



Technical Assistance Consultant's Report

Project Number: 44140
Date: September 2013

TA 7566-REG: Strengthening and Use of Country Safeguard Systems

Subproject: Country Safeguard Review (Papua
New Guinea)

GUIDELINES FOR THE ENVIRONMENTAL ASSESSMENT OF ROAD AND BRIDGE INFRASTRUCTURE PROJECTS

Prepared by ADB Consultant Team

This consultant's report does not necessarily reflect the views of ADB or the Government concerned, and ADB and the Government cannot be held liable for its contents.

Asian Development Bank

DRAFT VERSION



Department of Works

**Guidelines for the Environmental Assessment of Road and
Bridge Infrastructure Projects**

Ver 2

September 2013

TABLE OF CONTENTS

1	ROADS AND BRIDGES ENVIRONMENTAL MANAGEMENT GUIDELINE.....	4
1.1	Introduction to the Guideline	4
1.2	Legislation	5
1.2.1	Level 1 Activities	5
1.2.2	Level 2 Activities	5
1.2.3	Level 3 Activities	6
1.3	DoW Environmental Policy	7
1.4	Objectives of Environmental Assessment	7
1.5	Main Impacts of Roads and Bridges	8
1.6	Procedure for Commencing the Environmental Assessment	9
1.6.1	Level 1 Activities	9
1.6.2	Level 2B Activities	9
1.6.3	Level 3 Activities	10
1.7	Preparation of the Environmental Management Plan	11
1.7.1	Contents of the EMP	11
1.7.2	Summary of Impacts	11
1.7.3	Mitigation Measures	12
1.7.4	Environmental Monitoring.....	17
1.7.5	EMP implementation arrangements	18
1.7.6	Organisational Arrangements and Roles	18
1.7.7	Organisations with Direct Responsibilities	18
1.7.8	Other Organisations with Indirect Roles	21
1.7.9	Reporting and Review	21
1.7.10	Cost Estimates	22
ANNEX 1:	Checklist Of Possible Impacts For Road And Bridge Projects And Other Infrastructure	20
ANNEX 2:	Environmental Management Guides	26

LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
CEMP	Contractor's Environmental Management Plan
DEC	Department of Environment and Conservation
DoW	Department of Works
EIA	Environmental Impact Assessment
EMG	Environmental Management Guideline

EMP	Environmental Management Plan
EIR	Environmental Inception Report
EIS	Environmental Impact Statement
LARP	Land Acquisition and Resettlement Program
LLG	Local Level Government
NGO	Non Governmental Organisation
WB	World Bank

1 ROADS AND BRIDGES: ENVIRONMENTAL MANAGEMENT GUIDELINE

1.1 Introduction to the Guideline

This guideline (the guideline) updates an earlier guideline written for the Department of Works (DoW) in 1999. As the guideline was issued prior to the *Environment Act, 2000* and the *Environment (Prescribed Activities) Regulation, 2002* the guideline is now updated to be compliant with these legislative and regulatory requirements, including the more recent instructions issued by the Department of Environment (DEC) in 2004¹, 2012². and 2013³

Apart from the revisions required to update the regulatory requirements the technical material from the previous guideline has also been reviewed and is again included with only minor changes in this guideline (Annex 1).

The guideline also includes a new section on preparation of the EMP to comply with a recent instruction from DEC⁴ requiring all development projects to prepare a standard EMP. The EMP also introduces methodology for attaching the EMP to the contract and evaluating contractor competence in complying with the EMP requirements.

A new section (Annex 2) has been included to assist in development of mitigation measures and application of these to construction situations

The guideline is designed to address environmental requirements for undertaking infrastructure projects that the Department of Works undertakes, principally in roads and bridges but it is also to be used as the basis for reviewing other infrastructure projects such as ports, airstrips etc..

The guideline has been developed to primarily assist environmental specialists in undertaking the environmental assessment and implementation of road, bridge and associated infrastructure projects during design (pre-construction), construction and operation. Additionally an understanding of these procedures will assist project managers, works supervisors and contractors to comply with the environmental requirements that have been addressed by the environmental assessment and the EMP so as to avoid and minimise adverse environmental impacts.

¹ *Information Bulletin Notification of Preparatory Work on Level-2 and Level-3 Activities, DEC, 2004*

² *Procedures for Permit Applications and Revised Procedures for Registration of Intent to Undertake Preparatory Work on Level-2 and Level-3 Activities, DEC, Nov 2012.*

³ *Information Requirements for Permit Applications and Registration of Intention to Carry Out Preparatory Work, DEC, March 2013.*

⁴ *Guideline for Preparation of an Environmental Management Plan, DEC, 2013.*

1.2 Legislation

Within PNG environmental activities are addressed by the *Environment Act, 2000* and the *Environment (Prescribed Activities) Regulation 2002* which defines three levels of activities from *Level 1* (low risk activities), *Level 2* (moderate risk activities) and *Level 3* (high risk activities) which require differing degrees of assessment. The assessment levels are detailed in the DEC *Information Bulletin Notification of Preparatory Work on Level-2 and Level-3 Activities, 2004*.

Two further Operational Procedures have been issued by DEC:

- i. *Procedures for Permit Applications and Revised Procedures for Registration of Intent to Undertake Preparatory Work on Level-2 and Level-3 Activities, Nov 2012 and;*
- ii. *Information Requirements for Permit Applications and Registration of Intention to Carry Out Preparatory Work, March 2013.*

1.2.1 Level 1 Activities

Construction of provincial and district roads and bridges, and their maintenance are not included as a category within the *Information Bulletin, 2004* and therefore are considered as a Level 1 Activity. This requires DoW to notify the activity to DEC who will confirm the actual *Activity Level* to the proponent and the required documentation to be submitted to DEC for approval to undertake the work. The proponent (or DoW) is to follow the outline of *Information Required in Information Bulletin, 2004* and submit this to DEC for confirmation of the Level of assessment required. For Level 1 construction and maintenance activities this will at the minimum require the preparation of an EMP to comply with the DEC *Guideline for Preparation of an Environmental Management Plan, 2013*.

