –addressing preparation of access roads and decommissioning following use, of any borrow sites opened by the

contractor. Operating licensed facilities will not be included in this management plan, as they are already monitoring by the authorities.

149. The SSEMP, together with the sub-plans will be approved by the executing agency as well as the ADB, prior to the contractor mobilizing to the field

C. Operation Phase Impacts

150. Most of the impacts at the operation stage are positive and do not require mitigation. These include:

- Improved access to markets
- Reduced travel times
- Lower vehicle operating costs
- Reduced dust

151. However there are some negative impacts and these are listed in the following sections.

1. Lack of Environmental Safeguards

a) Description

152. While the proposed project will be completed with follow of environmental safeguards of the EMP. The contractor has to ensure the action taken during all stages with compliance of this EMP.

b) Mitigation Measure

153. The contractor, will provide mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to the PMU before the final payment can be released

2. Increased Traffic Volumes

a) Description

154. The Consultant's traffic forecast predicts an increase in traffic of up to 20% as a result of the road improvement. This brings with it increased noise and emissions, increased risks associated with the transport of materials and increased interaction with pedestrians and non-motorised transport.

b) Mitigation Measure

155. Traffic calming measures and speed limit signage will be provided to reduce the impact of the traffic through populated areas. Crossing areas will be marked and amber flashing lights installed in urban areas, when full traffic signals are not warranted.

3. Increased Risk of Accidents

a) Description

156. While the proposed road improvements will make the road safer in some respects, the increase in traffic and the potential for higher speeds may result in more road accidents especially in urban areas where there is a potentially dangerous mix of non-motorized, two, three and four-wheel traffic using the same carriageway.
157. The road design has had to balance the requirements of SPS 2009 to minimise displacement of encroachers and land acquisition against .road safety

b) Mitigation Measures

158. Improved traffic signage and road markings will be used to warn motorists of impending changes in road standards and to advise appropriate speeds
159. Properly designed traffic calming measures such as speed humps, speed signs and, possibly traffic signals will be installed within settlements.
160. Traffic police should be trained to more consistently enforce road rules.
161. One of the most effective ways of reducing deaths from road crashes is to reduce the time between the trauma occurring and hospital treatment. To this end an emergency ambulance provided by the local authorities would be the most effective. Failing that, better enforcement of the road rules and more stringent penalties should be sought.

V. GRIEVANCE REDRESS MECHANISM

A. Organisation

162. WSD will implement a three step grievance procedure for all project-affected people adjacent to the Mirwah to Naukot road. WSD will appoint a Grievance Resolution Officer (GRO) within its project management unit with the responsibility to ensure that the grievance redress procedures are known to the public and followed by the contractor.
163. A local grievance committee (GRC) will be constituted by the Works and Services Department (WSD). The GRC will consist of the GRO, Grievance Focal Person (GFP) who can be Community Leader, locally present NGO representative, the resettlement specialist or environment specialist from the WSD Environmental Safeguards Unit (depending on nature of grievance), one person from the revenue department and one or more co-opted members of the public. The GRC should include at least one woman.
164. WSD will ensure that the grievance procedure is accessible to all community members, including vulnerable people such as single mothers, the very poor, the elderly, and youth. Contact information, including contact addresses, emails, hotline numbers and websites will be posted at works site offices and on community notice boards in all towns. GRO will consult with appointed GFP prior to work commencing to inform them of the grievance procedure, relevant contacts and methods of resolution to maximise accessible to potentially affected persons through GFP.
165. Contact details will be distributed by the GRO to GFP in the appropriate local language, for posting in the village office.
166. To ensure women have access to the grievance mechanism, focus group discussions will be held to design protocols that are suited to their needs, including, access to the provincial ombudsman's office. Outreach programs will be tailored by GRC to women's needs to ensure information is communicated to them.

B. Procedure

167. The GRO will place a complaint register at an accessible location (Union Council office, Mosque, or at Camp Office) for respective community so anyone can register their complaint in this register and will check it on weekly basis.
168. The first step ([Figure 5](#)) on receiving a grievance will be for the GFP to refer the matter to the contractor, who will be given one week to respond to the grievance.
169. Any complaint that is not resolved directly will be referred to the GRC. The GRC will resolve the complaint within two weeks and inform the aggrieved party in writing the action taken against grievance.

170. If the complaint cannot be resolved at the GRC level, the issue will be referred to the director in charge of the Project Management Unit (PMU) if the grievance related to actions of the contractor or to the Provincial Ombudsman if the grievance relates to actions of WSD, the PMU or provincial government officers.
171. If the complaint still unresolved at the Provincial Ombudsman level, as the last step it may be taken at the national /provincial legal system. GRM shall take every possible effort to resolve the complaint at project level.
172. During loan implementation, all complaints received will be tracked and their resolution fully documented and reported to ADB by the PMU. The process will include the following elements:
- (i) Tracking forms and procedures for gathering information from the contractor/highway section and complainant(s);
 - (ii) Updating the complaints database routinely;
 - (iii) Identifying grievance patterns and causes, promoting transparency and information disclosure, and periodically evaluating the effectiveness of the grievance mechanism and environmental controls, and
 - (iv) Collecting and submitting input for inclusion in progress reports for ADB.

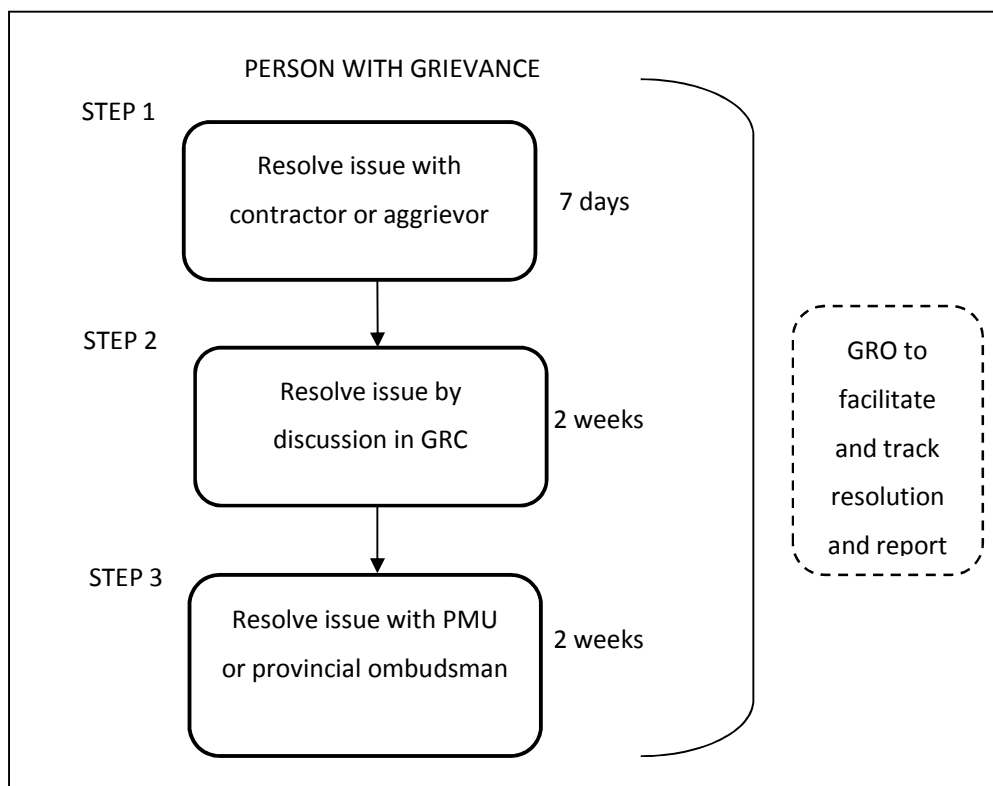


Figure 5. Steps of the Grievance Redress Process

VI. PUBLIC CONSULTATION

A. Objectives of Public Consultation

173. The overall objectives of the consultation process were as follows:
- To inform all interested people on the likely positive and negative effects of the road project and encourage feedback from stakeholders on IEE findings, principally the impacts and proposed mitigation measures;
 - To gain a consensus on the impacts identified, their importance and the relevance and effectiveness of the mitigation measures proposed;
 - To provide confidence that all relevant issues and mitigation measures have been identified, agreement that the mitigation measures are adequate, and that nothing significant has been missed;
 - To enable incorporation of stakeholder views and concerns in the IEE.