1.2.2 Level 2 Activities

Level 2 activities are subdivided into Category A (low risk) and Category B (higher risk) projects. All Level 2 infrastructure projects are included under the Cat B classification.

For Level 2B activities the Nov'12 and March'13 procedures outline a two step procedure for undertaking Level 2B projects.

- i. The first step (*Preparatory Work*) requires the proponent to register their intention (*Environmental Permit Application*) to undertake such an activity and submit a 1-2 page description of the preparatory works to allow DEC to determine whether a Permit is required to undertake the works. Schedules 1 and 2 of the March '13 Procedure contain outlines for completing an *Environmental Permit Application* which is to be lodged with DEC who will advise the proponent of the required *Level and Category*.

ii. The second step (*Activity*) for Level 2B projects is for the proponent to prepare a baseline environmental study and an EMP together with a monitoring program. The outline for a Level 2B environmental study is given in *Schedule 3 General Guidelines on the Additional Information Required to Support a Permit Application for a Level 2B activity*. The EMP is to be prepared to comply with DEC *Guideline for Preparation of an Environmental Management Plan, 2013*.

The following infrastructure projects are specifically covered in *Environment (Prescribed Activities) Regulation 2002*, under the following sub-categories;

Level 2: Sub-category 12: Infrastructure

12.4 *Construction of aerodromes or airfields except unpaved airstrips more than 10 km from an urban area.*

12.5 *Construction of new national roads.*

12.6 *Construction of electricity transmission lines or pipelines greater than 10km in length.*

12.6 *Construction of housing estates with an area greater than 5 ha.*

Level 2: Sub-category 7: Mining and Extraction

7.4 *Quarrying involving the extraction of more than 100,000 tonnes per annum, and*

7.5 *Gravel extraction operating continuously for more than 6 months and involving the extraction of more than 10,000 tonnes per annum.*

All Level 2 activities require the proponent to submit a notification to DEC that it intends to carry out a Level 2 activity. The notification is to follow the above procedure to be compliant with DEC requirements. DEC will confirm the Level and Category of the project (*preparatory work*) and the assessment required (*activity*).

1.2.3 Level 3 Activities

Level 3 activities contain a high degree of risk and the *Permit Application* requires a detailed study including the preparation of an *Inception Report* (i.e. scoping study), an *Environmental Impact Statement* (EIS) and an *EMP*.

Details of how to prepare these documents are provided in the following DEC Guidelines:

i. *Guideline for Preparation of an Environmental Inception Report, 2004.*

ii. *Guideline for Conduct of an Environmental Impact Assessment and Preparation of Environmental Impact Statement, 2004.*

iii. *Guideline for Preparation of an Environmental Management Plan, 2013.*

Road and infrastructure planners need to consider whether any of the planned activities include any of the following categories. If the activity is triggered by any of the following, a Level 3 assessment will be required. The following infrastructure projects are specifically covered in *Environment (Prescribed Activities) Regulation 2002*, under the following sub-categories;

Level 3: Sub-category 14: General

14.4 *Activities that may result in significant risk of serious or material harm within Wildlife Management Areas, Conservation Areas, National Parks and Protected Areas or any area declared to be protected under the provisions of an International Treaty to which Papua New Guinea is a party and which has been ratified by the Parliament of the Independent State of Papua New Guinea.*

Level 3: Sub-category 16: Forest Handling and Land Clearance

16.2 *Any large scale clearing carried out under Section 90 (a), (b), (c) or (d) of the Forest Act.*

Level 3: Sub-category 17: Mining and Extraction

17.3 *Extraction of off-shore coral deposits for roading, commercial lime making or similar use.*

Level 3: Sub-category 19: Infrastructure Construction

19.2 *Construction of sea ports and ship repair facilities serving ships of an individual tonnage of more than 500 tonnes.*

19.3 *Infrastructure construction that requires the reclamation of more than 5 ha of land below the high water mark.*

19.4 *Construction of sewage treatment plants designed to serve an individual population of greater than 50,000.*

Level 3: Sub-category 21: Waste Disposal

21.1 *Construction and operation of municipal landfills serving populations of more than 20,000 people.*

1.3 DoW Environmental Policy

1.4 Objectives of Environmental Assessment

Environmental assessment consists of two main components:

- i. the baseline assessment of the physical, biological and social environments.
- ii. The Environmental Management Plan which consists of the assessment of impacts, mitigation measures and monitoring requirements.

The resulting environmental assessment is to provide project planners, designers, maintenance supervisors and contractors with enough information to be able to understand the environmental issues of the project or activity and to keep negative impacts to an acceptable level thereby improving the project's sustainability.

The outcome of the assessment process will identify risks and thereby minimise damage to sensitive environments such as forests, food gardens, rivers, wetlands, karst areas, mangroves, coral reefs, seagrass beds and other coastal and marine areas, to protect landforms and soil cover, and reduce sedimentation of streams, to minimise damage to vegetation, animals and habitats; to avoid unnecessary damage to archaeological sites and other sites of cultural significance; and to cause minimal social disruption.

The assessment will also address social issues that the project or activity may create such as land acquisition and resettlement, hiring of labour, selection of sites for locating the contractor's facilities, location of labour camps and community health and safety.

During the environmental assessment process it is important that affected communities and minority groups are involved in all stages of the decision-making process. This includes local landowners and residents, government, commercial institutions, NGOs and other community groups. This can be facilitated by the appointment of a person to liaise directly with affected communities.

The decision-making process should be transparent, so the reasons for the decision are apparent to all participants. There should also be a process to resolve disputes or grievances that may arise especially at the village level.