B. Consultation Process

1. Scope

174. The environmental consultants conducted meetings with local people, NGOs and government departments. The latter included the municipal administration, Forest Department, Livestock Department, Sindh Environment Protection Agency, and the Deputy Commissioner Mirpurkhas. During these meetings a description of the project (appropriate to the audience) was given, along with an overview of the project's likely social and environmental impact.
175. The interviews with the government representatives and NGOs were based on issues such as solid waste management, wastewater, forest, wildlife and archaeological sites whereas discussions with general public concentrated on their concerns relating to the project and likely impacts during the construction and operation phases. These included both environmental and concerns.

2. Community Consultations

176. Community consultations consisted of formal and informal meetings at Mirwah Gorchani, Umb Mori, Tando Jan Muhammad, Digri and Jhudo City. Meetings were conducted on dated 29th and 30th June 2014. The consultation exercise was conducted in both Sindhi and Urdu languages. A non-technical oral description of the project was given providing an overview of all likely positive and negative impacts. Following which, an open discussion was held so that the participants could voice their concerns and opinions. All participants were encouraged to voice their concerns and opinions. Participants were also asked to suggest alternatives where they had particular concerns.
177. Feedback obtained from the stakeholders was documented, and all issues and suggestions raised were recorded in survey forms. Both social and environmental issues were raised. The social issues are discussed in more detail in the Summary Poverty Reduction and Social Strategy report.
178. The people interviewed (Table 9) had only minor worries and generally agreed that most effects would be temporary only. Some common concerns regarding the shortage of electricity, potable and non-potable water, wastewater disposal, traffic congestion, poor roads, minimal employment opportunities, and security issues were raised. None of these issues related specifically to road reconstruction but were general complaints. All appreciated the project and said that it would boost the value of property, while some said that business, economic and employment situation in the area will also improve.

179. A matrix of concerns raised by community members was prepared ([Table 8](#)). The register of attendance is provided as [Table 9](#). Other people joined the discussions but declined to be identified. A pictorial record of the meetings is included as Annex -2. Note that residents in Mirpurkhas were asked about both the Mirwah Naukot and Sanghar _Mirpurkhas roads. Where relevant, their comments will be included in both IEE.

Table 8: Summary of Concerns Raised During Stakeholder Consultations

Issues	Concerns raised by community	Remarks
Road design	Storm drainage should be provided Mirwah Gorchani, Umb Mori, Tando Jan Muhammad, Digri and Jhudo City Road must accommodate the heavy traffic of the sugar cane and cotton seasons	Drainage channels are proposed un all urban areas Seasonal traffic has been taken into account.
Interaction / Conflict with local community	Immigrant workers may be of different backgrounds and culture or they may involve in the illegal activities in the area and conflict between the community and worker may occur	Immigrant workers should be well scrutinized before their deployment in the project area.
Employment	Provision of semi-skilled and unskilled jobs for local labour.	Unskilled jobs will be given to locals people where possible. Training will be provided
Livelihood	Restriction of livestock grazing and accident killing of livestock and local residents. measure should be taken minimize the business loss in the urban area during the construction activity	Grazing areas should be protected and speed of vehicles will be limited to avoid accidents. The land use and resettlement plan addresses disturbance during construction
Safety of Community	Speed Restrictions, Traffic police may be deployed Flagmen need to be in place for traffic control, which is thought particularly important for the towns located along the roadside.	International Safety Standards for the road safety and community safety shall be adopted and maintained.
Medical Facility	Unavailability of Medical Facility	Reconstructed road will improve access to existing facilities
Dust, loss of trees and agricultural land	Existing damaged road creates lot of dust Trees and farmlands near the RoW should be protected leftover construction material shall be collected at completion of the activity	Dust will be reduced when road has been re-constructed Disturbance to trees and farmland will be minimal
Other issues	Minimizing the construction duration Road should be rehabilitated as early as possible Traffic congestion due to damaged road Travel time is increased due to damaged road	Construction will be programmed to minimise the length of disruption at any one point These issues will be addressed once road constructed

180. As appropriate these concerns have been incorporated into the EMP items and have been related to the appropriate WSD officers. They should be taken up by the safeguard specialist when appointed.

Table 9 General Public Interviewed During Public Consultation in relation to the Mirwah to Naukot Road

Name	Town/Village	Position /Occupation
Mr. Agha Rustam Khan	Mirwah Gorchani	Village leader
Mr. Muhammad Iqbal	Mirwah Gorchani	Tea shop
Mr. Shoib Ali Gorchani	Mirwah Gorchani	Student
Mr. Faraz Ali Gorchani	Mirwah Gorchani	Villager
Mr. Mukhtar Ahmed Memon	Mirwah Gorchani	Villager
Mr. Rasool Bux	Mirwah Gorchani	Farmer
Mr. Tariq Aziz	Mirwah Gorchani	Farmer
Mr. Rajab Ali Kaloi	Digri /UMB Mori	Villager
Mr. Yar Muhammad Kaloi	Digri /UMB Mori	Villager
Mr. Yasin Kaloi	Digri /UMB Mori	Farmer
Mr. Devshi	Digri /UMB Mori	Famer
Mr. Khalid Hussain	Digri /UMB Mori	Tyre Shop owner
Mr. Jalaludin Abring	Digri /UMB Mori	Worker
Mr. Muhammad Asif	Digri /UMB Mori	Farmer
Mr. Muhammad Ashraf	Tando Jan Muhammad	Private Job
Mr. Mohsin Ali	Tando Jan Muhammad	Private Job
Mr. Aijaz Ali	Tando Jan Muhammad	Private Job
Mr. Zulfiqar Ali Khaskheli	Jhudo City	Manager at Filling station
Mr. Amanullah Mahar	Jhudo City	Private Job
Mr. Irfan Ali	Jhudo City	Private Job
Mr. Habibullah	Jhudo City	Labor

3. Government Agencies

181. Stakeholders including local government and provincial government officials, local and international NGOs, and related stakeholders were consulted at their offices ([Table 10](#)). All the stakeholders were given maximum project information and were shown a detailed map of the area. Their concerns and suggestions are reproduced below.