The assessment should be carried out to the highest possible technical standards.

The process must be cost-effective and time effective. This is achieved by incorporating the environmental assessment process into the preliminary planning phase of any development project.

1.5 Main Impacts of Roads and Bridges

Impacts that are normally associated with the construction or maintenance of roads and bridges include a range of impacts that affect the biophysical and social environments. These are carried in from the earlier guideline and are shown in Annex 1 as a checklist of possible impacts. While mitigation measures need to be assessed for every situation a range

of the more likely or expected mitigation measures, together with their monitoring requirements and methods for addressing them in the contract documentation are shown in Annex 2.

1.6 Procedure for Undertaking the Environmental Assessment

Environmental assessments may be undertaken by either DoW or more likely by a proponent who is working on behalf of the DoW. Where the assessment is undertaken by a proponent the proponent will need to be familiar with the guideline requirements and the procedures to prepare the various studies to meet the Level 1, 2 or 3 regulatory requirements of the DEC. Upon completion of the assessment the proponent will leave the completed assessment documentation with the DoW Environmental Officer who will review the documentation and submit it DEC to issue the Environmental Permit.

The following procedure must be actioned as early as possible to ensure that the notification approving the Level is received in time from DEC for the project/activity to commence and be completed within the time schedule that has been established for the project.

The DoW Environmental Officer will be responsible for the following procedure.

1.6.1 Level 1 Activities

- i. For Level 1 activities; DoW is required to submit a statement to DEC requesting approval of the project or activity as a Level 1 activity together with an EMP.
- ii. DEC will advise either confirming the level and approving the activity/project, OR if DEC does not agree with the requested level, DEC will change this to a different level and advise DoW accordingly.

1.6.2 Level 2B Activities

- i. For Level 2B activities DoW will be required to register their intention in an *Environmental Permit Application* to undertake such an activity and submit a 1-2 page description of the *Preparatory Works* to allow DEC to determine whether an *Environment Permit* is required to be issued by DEC to undertake the works. *Schedules 1 and 2* of the March '13 Procedure contains an outline for completing an *Environmental Permit Application*.
- ii. The *Environmental Permit Application* is to be lodged with DEC who will advise DoW of the required *Level and Category*. Upon receipt of this DoW can advise the proponent to engage their consultant and start the assessment process.

- iii. The second step (*Activity*) for Level 2B projects is for the proponent to prepare a baseline environmental study and an EMP together with a monitoring program. The outline for a Level 2B environmental study is given in *Schedule 3 General Guidelines on the Additional Information Required to Support a Permit Application for a Level 2B activity*. The EMP is to be prepared to comply with DEC *Guideline for Preparation of an Environmental Management Plan, 2013*.

1.6.3 Level 3 Activities

- i. For Level 3 activities which contain a high degree of risk DoW will notify DEC (*Notification to Carry out Preparatory Works*) by providing the information required on pages 1 and 2 of *Notification of Preparatory Work on Level-2 and Level-3 Activities*.
- ii. DEC will confirm the level and if it considers that this is a Level 3 Activity will advise DoW to proceed. At this stage DoW can advise the proponent of the approval to commence who can arrange to mobilise their consultants to undertake a Level 3 Activity which requires an Environmental Impact Assessment process to be completed.
- iii. The consultant commences the study by preparing an *Environmental Inception Report* (EIR) which acts as a scoping study that establishes the Terms of Reference (ToR) for the subsequent *Environmental Impact Statement* (EIS) and *EMP*.
- iv. DoW submits the EIR to DEC who confirm or reject the EIR.
- v. If the EIR is approved, DoW advise the consultant to prepare the EIS and the EMP.
- vi. The EIS and EMP is submitted to DEC who arrange for the EIS and EMP to be reviewed and get the Minister's approval in principle to the EIS.
- vii. DEC advise DoW of the requirements for public advertisement and consultation and following the successful completion of these tasks, DEC will issue an Environment Permit to DoW with conditions which will most likely contain monitoring requirements to comply with the EMP.

Details of how to prepare the documents required for an EIS are provided in the following DEC Guidelines:

- i. *Guideline for Preparation of an Environmental Inception Report, 2004*.
- ii. *Guideline for Conduct of an Environmental Impact Assessment and Preparation of Environmental Impact Statement, 2004*.
- iii. *Guideline for Preparation of an Environmental Management Plan, 2013*.

1.7 Preparation of the Environmental Management Plan

An environmental management plan (EMP)⁵ is a project-specific activity plan designed to avoid or minimise the negative impacts identified in the environmental assessment process. While the EMP mainly addresses requirements to be addressed during the construction phase it also addresses issues identified in detailed design and during operation.

As the EMP specifies activities to be carried out and defines responsibilities it is one of the most important documents that emanates from the environmental assessment process. The construction section of the EMP is attached as a specification to the contract bid document which the contractor is to address and cost during the bid process.

All projects and maintenance activities whatever their level require an EMP which is to be attached to the contract bidding documents.

1.7.1 Contents of the EMP

An EMP consists of the following sections .

- i. Summary of Impacts*
- ii. Mitigation Measures*
- iii. Environmental Monitoring*
- iv. Public Consultation Plan*
- v. Implementing Arrangements*
 - a. Implementation Schedule*
 - b. Institutional and Organisational Arrangements*
 - i. Responsibilities for Mitigation and Monitoring*
 - ii. Reporting and Review*
 - c. Cost Estimates*

1.7.2 Summary of Impacts

The assessment of impacts and definition of mitigation measures is the formative part of the Environmental Management Plan (EMP). While this guideline is intended to address Level 1 and 2 activities, impacts that are identified in Annex 1 can be extended to identify impacts for Level 3 projects⁶.

⁵ The following outline for the EMP follows the Guideline for Preparation of an Environmental Management Plan DEC Publication xx 2013. It has been slightly adapted to meet DoW requirements, otherwise the methodology for preparing the EMP remains the same.