Attendance lists of the stakeholders from the four communities consulted in the subproject was collated and reproduced in Table 9. Pictures of the meetings are provided in Annex-2. Note that the Government offices at Mirpurkhas (Mirwah-Naukot) have jurisdiction over Sanghar Mirpurkhas project road. Hence some consultation comments will be repeated between IEE.

a) District Commissioner Mirpurkhas

182. A meeting for consultation with stakeholder was held with, District Commissioner Mirpurkhas, Mr. Usman Mehsood who is also heading the TMA of Mirpurkhas on dated 26.06.2014. He raised the following points after welcoming the proposed project activity in his area of jurisdiction. The meeting was held at DC Office Mirpurkhas. Their views are as under:

- He mentioned that with proposed project road economic activity will increase in the area, job creation opportunities will increase, Farm to market access of the area will be easy.
- He mentioned that there is no landfill site in the Mirpurkhas. Waste generated from the city is being dumped trenches.
- He also mentioned that wastewater generated from the city is being dumped in the seepage drains. There is no wastewater treatment plant in the city.
- He suggested that ADB shall also bring projects for the Mirpurkhas city in the area of Municipal solid waste management, Wastewater treatment and Drinking water supply.

b) Livestock Department Mirpurkhas

183. A meeting for consultation was held with official (Mr. Atif Qaimkhani Clerk) of the Livestock department Mirpurkhas on dated 27.06.2014 He raised the following points after convivial the proposed project activity in the area. The meeting was held at Livestock Department Mirpurkhas. Their views are as under:

- He had appreciated the proposed project activity, and mentioned it will be helpful for the local livestock and dairy farming industry, Farm to Market access will be better, and this will reduce the travel time and cost.
- Local agriculture industry will get boost, jobs will be available for the locals

c) Environment Protection Agency Sindh (Mirpurkhas Regional Office)

184. The Mirpurkhas office of the Sindh EPA is responsible for general environment protection in the project area. A meeting was held with the Deputy Director Mr. Shoib Rajput and his clerical staff on dated 27.06.2014. The main points are as follows:

- In general, the participants approved of the project and were of the opinion that there is dire need of this kind of project as the recent floods had badly damaged this road.
- A tree inventory shall be made before start of work, and tree plantation shall be carried out as per ADB Policy and local laws. A budget shall be kept for this purpose and specified in the BOQ and contract documents.
- Jobs shall be provided for locals during construction and operation phase
- Contractor shall dispose the hazardous waste through EPA certified contractors.
- Due to unavailability of Safe drinking water Hepatitis C is spreading in the region.

- There is no proper landfill site in the project area (Mirpurkhas and Sanghar) A dumping site for any non-hazardous waste will be indicated to the contractor jointly by the EPA Office and local TMA.
- Currently 75% of solid waste is left unattended. The leftover material is being openly burnt which is causing health issues.

d) District Forest Office Mirpurkhas

185. A consultation meeting was held with Mr. Shahzad Saddiq Gill District Forest Officer (DFO Mirpurkhas), Mr. Abdul Rasheed Range Officer Mirpurkhas, on dated 25.06.2014 to discuss environmental issues related to the proposed project. The consultant team provided information about the proposed project with the help of the project area map and requested the officers to identify any protected forest or other concerns of the Department. A set questionnaire was also filled during the meeting. During the meeting the DFO expressed some reservation regarding the project. Their views and answers are re-produced as follows.

- He appreciated the project activities; and thought this kind of project will increase the employment opportunities in the area and increase business opportunities.
- He also said that this project will reduce the travel time, and energy of locals as the current road condition is poor.
- He also said this kind of project will help to shift the demand of wood, when people of the area get the gas they will not burn wood as fuel.
- He said the reserved forest of the area should not be disturbed at all and he mentioned that Khipro Forest is the only protected forest of the area.
- The Range Officer mentioned that the Forest Department has planted some 865 cornucopias trees of along the project road. They should be protected, or if cutting is unavoidable, re planting shall be carried out as per local law.

4. Non-Government Organizations

186. After the 2010 floods, various NGOs were established with local and foreign funding to participate in the relief works. Some of these NGOs are still involved in various projects related to social and environment development and were consulted for this project on dated 27.06.2014. Mr. Muhammad Hussain from the NGO HANDS made the following comments and suggestions;

- As roads are vital for communication during the any emergency; this project should be started as soon as possible.
- Better road conditions will reduce the rate of accidents around the sugar mills
- Road works should be sprayed with water to avoid dust generation in the urban and rural areas during construction.

C. List of Public and NGO Sector Stakeholders Consulted

187. A number of stakeholders, other than the general public, who are likely to benefitted or be involved during the project execution phase, were also consulted ([.Table 10](#)).

Table 10 List of Stakeholders Consulted for Mirwah to Naukot road

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Shoib Rajput	Provincial Government	Deputy Director EPA Sindh

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr Shehzad Saddiq Gil	Provincial Government	Divisional Forest Officer Mirpurkhas
Mr. Gul Junejo	Provincial Government	Divisional Forest Officer Sanghar
Mr Abdul Rasheed	Provincial Government	Range Forest Officer Mirpurkhas
Mr. Dedar Hussain Baloch	District Government	District Municipal Administration Sanghar
Mr. Lal Khan	District Government	Acting Taluka Municipal Officer
Mr. Muhammad Hussain	NGO	HANDS (NGO)

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives of Environmental Management Plan

188. The purpose of the environmental management plan (EMP) is to provide a summary of the predicted impacts associated mitigative measures and monitoring actions so as to minimize potential negative impacts and enhance positive impacts from the Project. The EMP will provide a guide (almost checklist) for the main stakeholders, namely the owner, contractor and operator of the road, on what mitigative actions need to be taken and where and when they are needed. It will thus help to improve the likelihood that adverse impacts are mitigated, project benefits are showcased, and an environmentally beneficial standards of best practice is provided to all those involved. In particular, the EMP:

- Defines roles and responsibilities for those involved in the implementation of the EMP and identifies areas where these roles and responsibilities can be shared with other stakeholders
- Provides concise instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact, making these legally binding through their inclusion in contract specifications
- Defines the requirements for communication, documentation, training, management and implementation of the mitigative measures; and,
- Specifies actions required to assess compliance with and effectiveness of the mitigation measures through a compliance and effects-monitoring mechanism, defined in the EMP's two action tables.

B. Environmental Management Plan for Mirwah to Naukot Road

189. The EMP, mitigation and monitoring tables for the Mirwah to Naukot road is included as Annex 1 to this report. It will be included in the contract documents in its entirety as an environmental clause, referenced as a mandatory exercise or integrated into the contract specifications as specific clauses. The estimated costs ([Table 11](#)) will be used to prepare a specific environmental safeguards section in the construction Bill Of Quantities, thus enabling the Construction Supervision Consultant to pay only as environmental tasks are completed and complied with.

190. The EMP will be revised if project design and construction parameters are changed significantly, then updated during the pre-construction stage of the project.

1. Preconstruction Phase

191. The pre-construction period is the time when road planners can influence the road design and work, thereby avoiding or reducing to an acceptable level any potential negative impacts. The value of the environmental assessment process can be undermined if this IEE and its EMP are not shared with or adopted by relevant parties during the design and bidding stages. A number of common issues and solutions are described in the EMP.

192. In line with ADB SPS (2009), impacts and risks have been identified in the context of the project's corridor of impact. For rehabilitation projects, this impact corridor is the road RoW (20m-25m), any haul routes established for the work, and any temporary storage areas, usually located within the RoW. All construction materials will be purchased from fully licensed suppliers, who are assumed to be operating in an environmentally acceptable manner as defined by the national and provincial EPAs.

193. The EMP's mitigation (EmiT) and monitoring (EmoT) tables (Annex 1) identify eight important actions to be undertaken by the Sindh Works Department and the

Construction Supervision Consultant, including a task to brief the selected maintenance staff of the WDS and any contractors on the EMP and the actions to be undertaken.

194. A Site specific EMP (SSEMP) is to be prepared by the contractor based on the generic EMP provided in the IEE. The SSEPM will perform a risk assessment of all mitigation options and will propose site specific mitigation options that would be appropriate and commensurate with the actual impact. The contractor will not be able to start the construction works before the approval of SSEPM from PMU and final approval from ADB.
195. All environmental assessment documentation shall be prepared and approved during the preconstruction period, translated into the local language and distributed to all stakeholders, namely the local works department, the contractor(s), any monitoring agency and local government managers, for use in implementation of the environmental management actions.. By knowing where and what environmentally sensitive receptors exist, and what issues are likely to arise in the future, Sindh Works and Services Department will be able to avoid serious impacts by modifying designs, adjusting alignments or switching to more sustainable methods and/or materials.
196. Sindh WSD will provide a briefing to contractors on the contract and implementation requirements of the EMP.