⁶ Level 1 and 2 activities are mainly small "activities" with minor easily addressed impacts i.e. small projects or maintenance projects. i.e. at this level the activity is of a relatively easily understood nature that can be easily mitigated using well understood technology. For Level 3 activities these are

1.7.2.1 Identification of Impacts - Level 1 Activities

For activities that are categorised as Level 1 - where only the EMP is required to be prepared - the EMP is based on the expected impacts that would occur at the site. These will have been identified during the *Notification Stage* when the activity is notified to DEC for their confirmation of the *Activity Level*. These would be minor impacts of a general and well understood nature that can be relatively easily mitigated. For Level 1 projects the assessment of impacts for *Notification* is to be based on a review of the possible impacts identified in the *Checklist of Possible Impacts* attached as Annex 1.

1.7.2.2 Identification of Impacts - Level 2 Activities

The main impacts will have been identified in the *Preparatory Work* undertaken as the first step in notifying DEC of the activity by addressing the requirements of the *Environment Permit Application*. For Level 2B projects a baseline environmental study is undertaken in accordance with *Schedule 3 Guidelines on the Additional Information Required to Support a Permit Application for a Level 2B Activity*. For Level 2B projects the assessment of impacts is to be based on a review of the possible impacts identified in the *Checklist of Possible Impacts* attached as Annex 1.

1.7.2.3 Identification of Impacts – Level 3 Activities

For Level 3 Activities, i.e. large complex projects with extensive impacts , impacts are to be identified via a scoping process that is addressed by the *Inception Report* as part of the preparatory work. The *Inception Report* findings establish the Terms of Reference for the *EIS*.

1.7.3 Mitigation Measures

Where impacts and risks cannot be avoided or prevented, mitigation measures and actions are to be identified to reduce or minimize adverse impacts so that the project is constructed and operated in compliance with applicable legislation and well understood “best practices” that are commonly used throughout the industry. Mitigation measures are to be provided for each impact that has been identified.

Key considerations includes the mitigation of potential adverse impacts to the level of “no significant harm to third parties”, the polluter pays principle, the precautionary approach and adaptive management. Should residual impacts remain, compensatory measures or offsets are to be considered, e.g. in replacing forest losses.

now “projects” with more complex and a more extensive range of impacts, many of which may be of major significance that cannot be easily mitigated.

From the range of impacts identified in the preceding step determine suitable mitigation measures from the range of *Environmental Management Guides* shown in *Annex 2*.

For each mitigation measure, allocate who and which organisation will be responsible for implementing the measure together with its cost. Also determine the time when the measure is to start to be applied.

1.7.3.1 Mitigation Plans

For road and bridge projects mitigation measures can often be bundled in specific mitigation plans. Some of these plans may include the following:

- i. **SITE CLEARING PLAN:** The objective of the plan is to clearly identify the area to be cleared to avoid excessive clearing of vegetation. It will require definition of areas not to be cleared e.g. vegetation with high conservation value, buffer strips along water courses, etc. Show how the vegetation is to be disposed of after clearing – try and avoid burning and instead consider methods of allowing adjoining communities to collect and dispose of the material. Define methods for stripping topsoil and stockpiling it for later use in site rehabilitation.
- ii. **INVASIVE SPECIES CONTROL PLAN:** where aggressive invasive species – both flora and fauna – may be present which may invade the area as a consequence of the project either from construction or operation, the plan is to address methods of controlling the inadvertent spread of these species by project activities.
- iii. **SITE PROTECTION: EROSION AND SEDIMENT CONTROL PLAN:** The objective of this plans is to protect disturbed areas against erosion and minimise sediment mobilisation. The plan would identify the erodibility risk of the soil and causes of erosion such as rainfall intensity, length and degree of slope and cover protection requirements on the construction site. The Plan may require the construction of temporary or permanent installations to stabilise areas to control erosion and prevent the delivery of sediment into waterways.
- iv. **ROADSIDE DRAINAGE PLAN:** In areas of intensive gardening, especially in high rainfall areas, it is important to ensure that road drainage is not directed into garden areas. It is recommended that during the construction phase regular meetings be held with landowners along each section of the route, to design cooperatively the outflows from the road, and to ensure that they are channelled into safe outlets e.g. natural streams. Wherever possible, runoff from the road should also pass via a broad grassed surface to slow down the velocity and allow sediment to be deposited.

- v. Roadside drainage systems also need to be evaluated with regards to their long term stability in terms of their length of slope and degree of slope. Excessive lengths and slopes of bare earth channels should be broken up by increasing the number of outlets or stabilising the channels with non-eroding materials such as corrugated steel pipes or concrete sections⁷.
- vi. QUARRY AND GRAVEL EXTRACTION PLAN: Quarry sites or borrow pits for both embankment material and pavement gravels and aggregates will normally be needed for road construction and sealing. Both solid rock quarries and river floodplain gravel sites may need to be accessed. The plan will need to develop procedures to access the area if it is held privately or in customary title. The Plan will need to advise whether licences or approvals are required. Following completion of construction all quarries and borrow pits will need to be “closed” by being landscaped, topsoil being respread and revegetated.
- vii. STOCKPILE AND SPOIL HEAP MANAGEMENT PLAN: The objective of this plan is to identify methods to locate stockpiles so that they do not erode thereby preventing sediment entering watercourses. The placement of stockpiles must ensure that natural drainage channels are not restricted and that spoil heaps and stockpiles are constructed and maintained in a manner which ensures that they are stable. Following completion of construction the areas must be closed by rehabilitating the site. Access roads to any dump sites must also be closed and rehabilitated. Where access roads are to be closed and will no longer be used the road will need to be ripped to remove soil compaction before being revegetated.
- viii. SITE REHABILITATION PLAN: As work is completed in construction sites, quarry/borrow pit sites, and road batters, the Site Rehabilitation Plan will determine the methodology to be applied to these areas. Saving and stockpiling topsoil is an essential part of the plan together with recommendations for rehabilitating the disturbed sites including revegetation of exposed areas. The plan will also detail methodology to be used in closing work areas such as contractor’s facilities which may require the removal of contaminated soil from fuel storage areas and workshop facilities. Rehabilitation plans should be discussed with local landowners who may be able to undertake the rehabilitation and attendant revegetation work as a local community contract.