2. Construction Phase

197. A major factor that can lead to the failure to implement an EMP is lack of qualified environmental experts with the contractors, and therefore (often total) lack of understanding of the EMP and good environmental management practice. An extensive training plan for the Contractor and PWD is being incorporated which need to be implemented. This should help to address this problem. Using the EMP, the contractor will prepare an Environmental Management Work Schedule (EMWS) placing all measures defined in the general EMP in a time bound schedule. It will identify mitigation and monitoring actions required in relation to particular construction activities. The contractor, with advice from the Environment and Social Unit (ESU) (a section within the PMU) will be mainly responsible for implementing the EMP.
198. There are eleven Construction phase EMP actions focusing mostly on contractor activities, the management of worksites and contractors' equipment and people. Specifically this part of the EMP focuses in defining ways to minimize effects such as dust generation, emission from vehicles and air quality, disposal of spoil and solid waste, noise and vibration from construction machinery, quarry and borrow material transport and disposal, contamination of surface and groundwater resources and work camp management.

3. Operating Phase

199. Operation period actions focus on confirming that the contractor completed the EMP tasks required and that the operation of the improved road does not aggravate existing problems such as roadside safety. All the work proposed is on existing roads and confined to the existing RoW. There will be some increase in the speed and volume of traffic, raising potential road safety issues (e.g. Q1 and 2). Speed limits will be monitored through traffic police as discussed earlier.
200. Most of the impacts are positive due to better road conditions which do not require any mitigation measures such as:
- Less travelling time
 - Quicker access to Market

- Fuel efficiency
- Less dust generation
- Safer journeys

C. Cost Estimates

201. The cost of implementation of the environmental safeguards includes both the direct cost of the mitigation measures and the costs of monitoring the execution of the EMP such as laboratory costs and monitoring visits, training costs, etc. Table 11 shows the cost to be included in the BOQ items by the contractor.

Table 11 EMP Implementation and monitoring estimated cost for Contractor

Items	Unit Cost	No of Units	Estimated 1 st year	Estimated 2 nd Year	Total (Rs)
Training (Different trainings for 193 persons)		193	981,000	981,000	1962,000
Generators & Construction Machinery Noise Monitoring	7000	90	7560000	7560000	15120000
Drinking Water Quality Monitoring (During Const)	10000	12	120,000	120,000	240,000
Workers Communicable Disease Screening Test	8000	193	1544000	-----	1544000
Personal Protective Equipments (for 200 persons approx) replacing every year)		210	1305500	1305500	2611000
Fire Fighting Equipments purchase and refilling		30	250,000	100,000	350,000
Health & Hygiene	--	--	741360	741360	1482720
Canal Monitoring (Pre-Const, During Const,) monthly basis 1 month for pre-cons + 24 month of Construction	4,000	33	1,584,000	1,584,000	3,168,000
Ambient Air Monitoring (Pre-Const, During Const,) Three Places (Two towns + Asphalt plant) on monthly basis	27000	36	972,000	972,000	1944,000
Noise Monitoring (Pre-Const, During Const,) monthly basis at 15 sensitive locations	750	20	180,000	180,000	360,000
Environmental Officer Salary	150,000	1	1800,000	1800,000	3600,000
Subtotal					32,021,720
Contingency Cost 10%					32,021,72
Total					35,223,892

D. INSTITUTIONAL CAPACITY NEEDS, PROPOSED STRENGTHENING AND IMPLEMENTATION ARRANGEMENTS

1. Technical Capacity Building

202. The Sindh provincial road improvement project will be coordinated by the Works and Services Department as an executing agency (EA) with a project management unit (PMU) established within WSD as Implementation Agency. The PMU will be self-sufficient to monitor the environment related issues.

203. A dedicated Environment and Social unit (ESU) will be established within the PMU. Unit will be headed by the PMU Project Director and will have the two qualified environmental specialists. One for the upper Sindh Area roads, and other for Lower Sindh region roads. Both will monitor the environment related issues and monitor the Contractor and consultant progress and report the Project Director WSD and ADB.

2. Implementation Arrangements

204. The Project Management consultant (PMC) will support all Deputy Directors and PMU for project development. The PMC's environment experts will support the ESU in ensuring that project roads comply with ADB's SPS (2009), PEPA 1997 and S-EPA 2014 ([Table 12.](#))

Table 12 Implementation Organisation for Road Reconstruction and Rehabilitation

Role	Body
Executing Agency (EA)	Works and Services Department Sindh
Implementation Agency (IA)	Works and Services Department, Project Management Unit
Design Consultants	To be appointed
Project Management Consultants	To be appointed
IEE Environment Consultants	Engineering Consultants International ECIL
Social Consultants	Environment Management Consultants (EMC)
Technical and Financial Support	Asian Development Bank

205. The ESU will, with assistance from of the PMC environmental specialist:

- Prepare environmental screening checklists;
- Ensure that the EMPs, including all proposed mitigation measures and monitoring programs are properly implemented by the contractor.
- Ensure the health and safety of workers, and community guidelines are being followed by the contractor.
- Share information and disclosure of environmental safeguard documents (including any Corrective Action Plans prepared in cases of change to original project design) as required.
- Carry out visits to construction sites, work camps, quarries and borrow pits to review the environmental performance of the contractors;
- Ensure that the required environmental training is provided to the staff concerned;

206. Contractor will hire one full time person to address the environment safeguards; Environmental Engineer's responsibilities will include;

- Prepare Site-specific EMP consistent with the EMP of this road.
- Monitor the work and undertaken the monthly reporting.

- Carryout site visits of construction camp, construction site(s), quarries and borrow pits to review environmental status and rectify the non-compliances.
 - Supervise the environmental monitoring is being carried out as pre-defined frequencies mentioned in EMP
 - Coordinate with PMU Environment specialist to conduct site visits.
 - Impart trainings as per schedule.
 - Prepare monthly environmental monitoring report
 - Conduct day to day Site inspection activities for any non-compliance
 - Conduct environmental monitoring activities through certified environmental laboratory.
207. ADB's responsibility will be to review IEEs as a basis for the approval of the subproject.

3. Monitoring and Reporting

208. The monitoring and reporting frequencies and responsibilities are as follows;

a) Implementing Agency

- PMU will develop the monthly compliance monitoring checklist and brief to Environment Engineer of the Contractor.
- Carryout field visits for HSE compliance monitoring on quarterly basis
- Submit a bi-annual monitoring report to ADB commencing from when the contractor is mobilized.

b) Project Management Consultants

- Ensure the compliance monitoring is undertaken as required.
- Conduct the monthly review meeting with the Contractor to address any issue arising.

c) Contractor

- Contractor Environment Engineer will be required to submit monthly checklists to the Implementing Agency duly reviewed by PMC, identifying what mitigative actions have been undertaken.
- Conduct the Environmental Monitoring (Ambient Air, Drinking water, Canal Water, Noise (ambient noise and equipment noise) as per frequencies and parameters mentioned in (Table 13).