⁷ *Tipping rocks into eroded channels will not stabilize channels unless they are placed on a geotextile membrane.*

- ix. **FUEL HANDLING PLAN:** Where large quantities of fuel will be stored on-site this plan addresses the design of fuel storage areas so that spills are contained on-site. Fuel handling and transfer procedures for refuelling from mobile tankers should be addressed with regard to where refuelling operations can be safely undertaken. The plan will also need to address training of refuelling staff in fire safety procedures and spill clean up.
- x. **WASTE MANAGEMENT PLAN:** For large construction sites a Waste Management Plan will be required to address the collection, handling and disposal of waste. This would address all wastes to be used on site including organic and inorganic waste and dangerous and hazardous wastes. Clean up procedures for handling spills of dangerous and hazardous wastes must also be addressed. Waste Management Plans must be compliant with national legislation.
- xi. **STORAGE AND HANDLING OF HAZARDOUS WASTES:** Identify which materials are classified as hazardous materials. These would have a HAZCHEM rating and be accompanied by a Material Data Sheet (MDS). Using the MDS develop a plan the store and handle these materials together with the appropriate safety and training procedures for workers who may be required to handle these materials.
- xii. **TRAFFIC MANAGEMENT PLAN:** The Traffic Management Plan (TMP) addresses issues that will arise from increased traffic arising from contractor's vehicles using access roads that are also shared and used by the community. Risks will be created for the community where the contractor's vehicles will be required to transport materials using these roads for access to the work site or as haul roads. The plan will need to address requirements for driver employment and safety awareness, how fugitive loads will be secured to avoid dust and materials falling onto the roads, requirements to wash down trucks and remove mud from wheels before entering roads. At the completion of work any damage to the road is to be repaired and the road reinstated to a condition that it was at the time of commencing haulage along the road.

The Community Consultation and Grievance Reporting Plan should be used as the vehicle to communicate with the community concerning the Traffic Management Plan. This would also contain details of the grievance reporting mechanism which will provide the community with a method of addressing any issues arising from traffic passing through their communities and using their roads.

- xiii. **COMMUNITY CONSULTATION AND GRIEVANCE REPORTING PLAN:** Consultation with local and provincial governments, communities and stakeholders along the project

route or area is imperative as an absence of consultation often ends up with misinformation and miscommunication that can hinder project activities. Consultation must be carried out prior to the project commencing and this should be frequent throughout the life of the project.

To address these issues and the complex land ownership and cultural environments that often operate within the project area a Community Consultation Plan should be prepared for projects or situations where these issues will arise. The plan will develop methodology for delivering effective and participatory consultation to the affected communities. The plan will address the project's implementation and advise on issues that the project may cause or exacerbate by its construction and operation e.g. material sources which are identified during implementation, location of labour camps, recruiting labour, community safety where haul trucks may pass through villages, dust management within villages etc. Community consultation can also be used to facilitate dialogue in arranging small community based contracts for labour intensive work such as site clearing or rehabilitation. For these situations the plan would recommend that a specialised person be included within the Contractor's team structure and costed in the Bid offer to facilitate community consultation.

Grievance Reporting Mechanism: A grievance reporting mechanism should also be included as a part of the Community Consultation and Grievance Reporting Plan which provides a method for resolving community grievances or complaints, raised during the construction phase. Normally these would be raised first with the contractor. Should the contractor be unable to resolve the issue the issue is then passed to the next higher level which in most cases would be the PMU or if no PMU has been formed then directly to the Environmental Unit (EU) in the DoW for a decision. Complaints must be made and dealt with openly and without any fear of retribution to the person making the complaint.

If a reporting procedure has not already been prepared and approved by the EU the contractor is required to prepare a Grievance Reporting Procedure that establishes the steps for any person making a complaint. All complaints will be addressed by the contractor and recorded in a Complaints Register which will be kept on site⁸. will be reported in the contractor's monthly reports.

⁸ The Complaints Register should be triplicate book with the original of the complaint being returned to the person making the complaint. The duplicate being sent to the PMU or EU, and the triplicate being retained in the book. Both the duplicate and the triplicate should show the action that was taken as to how the complaint was resolved. At the end of the month the status of any complaints raised that month is addressed in the contractor's monthly report.

The contractor is responsible for implementing the procedure which includes maintaining the Complaints Register which is to be available to the public at the work site. The contractor will be responsible for ensuring that complaints are registered and dealt with according to the procedure.

- xiv. **COMMUNITY HEALTH AND SAFETY PLAN:** this plan specifically addresses community health and safety issues in such areas as developing HIV/AIDS awareness, providing briefing to communities on increased traffic passing through their areas from contractor's vehicles, procedures to access the work site etc. The plan will also need to have a grievance redress mechanism in it for communities to be able to effectively raise health and safety issues with the project management. The appointment of a Community Liaison Officer will be able to resolve many of these issues as an intermediary between the community and the project management.
- xv. **WORKER HEALTH AND SAFETY PLAN:** this will address requirements of the PNG labour legislation and provide methodology to mitigate possible adverse work place accidents and ensure a safe and healthy work place.