Table 13 Monitoring and reporting frequencies

S.No	Time frame	Location	Category / Equipment	Parameters to be Monitored	Reporting Frequency	Implementer Responsibility	Supervision
1.	Environmental monitoring plan for Canal Water Monitoring						
a	Pre-Construction	Forty two water crossings	Physical Parameters	pH, Color, Turbidity, TDs, Total Hardness	Once	WSD	PMU
b	Construction	Thirty three water crossings	Physical Parameters	pH, Color, Turbidity, TDs, Total Hardness	Monthly	Contractor Environment Engineer	Supervision Consultant

S.No	Time frame	Location	Category / Equipment	Parameters to be Monitored	Reporting Frequency	Implementer Responsibility	Supervision
2. Environmental monitoring plan for Drinking Water							
a	During Construction	Campsite	Biological Parameters	E-Coli, fecal coli form, Total Coli form	Quarterly	Contractor Environment Engineer	Supervision Consultant
b	During Construction	Campsite	Physical Parameters	pH, Color, Turbidity, TDs, Total Hardness	Quarterly	Contractor Environment Engineer	Supervision Consultant
c	During Construction	Campsite	Chemical Parameters	Chloride, Fluoride, Nitrate, Nitrite, Pb, Zn.	Quarterly	Contractor Environment Engineer	Supervision Consultant
3. Environmental monitoring plan for Ambient Noise							
a	Pre-Construction	15 sensitive locations (School Hospital Residential Areas)	Ambient Noise	dBA	Once	WSD	PMU
b	During Construction	15 sensitive locations (School Hospital Residential Areas)	Ambient Noise	dBA	Monthly	Contractor Environment Engineer	Supervision Consultant
4. Environmental monitoring plan for Air Emission							
a	During Construction	Campsite	Construction Machinery & Generators	CO/CO ₂ , SO ₂ , NO _x , PM ₁₀	Monthly	Contractor Environment Engineer	Supervision Consultant
5. Environmental monitoring plan for Ambient Air							
a	Pre-Construction	Three towns along road and One at Campsite	Ambient air	SO _x , NO, NO _x , CO, PM ₁₀	Once	WSD	PMU
b	Construction	Three towns along road and One at Campsite	Ambient air	SO _x , NO, NO _x , CO, PM ₁₀	Monthly	Contractor Environment Engineer	Supervision Consultant

d) ADB

- Review the biannual monitoring report and follow up all outstanding issues.
- Approve any proposed changes to the management plans or procedures

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. Principal Findings

209. This IEE is one of six been prepared for the Provincial Road Improvement Project of Government of Sindh Works and Services department. This IEE is in respect of the Mirwah to Naukot road.
210. The proposed rehabilitation/reconstruction of the Mirwah to Naukot road will have very little environmental impact. The work will be constrained within the current right of way and thus there will be no significant impact on adjoining lands, cultural sites or on fauna or flora. The environmental category is 'B'. There is a minimal requirement for resettlement of illegal encroachers; this is being addressed in a separate LARP.
211. The following are the main issues identified and concerns raised during the study:
- The project is in predominantly bad condition and travelling time is around double the time that would be expected for a road in good condition;
 - The road embankment is eroded in some places;
 - There are mosques, graveyards and shrines built adjacent to the ROW of the project road no cultural or sensitive structure will be affected.;
 - There are major and minor canals and waterways crossing the road, requiring special care during construction works
 - There is only one designated forest in District Sanghar, Khipro Forest. This is far from the project road and will be unaffected.

B. Conclusion

212. The improvement of the Mirwah to Naukot road, part of the Provincial Road Improvement Project of the Government of Sindh, is limited to road reconstruction within the existing right of way. It is therefore likely to have only limited impact of a temporary nature and short duration. The impacts can be mitigated with the measures proposed in the Environmental Management Plan.
213. Provided the EMP is followed, there should be no damage to cultural and archaeological sites. Trees located on the embankments will not be disturbed. The environmental safeguards will have to be monitored by concerned agencies, including Contractor, Environment Specialist ES (PMC) and PMU-W&S Department. Due diligence, with mandatory coordination among various stakeholders, will further ensure mitigation of any adverse impacts.
214. This IEE study concludes that the proposed pilot road project will not lead to significant adverse environmental and social impacts of such nature or magnitude that would require a more detailed report in the form of an EIA. Additionally careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.
215. The project has been discussed with local people, government officials and NGO. The consultations elicited general support for the project. There were no serious environmental issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust. There was also a concern about safety, especially during construction, but generally a view that improved road conditions would improve safety.

C. Recommendations

216. A schedule of activities associated with reconstruction has been prepared and the potential environmental impacts of each activity assessed. For each activity, recommended mitigation and monitoring actions have been identified. These are covered in the Environmental Management Plan. All impacts are minor and able to be mitigated.
217. The following recommendations are carried over from the text:
- Environmental monitoring shall be carried out by the IA and contractor in compliance with the EMP to minimise damages to the environment, workers or the community. This will be enforced through contract specifications and an environmental BoQ section.
 - The contractor will ensure that borrow material /earth-fill will be obtained from the approved sites.
 - Trees located on the embankments will not be disturbed.
 - Asphalt plant shall be located at least two kilometres from settlements
 - Construction camps will be located a minimum of 1000m from existing settlements, built-up areas and at least 500m from canals.
 - Excavation of earth fill will be limited to an appropriate depth of 20cm.
 - Canals and other water resources will be closely monitored to ensure no contamination occurs due to project related activities
 - A dust abatement program will be implemented that includes spraying water on roads and work areas within villages and past houses adjacent to the road.
 - Health and safety plans will be prepared.
 - Construction work shall not hinder local people's access to nearby facilities.
 - SSEMP will be developed by the contractor which needs to be reviewed by the PMC, approved by IA and final approval is required from ADB. Contractor will not be able to start the construction till the SSEMP is not approved.
 - An emergency and safety plan will be developed by the contractor/PMU for bridges and roads near canals and waterways.
 - A grievance redress mechanism will be implemented by the contractor to ensure that community complains are addressed and recorded.

Annex 1

Table 14 Environmental Management Plan: Environmental Mitigation Table (EmiT) and Environmental Monitoring Table (EmoT)

Environmental Management Plan (EMP):Environmental Mitigation Table (EmiT)

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
1. Pre-Construction Period Impacts					
1.1. Lack of environmental technical capacity within WSD and its PMU in environmental assessment and design, management, supervision and reporting.	WSD will establish a unit, or at least a person within the PMU, to manage environmental, social and safety aspects of maintenance projects. The PMU will be staffed by at least one full-time suitably qualified Environment Specialist, who will ensure that environmental safeguard measures associated with this and other projects are credibly implemented, including provision of necessary training to WSD road maintenance staff.	A PMU will be established prior to loan effectiveness, with training completed during detailed design. Contractor training, and environmental briefing will be conducted prior to mobilization.	Head office WSD	WSD	WSD
1.2. Consideration of IEE/EMP in preparation of the detailed design and bid documents.	PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.	Before the tendering	NA	WSD	Supervision Consultant
1.3. Loss of Vegetation and trees	During detailed design the supervising engineer/consultant will modify the design on order to minimize the removal of mature trees from roadsides; carriage	Design and implementation planning for Mirwah to Naukot road	At any locations where mature trees will be cut down.	WSD	PMU

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
1.4. Top Soil Erosion	Sindh WSD will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation with and compensation of landowners.	During Planning phase, in parallel with the preparation of bid documents	At any locations where borrow pits, quarries will be operated.	WSD	Supervision Consultant
1.5. Disturbance to Archaeological and Cultural Sites	No cultural or archaeological sites have been identified in the Mirwah to Naukot road and thus no mitigation measures are required.	----	---	-----	-----
1.6. Materials Haul Routes	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the WSD will establish a route plan to minimize this disruption	Prior to contractor mobilization	NA	WSD	Supervision Consultant
1.7. Consultation Plan with affected roadside landowners	Rehabilitation work will result in access from a business and residence to the road being cut off or limited at times. To prepare for this inconvenience, WSD will define a roadwork information exchange procedure requiring the contractor to contact roadside landowners of the work, the period of access restriction and the measures taken to allow movement around the construction work.	Completed prior to contractor mobilization and provided the contractor as part of the contract documentation	NA	WSD	Supervision Consultant
1.8. Contractor's Environmental	Unfortunately contractors have a very poor record with complying with	Plan to be provided the	WSD	WSD	Supervision

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
Safeguards Capacity	workplace and environmental safety regulations. To address this WSD will require the contractor to define a Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment	Consulting Engineer and PMU prior to start of work			Consultant
2. Construction Period Impacts					
2.1 Dust Generation Transportation of Material					
A small increase in particulate matter (dust) is expected within the ambient air of the construction area and from vehicles hauling construction materials to the work sites.	<ul style="list-style-type: none"> i. The Contractor will be required spray water on unsealed roads and work areas within villages and past houses located close to the road and giving priority to sealing in urban areas. ii. Dust control at the construction site will be controlled by watering, setting strict speed limits of no more than 30kph in or near settled areas. 	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor	Supervision Consultant
2.2 Dust Generation: Quarry and Batchling Plant Operation	<ul style="list-style-type: none"> i. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system. ii. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or which can be easily retrofitted 	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
2.3 Top Soil Erosion	<ul style="list-style-type: none"> i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. iii. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. iv. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. v. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in agreements between the land owner and contractor 	During Construction	At any locations where borrow pits, quarries will be operated.	WSD	Supervision Consultant
218. 2.4 Increase in air pollution from vehicular and machinery exhaust	<p>Emissions will be minimised by:</p> <ul style="list-style-type: none"> i. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; ii. use of appropriate octane fuel and haul loads within specified limits. iii. Vehicle idling time limits to no more than 2 minutes, iv. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent 	During Construction	Construction Site	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	excessive TPM pollution.				
2.5 Disposal of Spoil and Solid Waste					
i. asphalt layers and base materials of the existing road	i It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverized, spread on access roads and compacted.	During Construction	All Construction Sites	Contractor	Supervision Consultant
ii. Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps.	<p>i The contractor will identify dumping locations for construction debris and non-hazardous solid waste with r TMA Mirpurkhas, and EPA Mirpurkhas.</p> <p>ii The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor s under section 13 of the Sindh Environment Protection Act 2014.</p> <p>iii The cost of disposal of hazardous and non-hazardous waste shall be included in the Contractors BOQ.</p>	During Construction	All Construction Sites	Contractor	Supervision Consultant
2.6 Noise & Vibration					
i. Noise and Vibrations associated with earthworks and haul	i Enforcing a speed limit of 30 kph within 500m of any village and the use of water sprinkling for dust	During Construction	Construction areas	Contractor EHS	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
roads.	<ul style="list-style-type: none"> settling at least on road for 500m on either side of a village. ii Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. iii Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between contractor and local communities. 	period		Inspector	
ii. Excessive Noise at sensitive sites	At the same locations and times that surface water quality is tested, noise measurements will be completed, but with measurements taken at sensitive receptors As defined in the IEE	Throughout construction period, at least every month, using a portable sound pressure meter.	As listed in IEE: Schools, residential areas ,Mosques and health care facilities along the road side, and as identified in the IEE.	Contractor EHS Inspector	Supervising Consultant
2.7 Quarry/Borrow Materials					
i. Overloading of trucks, may damage pavement, bridges, and culverts	i. The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected.	Throughout construction period	Construction sites	Contractor EHS Inspector	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
ii. Risk of erosion and destruction of landscape / agriculture land from side borrow operations.	ii. Any need for borrow material outside of the RoW will be subject to local environmental approvals and procedures and should also be carried out in consultation with ES of IA/PMU.	Construction Period	Along any stretches where road will be raised and fill is needed, particularly in areas with long visual distances	Contractor EHS Inspector	Supervising Consultant
iii. contractor extracts material from borrow areas without the permission of the Landowner.	iii. It will be ensured by PMU that borrow material will be purchased/ or taken only after the consent of the land owner has been obtained.	Construction Period			
2.8 Contamination of Water Resources (Surface& Ground)					
i. Surface water can be polluted by entering cement and other chemicals used in rehabilitation works.	<p>i. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected.</p> <p>ii. Fuel and oil storage areas should be at least 500m away from watercourses and repair and fuelling yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site.</p> <p>iii. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refuelling to be carried out at the fuel storage area and not be permitted within or adjacent to watercourses. Surface water channels crossed by the road will</p>	Throughout the construction period	Based on an analysis of soil conditions by contractor /and consultant hydrology and geotechnical expertise	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	<p>be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing.</p> <p>iv. Water channels have to be diverted properly, protection arrangements should be provided at each culvert / water crossing</p>				
2.9 Damage / disturbance to Utilities within RoW	<p>i. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused.</p> <p>ii. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.</p>	<p>Before the start of construction work.</p> <p>Design phase.</p>	Where utilities services located	Contractor EHS Inspector	Supervising Consultant
2.10 Traffic Disturbance					
Loss of access for roadside residents	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area, Work that affects the use of side roads and existing access shall not be undertaken without provision of adequate alternate routes; to the prior satisfaction of the Engineer and affected persons. Contractor shall submit the Traffic plan which needs to be approved from The Engineer.	Construction Period	Town Crossings Canal Crossings	Contractor EHS Inspector	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
2.11 Health and Safety Concerns					
<p>i. Protecting the workforce and maintaining a safe working environment.</p> <p>ii. Transmission of communicable diseases (such as STI's and HIV/AIDS) to the local community.</p>	<p>i. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, cleaning agents, herbicides and pesticides.</p> <p>ii. Contractor must provide protective masks to milling machine operators, and anyone working in the area of the milling machine dust-cement hopper area, with masks of a micron size, capable of capturing dust down to 2 microns.</p> <p>iii. Contractor to provide high-visibility clothing for workers at sites that have active traffic. Any works at night should be adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment.</p> <p>v. All Construction labour and staff of the contractor and consultant will be tested for the communicable disease (STD &STI).</p>	Construction period	Construction Camps, Construction sites and Asphalt Plant area	Contractor EHS Officer	IA
2.12 Intruption /Contamination of Water channels					
	<p>i. Contractor should provide the adequate sized diversion, so that there shall be no</p>	Construction period	Culverts and bridges	Contractor EHS Officer	IA

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	<p>disturbance to water flows of canal /water course.</p> <p>ii. Protection mechanism should be provided to avoid contamination.</p> <p>iii. Contractor should prepare traffic management plan, duly approved by the Engineer. Contractor shall also provide appropriate diversions, with signages and lighting arrangements, to avoid any accidents.</p> <p>iv. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed</p>				
2.13 Over Used Local Resources					
i. Project Labor force can impose a burden on, water resource, wildlife, fuel wood, and sanitation system.	i. Local labour will be hired for the project so there will be no additional impact on natural and social resources and services.	Construction period	Construction Camps, Work site and Asphalt Plant area	Contractor EHS Officer	IA
219. 2.14 Contractor Good Housekeeping Practices not Applied					
	<p>i. All camps shall be provided with septic sanitation facilities and potable water.</p> <p>ii. A solid waste collection</p>	Throughout the construction period	All construction camps , work areas and contractor	Contractor EHS Inspector	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	<p>iii. program must be established Monitoring will be required for the solid waste disposal at camp site and to ensure that the health and safety plan based on contract specifications is followed.</p> <p>iv. Once the site is no longer needed the contractor must fully decommission it, with special emphasis on waste removal and clean up of any spills or hazardous materials plus any necessary re-vegetation.</p>		'yards'		
3. Operating Period					
3.1 Missing environmental safeguards completion report	The contractor, will provide an mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to the PMU before the final payment can be released	1 month before the end of the construction period	NA	WSD & Contractor	WSD
220. 3.2 Air Quality degraded and Noise Level Increase	Maintenance Dept. will endeavour to keep road dust free and speed limit signs will be maintained. Police will improve enforcement of limits and conduct spot checks if muffler systems on trucks. Also signed re no-horn use will be erected in urban areas.	Operation period	All nearby Towns	Traffic Police	-
3.3 Increased Risk of Accident and Injury	Appropriate traffic calming and signage will be installed for the driver, speed	Operation period	As per design	Contractor and Traffic	ES/PMU /IA