1.7.4 Environmental Monitoring

For each mitigation measure identified, the EMP is to describe the following:

- i. Activity with potential impact.*
- ii. Proposed mitigation measure.*
- iii. Responsibility for supervising and managing the implementation of the mitigation measure.*
- iv. The cost of mitigating the impact.*
- v. The Parameter to be monitored.*
- vi. Frequency of monitoring and means of verification that the measure is achieving its result.*
- vii. Who is responsible for monitoring the parameter?*
- viii. The cost of monitoring the parameter.*

The EMP will identify how the monitoring program will be organised throughout the life of the project and identify the person within the organisation that will have the overall responsibility for supervising the program. The monitoring program will define whether any other organisations may have secondary independent monitoring roles to validate the data. Schedules and procedures to review the mitigation measures should be provided to assess after a period of time, whether any of the mitigation measures are not responding in the way that the EMP predicted. Should this be demonstrated then the mitigation and associated

monitoring requirements will need to be redesigned to accommodate these changes. Changes may also be needed in the monitoring program as parameters change or become irrelevant.

Prepare a matrix of the monitoring program that summarises the above eight parameters.

1.7.5 EMP implementation arrangements

This section of the EMP includes a project implementation schedule and identifies the various organisations responsible for supervising the implementation of the mitigation and monitoring measures.

1.7.5.1 Implementation Schedule

Provide a schedule of the project's main phases (design and pre-construction, construction and operation) that shows the start and finish dates of the main project activities, e.g. site clearing, establishment of contractor's facilities, removal of road sub-base etc. Knowing when these activities are planned will identify when specific mitigation measures will need to be scheduled.

1.7.6 Organisational Arrangements and Roles

For each activity where mitigation and monitoring measures have been identified, identify who (a person within an organisation) and which organisation will be responsible for implementing the measure.

Responsibilities are then allocated between those organisation with primary direct responsibilities and those with indirect or secondary responsibilities.

1.7.7 Organisations with Direct Responsibilities

1.7.7.1 DoW

DoW⁹ will need to identify a management and organisational structure to manage the project including the environmental requirements, together with personnel to implement and supervise the EMP. If neither suitably qualified personnel nor a suitable management structure exists DoW will need to arrange to recruit personnel and establish the management organisation. For smaller projects it may be possible to arrange the supervision of the EMP

⁹ *In this situation DoW is considered as being the "Proponent", however should another organization be responsible for implementing the EMP, DoW will need to reallocate the roles as required between the other organization and DoW.*

by hiring an environmental consulting organisation. The management and reporting structure is to be included as part of the EMP¹⁰.

Identify and define the roles of those personnel who will be responsible for supervising the EMP¹¹ including the following personnel; the Project Manager, the Supervising Engineer, the Environmental and Social Officer and any other appointments e.g. Community Liaison Officer etc., that are necessary to ensure the EMP is adequately supervised.

Provide an organisational structure showing the relationship of the PMU environmental unit within the overall PMU organisational structure together with the location of the various supervising personnel so that responsibilities and reporting arrangements are clearly shown.

Examine each of the project activities with regard to legislative requirements and ensure that the EMP addresses all of the requirements that the project will need in terms of licences and approvals, during construction. Provide details of the legislation that applies and the organisation responsible for providing the approvals.

DoW will be responsible for ensuring that the EMP is attached to the Bidding documents so that the EMP requirements can be addressed and costed when the contractor makes the bid. This ensures that the cost of carrying out the EMP is included within the bid price.¹²

DoW will also need to review the contractor's bid and establish the following:

- i. The contractor has addressed and costed the EMP.
- ii. The level of specialisation and competence within the contractor's team to effectively comply with the EMP requirements. If the contractor is unable to meet these requirements and DoW wishes to proceed with the bid, DoW will need to consider

¹⁰ The structure of the management unit is often referred to as a Project Management Unit or PMU. Within the PMU an Environmental Unit (EU) may be organized and depending on the project's scope and objectives the EU would contain at least one person responsible for supervising environmental compliance and normally another person to address social and land acquisition issues. For smaller projects one person may manage the requirements for both environmental and social issues. The Proponent is required to address the management organizational structure for implementing the EMP as a part of the EMP.

¹¹ Roles are normally defined within the persons ToR, e.g. the Project Manager's ToR should include a statement – the Project Manager will be responsible for ensuring that the EMP is applied and satisfactorily implemented to meet the requirements of the EMP. The Supervising Engineer may have the following included in their ToR ... the Supervising Engineer will be responsible for supervising and directing the Contractor to comply with the EMP.

¹² To ensure that the EMP is costed, (i) the EMP needs to be attached as a Specification in the Bid document and (ii) a budget line included in the bid where the cost of applying the EMP is specified. Usually the Project Manager would be identified as the person with the primary responsibility for ensuring the EMP is attached to the Bid Documents. The Environmental Officer should also verify that this has been done before the Bid Document is released.

training the contractor to build up capacity in environmental management and supervision of the EMP¹³.

DoW will also be responsible for establishing the monitoring program requirements as set out in the EMP. Normally the contractor has the primary responsibility for monitoring the EMP which requires DoW to independently monitor the contractor's work.

DoW will submit regular reports as required to those organisations identified in the project management/loan agreement.

1.7.7.2 Contractor's Role

The contractor will have a major role in implementing the EMP during construction.

- i. At the time of bidding the contractor is required to review the EMP and cost the program.
- ii. The contractor is also required to include in the Bid the structure and experience of the work's supervisory team. Depending on the size of the project the contractor may include several positions for managing the EMP.
- iii. Before construction commences the EMP is to be reviewed and re-issued by the contractor as a contractually binding document (the Contractor's EMP (CEMP)). The CEMP will address the impacts and their mitigation measures as shown in the original EMP. The CEMP will provide workable plans to comply with the EMP requirements. The second role of the CEMP is to identify staff within the contractor's project management organisation to supervise compliance with the CEMP including monitoring. The CEMP is submitted by the contractor to DoW prior to starting work. The contractor can only commence work following the approval of the CEMP. A copy of the CEMP may need to be sent to DEC to comply with their requirements.
- iv. During construction the contractor will have the primary role of monitoring and supervising the CEMP.
- v. The contractor will be required to submit monthly reports to DoW showing how the CEMP is being implemented and monitored.

¹³ As EMP compliance is a relatively recent requirement, contractors have often had little exposure to implementing an EMP. To familiarize contractors with EMP compliance requirements the DoW should consider establishing a national training program for contractors in implementing the EMP requirements.

1.7.7.3 DEC Role

Define DEC's role in supervising the EMP. This may include approving the EMP and further roles in monitoring and auditing of the EMP.

1.7.8 Other Organisations with Indirect Roles

Identify other organisations who will be required to supervise the implementation of the EMP and determine their role.

Some of these organisations may have approval and implementation responsibilities for e.g.; paying compensation for land acquisition under the Land Acquisition and Resettlement Plan (LARP), approving the clearing of forest land, extraction of gravel from rivers and opening quarries, etc.. The role of these supporting organisations need to be clearly established so that at the time of implementing the EMP there are no surprises in not having the necessary approvals in place.

For projects that may be financed by multi-lateral agencies such as the ADB and WB an assessment of the organisations capacity to effectively undertake their roles may be required. If capacity needs to be strengthened, a program needs to be identified and costed, and included in the project preparation documents to meet these requirements.

1.7.8.1 Financier's Role

Define the financier's role in addressing any requirements in the EMP. For multilateral lending agencies specific reporting and monitoring procedures may be required to meet the agencies lending conditions.

Where funds have been sourced from private lending institutions, *Equator Principles*¹⁴ can be expected to apply.

1.7.9 Reporting and Review

This section of the EMP identifies the reporting requirements to meet the needs of the DoW, DEC and possibly the financier.

Normally reports will be generated from the contractor to DoW as monthly reports that shows progress as to how the CEMP is being implemented and includes the contractor's monitoring report.

¹⁴ The [Equator Principles](#) (EPs) are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The Contractor is to provide details in a Monthly CEMP Report. The report will be prepared by the person who has been identified within the Contractor's team who is responsible for overseeing the CEMP procedures. The report will outline progress with regard to the project's physical monitoring targets and implementation of the CEMP for these works. The report should note which tasks have been completed and have been approved for payment by the Employer. The report is to specify if any Defect Notices have been issued by the Employer to correct work and what has been done by the Contractor to address these issues. Any complaints or issues that have been received from the public are to be listed in the report. Three copies of the report are to be sent to the Employer. The report will contain the following sections.

- i. Status of work programme; work completed, construction underway and work planned.
- ii. Environmental staff situation for month.
- iii. Staff and worker awareness training carried out
- iv. Waste volumes, types and disposal (inorganic and organic)
- v. Areas re-vegetated and rehabilitated
- vi. Dust Control Report
- vii. Discovery of Artefacts
- viii. Safety and Monthly Accident Report
- ix. Weekly Monitoring Reports
- x. Copy of Contractor's Daily Record.
- xi. Defect Notices issued and status of all non-conforming work
- xii. Environmental Incidents
- xiii. Complaints received and resolution
- xiv. Other relevant environmental issues.

DoW will normally aggregate the contractor's monthly reports into a quarterly report and together with its comments forward these as required to the financing organisation and possibly DEC.

1.7.10 Cost Estimates

Collect all of the costs of the EMP in this section. Include costs of staff and support services, costs for implementing the mitigation measures and costs of monitoring. Present these in a table for each budget year. Calculate the cost of the EMP budget as a percentage of the total project budget cost.

This concludes the EMP.

ANNEX 1: CHECKLIST OF POSSIBLE IMPACTS FOR ROAD AND BRIDGE PROJECTS AND OTHER INFRASTRUCTURE

These checklists will guide the selection of impacts for road and bridge projects on the biophysical and social environments.

Evaluate the likely impact of the project on the following:

- Landscape
- Local ecosystems
- Natural resources (food and other)
- Archaeological or other cultural sites
- Local water sources, groundwater
- Describe what action has been taken by the PNG Government regarding land acquisition and compensation, and crop compensation for this project. Comment on any impact these issues have on the project.

Evaluate what the impact of the project will be on:

- Present land use
- Present access/transport in the area
- Local income generation
- Land/ sea tenure and use
- Access by outsiders to the area, and by local communities in and out of the area
- Population and population change
- Existing services (schools, medical aid posts, transport, water supplies, waste disposal facilities)

Evaluate the off-site impacts the project will have (on rivers or areas downstream, and on quarries or other materials extraction areas, and on the need for waste disposal areas).

- Will traditional cultural (men's or women's) or archaeological sites be affected by the project? (Note: If the area is culturally or archaeologically sensitive, as outlined in the guidelines, you may need a survey carried out to locate such sites before you start work). If so what steps will be taken to protect or salvage information from the sites?

Note in addition:

For projects in forested areas:

- Is the local vegetation mainly lowland forest, montane forest, mangrove forest?
- Will primary forest resources be destroyed¹⁵?
- Are there important species, habitats or ecosystems in the area to be affected (immediately or 'off site')? or is the area ecologically sensitive or fragile? [Note information in the guidelines, and check at a broad scale PNGRIS, CNA maps, or with DEC for WMAs]
- Are any unmodified forested areas locally important hunting or *tambu* areas?
- Will you remove any vegetation? or leave any surface bare? If so, what will be the impact of clearance, and how will you prevent sediment from burying vegetation, entering streams or reaching the shoreline?
- Can construction areas be placed to avoid disturbing local habitats?
- Will the forest landscape be altered (e.g. by rock or soil removal, spoil dumping, timber removal)?