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	limits shall be monitored by the traffic police to avoid any accident and subsequent spillage. An emergency service may be provided by the local authorities.			police	

A. Compliance Monitoring

1. Works and Services Department (WSD) and the Supervising Consultant and to a lesser extent the contractor shall be responsible for the implementation of the Environmental Monitoring measures specified in the Environmental Monitoring Table (EMoT). During the construction period monthly safeguard monitoring checklists and observations on air, noise and water quality will be presented in a tabular monitoring reports and submitted to the Implementation Agency ES- PMU,. Monitoring reports and notes to file shall be prepared as per the frequency mentioned in the EMoT and shall be assembled by the PMU and its construction supervision consultant into semi-annual monitoring reports, as mandatory submissions to ADB. Noise measurements will be obtained via a portable noise meter to be used by the contractor and/or the PMU's safeguard specialist or the Supervising Consultant's environmental specialist.

Environmental Management Plan (EMP): Environmental Monitoring Table (EMoT)

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
1. Pre-Construction Period Impacts						
1.1. Lack of environmental technical capacity within WSD and its PMU in environmental assessment and design, management, supervision and reporting.	WSD will establish a unit, or at least a person within the PMU, to manage environmental, social and safety aspects of maintenance projects. The PMU will be staffed by at least one full-time suitably qualified Environment Specialist, who will ensure that environmental safeguard measures associated with this and other projects are credibly implemented, including provision of necessary training to WSD road maintenance staff.	Confirm that WSD and Contractor training is carried out during the relevant timescales.	At least 1 month before construction begins Within the 1 st month construction begins.	Environment person working within PMY	PMU	WSD
1.2. Lack of integration of IEE/EMP requirements into construction bid documents.	PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the environmental boundaries defined in the EMP.	Confirm that bid documents, contracts and have specific environmental items or there is a specific reference to the EMP	Before the tendering and before contract finalized	Date and time that confirmation completed filed with PMU	PMU-monitor	PMU or Supervision Consultant (if available)
1.3. Loss of Vegetation and trees	During detailed design the supervising engineer/consultant will modify the design on order to minimize the removal of mature trees from roadsides; carriage	Monitor to obtain copy of plan and record compliance—for presentation in smi-annual audit report	Prior to start of construction	Date and time that confirmation completed recorded & filed with PMU	PMU-monitor	PMU

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
1.4. Top Soil Erosion	<p>Sindh Works will prepare an earthworks checklist that will define, for the contractor, limits to the excavation during the road rehabilitation.</p> <p>Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is done</p> <p>Encroachment on private land will be minimized and only after consultation with landowners and compensation of losses Land owners will be compensated This will be monitored through ES- PMU</p>	Monitor checks that topsoil management steps prepared and ready for implementation	During Planning phase, in parallel with the preparation of bid documents	Copy of topsoil protection actions	PMU	Supervision Consultant
1.5. Disturbance to and Archaeological Cultural Sites	There are no cultural or archaeological sites found in the Mirwah to Naukot road and thus no mitigation measures are required.	----	---	----	----	----
1.6. Materials Haul Routes	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the WSD will establish a route plan to minimize this disruption.	Route plan confirmed by PMU-planners and recorded for use in audit report	Prior to contractor mobilization	Written and dated note indicating compliance & inspection	PMU	Supervision Consultant
1.7. Consultation Plan with affected roadside landowners	The work along this road will affect the access from a business and residence to the road . WSD will define a road work information exchange procedure requiring the contractor to inform roadside landowners of the work, the period of access restriction and the	Review of plan and confirm a) consultation action proposed b) inclusion of timetable and c) inclusion of clean	Completed prior to contractor mobilization and provided the contractor as part of the contract	Written and dated note indicating compliance	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	measures taken to allow movement around the construction work, as well as actions to be taken to re-establish the preconstruction access	up and reconnection action.	documentation			
1.8. Contractor's Environmental Safeguards Capacity	Contractors frequently do not comply with workplace and environmental safety regulations. To address this WSD will require the contractor to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, mandatory use of Personal Safety Equipment	Review Construction contracts and specifications- to check content for OHS plan content.	Plan to be provided the Consulting Engineer and PMU prior to start of work	Written and dated note indicating compliance	PMU	Supervision Consultant
2. Construction Period Impacts						
2.1 Dust Generation : Transport of Materials						
i. A small increase in TPM (dust) is expected within the ambient air of the construction area and from vehicles hauling construction materials to the work sites.	<p>i. The Contractor will be required spray water on unsealed roads and work areas daily, within villages and past houses located close to the road and giving priority to sealing in urban areas.</p> <p>ii. Dust control at the construction site will be controlled by watering, setting strict speed limits of no more than 30kph in or near settled areas.</p>	Travel work areas and check for dust—and if found take immediate action with contractor	Anywhere where there is material moved, earthworks cutting and filling.	Written and dated note indicating compliance or issue and action taken	PMU	Supervision Consultant
2.2 Dust Generation: Quarry and Batchling Plant Operation	i. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system.	Travel Quarry and Batchling Plant Operation site and check for dust—and if found take immediate	Anywhere where Quarry and Batchling Plant is being operated.	Written and dated note indicating compliance or issue and	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	i. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or which can be easily retrofitted	action with contractor. Inspect batching plant dust suppression mechanism, its maintenance log book.		action taken		
2.3 Top Soil Erosion	<ul style="list-style-type: none"> i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. iii. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. iv. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. v. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in agreements between the land owner and contractor 	<ul style="list-style-type: none"> i. Check query sites for depth. ii. Ensure contractor store topsoil properly, and restore query site as much as possible at end of work. iii. Ensure Land owner get adequate compensation 	At any locations where borrow pits, quarries will be operated.	. Written and dated note indicating compliance or issue and action taken	WSD	Supervision Consultant
2.4 Increase in air pollution from vehicular and machinery exhaust	Emissions will be kept to a minimum by: <ul style="list-style-type: none"> i. ensuring that the contractor's fleet of vehicles are properly 	Record findings and conduct regular inspections in association with	Throughout the construction period	Inspection note to file for use in contractor reporting and	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	<ul style="list-style-type: none"> ii. maintained according to manufacturer's specifications; ii. use appropriate octane fuel and haul loads within specified limits. ii. Vehicle idling time limits to no more than 2 minutes and v. Equipment maintenance specifications will be imposed through construction inspection and regular reporting. v. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive TPM pollution. 	construction supervision		in semi-annual audit report		
2.5 Disposal of Spoil and Solid Waste						
i. Asphalt layers and base materials of the existing road	i. It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverized, spread on access roads and compacted.	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	PMU	Supervision Consultant
ii. Disposal of waste sand, aggregate, empty drums, concrete waste and waste from work camps.	<ul style="list-style-type: none"> i. The contractor will identify dumping locations for construction debris and non hazardous solid waste with TMA Mirpurkhas, and EPA Mirpurkhas. i. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor s under 	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	<p>section 13 of the Sindh Environment Protection Act 2014.</p> <p>iii. The cost of disposal of hazardous waste and non-hazardous waste shall be included in the Contractors BOQ item.</p>					
2.6 Noise & Vibration						
i. Noise and Vibrations associated with earthworks and haul roads.	<p>i. Enforcing a speed limit of 30 kph within 500m of any village and the use of water sprinkling for dust settling at least on road for 500m on either side of a village, Same approach is to be taken if the other site is used.</p> <p>ii. Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800.</p> <p>iii. Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between the contractor and the local communities.</p>	Using a portable noise meter, monitor checks conditions , and inspects if work conducted within permitted time period on urban zones	Throughout construction period	Inspection note, signed and dated	PMU	Supervision Consultant
ii. Excessive Noise at sensitive sites, identified in IEE, i.e. schools, residential areas, mosques, health care centers	ii. At the same locations and times that surface water quality is tested, noise measurements will be completed, but with measurements taken at sensitive receptors As defined in the IEE	Noise measurements at these sites recorded by monitor and if exceeding, immediate action to erect temporary barriers	Throughout the construction period	Inspection note with noise reading results	PMU	Supervision Consultant
2.7 Quarry/Borrow Materials						

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
i. Overloading of trucks, damaging pavement, bridges, culverts etc	i. The Contractor will need to ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected.	Examine weighbridge records and compare to amount of material moved	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant
ii. Risk of erosion and destruction of landscape / agriculture land from side borrow operations.	ii. Side borrow action is discouraged. However, any need for such work will be subject to local environmental approvals and procedures and should also be carried out in consultation with ES of IA/PMU.	Inspect all side borrow activities and establish what permission given, and if none require immediate closure and restoration of the site.	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant
iii. contractor extracts material from borrow areas without the permission of the Landowner.	iii. It will be ensured by PMU that borrow material will be purchased/ or taken only after the consent of the land owner has been obtained.	Inspect all borrow areas outside RoW and establish permit/ agreement to take materials	Throughout construction period.	Inspection note re findings, dated and signed		
2.8 Contamination of Water Resources (Surface& Ground)						
i. Surface water can be polluted by entering cement and other chemicals used in rehabilitation works	i. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. ii. Fuel and oil storage areas should be at least 500m away from watercourses and repair and	Regular inspection of work camps, contractors yard, fueling areas , fuel storage	At least monthly throughout the construction period	Checklist showing check fuel and lubricant handling, waste oil management , machinery	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	<p>fuelling yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site.</p> <p>iii. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refuelling to be carried out at the fuel storage area and not be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the crossing once before, during and after the work has been completed on that crossing.</p> <p>iv. All diversions must be checked for Signages and lightings on weekly basis,</p>	Regular monitoring of diversion for signages and lightings	At least fortnightly where diversions are placed	<p>was down water control, etc. signed and dated--filed.</p> <p>Checklist showing the check for lighting and signages signed and date filled</p>		
2.9 Damage / disturbance to Utilities within RoW	<p>i. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused.</p> <p>ii. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.</p>	Review of notifications and approvals from all utilities as per the legal requirements	<p>Before the start of construction work.</p> <p>Design phase.</p>	Inspection note re findings, dated and signed	PMU	Supervision Consultant
2.10 Traffic Disturbance						
i. Loss of access for roadside residents	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and	Inspect construction areas where	Throughout construction period	Inspection note re findings,	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	properties connecting the project road/area, Work that affects the use of side roads and existing access shall not be undertaken without provision of adequate alternate routes; to the prior satisfaction of the Engineer and affected persons. Contractor shall submit the Traffic plan which needs to be approved from The Engineer.	access is an issue and establish if contractor is managing problem and if local residents are satisfied.		dated and signed		
2.11 Health and Safety Concerns						
<p>i. Protecting the workforce and maintaining a safe working environment.</p> <p>ii. Transmission of communicable diseases (such as STI's and HIV/AIDS) to the local community.</p>	<p>i. Contractor must provide safety vests, hard hats and protective footwear, dust masks (good for 2.5 micron size particles) and ear plugs for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, cleaning agents, herbicides and pesticides.</p> <p>ii. Contractor to provide high-visibility clothing for workers at sites that have active traffic. Any works at night should be adequately lit and high visibility clothing worn. Contractor to provide basic training on use of protective clothing and equipment.</p> <p>iii. All Construction labour and staff of the contractor and consultant will briefed in STD's and given option to be tested (personal choice).</p>	Inspection of construction sites to ensure proper use of OHS gear and contractor enforcement	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant
2.12 Intrruption /Contamination of Water Sources						

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	<ul style="list-style-type: none"> i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /water course. ii. Protection mechanism should be provided to avoid contamination. iii. Contractor should prepare traffic management plan, duly approved by the Engineer. Contractor shall also provide appropriate diversions, with signages and lighting arrangements, to avoid any accidents. iv. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed 	<p>Inspection of diversion along the road, check signages, lighting any leakage etc at the diversion and rectify through contractor. Ensure contractor has adequately restored temporary land.</p>	<p>Culverts and bridges</p>	<p>Contractor EHS Officer</p>	<p>IA /PMU</p>	<p>Supervision Consultant</p>
2.13 Over Used Local Resources						
<ul style="list-style-type: none"> i. Project Labor force can impose a burden on, water resource, wildlife, fuel wood, and sanitation system. 	<ul style="list-style-type: none"> i. Local labour will be hired for the project so there will be no additional impact on natural and social resources and services. 	<p>Inspection of work areas and meet with local officials to establish if excessive use of local resources is a concern</p>	<p>Throughout construction period—at least once when work is near or in a community</p>	<p>Meeting note signed and dated</p>	<p>PMU</p>	<p>Supervision Consultant</p>
2.14 Contractor Good Housekeeping Practices not Applied	<ul style="list-style-type: none"> i. All camps shall be provided with septic sanitation facilities and potable water. ii. A solid waste collection program must be established iii. Monitoring will be required for the solid waste disposal at camp site 	<p>Inspect all camp operations including worker housing and all waste management procedures</p>	<p>Throughout the construction period while work camps are in operation</p>	<p>Inspection note re findings, dated and signed</p>	<p>PMU</p>	<p>Supervision Consultant</p>

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	<p>and to ensure that the health and safety plan based on contract specifications is followed.</p> <p>iv. Once the site is no longer needed the contractor must fully decommission it, with special emphasis on waste removal and clean up of any spills or hazardous materials plus any necessary re-vegetation.</p>					
3. Operating Period						
3.1 Missing environmental safeguards completion report	The contractor, will provide an mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract document and submit that to the PMU before the final payment can be released	Obtain completion report and review for compliance	1 month before the end of the construction period	Note to file and copy of completion report	WSD	WSD
3.2 Air Quality degraded and Noise Level Increase	Maintenance Dept. will endeavour to keep road dust free and speed limit signs will be maintained. Police will improve enforcement of limits and conduct spot checks if muffler systems on trucks. Also signed re no-horn use will be erected in urban areas.	WSD to take necessary action	During the operation of the upgraded road—on a continuing basis	Note to file indicating status of this maintenance work	WSD	WSD
3.3 Increased Risk of Accident and Injury	Traffic speed limit and noise restriction signage will be installed along the road and monitored by the traffic police An emergency service may be provided by the local authorities. Traffic calming in urban areas including speed-bumps.	WSD to take necessary action	During the operation of the upgraded road—on a continuing basis	Note to file indicating status of this maintenance work	Traffic Police and WSD	WSD