For projects in coastal areas or on small islands

- Will the project affect beaches, coral reefs, seagrass beds, mangroves, wetlands or swamps (immediately, or through its 'downstream' effects)? Will mangrove regeneration be necessary?
- Will the project affect wading bird habitats (or other habitats protected by CITES or other treaties)?
- Will the project involve discharge of nutrients or other effluents to the coastal zone, or to coastal streams?
- Are there seasonal patterns of sand movement in the area? How will you ensure your project activities will not restrict that movement, and cause coastal erosion?
- Does the project involve the use of coastal bores? If so how will you protect the water source from over-use and saline intrusion?
- Will proposed structures be within 50m of the shoreline? Have you taken into account potential sea level rise, and how it may affect your project?

¹⁵ The ADB The Bank's Policy on Forestry, March 1995, does not permit lending where primary forest will be cleared.

- Will construction activities all occur beyond the inland limit of any coastal wetlands or mobile coastal landforms?
- Will the project require the use of pesticides or fertilisers? Will petrol or oil or other hazardous chemicals be used? If so how will you prevent them entering the coastal zone?
- Will the project involve the extraction of materials from the near-shore area? or disturbance of the near-shore area?
- Will the project involve activities which may damage the sea bed?
- Will the project affect marine species? fisheries resources? fisheries habitat?

Impacts on water and air quality (contaminants and pollution controls)

- Will the project generate waste products (including increased sewage or solid wastes)? Will waste products be disposed of locally? How will sewage be treated? How will solid waste be treated? How will rock or soil waste or chemically contaminated soil be treated?
- Do you have site-specific erosion and sediment control plans for each sector of the project area?
- Will the project or its waste disposal affect the quality of local streams or of the groundwater? What steps are being planned to minimise sedimentation in streams? and contamination of groundwater?
- Will toxic chemicals (including herbicides, tar, oils, paints, other industrial chemicals) be used or disposed of in the project area?
- Will hazardous substances (including large quantities of fuels) be used or stored in the project area? What plans are there to contain these substances? How will fuel, oil, or other hazardous chemicals be delivered, transferred and stored to prevent any leakage into the soil, streams, limestone karst areas or into the coastal zone?
- Will heavy machinery create dust or noise problems, or reduce safety for pedestrians, including children and old people? What plans are there to separate heavy machinery from residential areas? Or to minimise these impacts?
- How will batching areas (for concrete or bitumen) and other construction sites be contained while in use? and cleaned and rehabilitated after use?

Environmental health and natural and construction hazards

- Will there be a need to repair environmental damage (especially after the project ceases) or providing environmental protection? If so has the cost of that work been built into the project?
 - Will there be ponding of water at the site? What steps will you take for disease vector (especially mosquito) control?
- Is the environment naturally unstable (prone to coastal erosion, within the zone which would be affected by any rise in sea level, in an area of known earthquake or landslip activity, cyclones or severe storms, floods or droughts)? What plans are there to protect the development against these natural hazards? Will the presence of the development cause increased environmental damage should natural hazardous events occur? If so what environmental protection measure will you implement?
- Will any used machinery be brought to the site from other regions, or from another country? If so how will it be cleaned? How will the washing water be disposed of? What steps are being taken to avoid the entry of noxious organisms?
- Are safety measures in place to protect the workforce? Is the necessary safety clothing/equipment available for all workers? Have they been trained in its use?
- Is there a contingency plan to deal with spills of hazardous chemicals (including oil products) in the project area?
- Are fire-fighting materials, and spill clean-up chemicals (water, sand, detergents, acid, and alkali) available for use at the site?

Special Planning for Bridge Infrastructure Projects

In addition to the impacts which are associated with other infrastructure projects, there are special issues to consider for bridges, wharves and jetties.

For single span no-pile bridges:

- Note all disturbances which will occur, bank vegetation, gardens, levee or straight bank edge. Identify bed and bank sediments clearly as predominantly clayey, sandy or gravelly. Note possibilities for erosion and collapse.
- Identify potential for sediment to enter streams, and methods for control.
- Identify access road requirements and the need for temporary diversions. Consider the physical impacts of these, and proposed methods of rehabilitation.

- Design methods to ensure runoff does not drain onto garden land, cause flooding of garden land, or that containment structures do not block existing watercourses to garden land.
- If there is a need for temporary constructions in, or diversions of rivers, all possible impacts in terms of bank erosion and sediment accumulation later dispersal should be considered.
- In alluvial landscapes, it is likely that archaeological materials will occur on levees or old terrace remnants, and their management should be considered.

Additionally for longer bridges:

- The impact of piles on turbulence, sediment movement and deposition, and consequent bank and stream bed erosion should be taken into account in planning.
- If drilling in river beds, methods are needed to control suspended sediments, ensure there are no damage to water tables, and no leakage of saline or acid sulphide/sulphate subsoil materials.
- For piles near river banks, there should be controls on bank stability, and an assessment of the upstream and downstream impacts of any proposed river training structures.
- Determine whether any temporary construction works are required in the river for drilling and pile-driving works. If so what will be the impact of these works on flows, on potential erosion, and what steps will be taken to rehabilitate the river section when the works are completed?

As for roads:

Sources of fill and concrete aggregate should be assessed as for road materials. Issues of noise, safe pedestrian access across the bridge, and along the bank. nature and slopes of batters, revegetation of batters and bank access routes should be considered as in road projects. In limestone karst areas, designs should avoid any contaminants entering sinkholes, as sub-surface hydrologic systems are generally unknown.

For construction areas there should be control and containment methods for all wastes, including sewage, and subsequent removal of solid waste to an appropriate disposal site, and rehabilitation of the site. Methods of dealing with any hazardous chemicals, including

fuel and oils, the management of cement batching plants including their location, and methods to control noise, dust, and runoff should be addressed.

Around the bridge and streams

- Evaluate the stream channel (clayey, sandy, gravelly):
- If sandy or gravelly, describe methods which will be used to stabilise the bank at the construction site.
- If clayey, explain the methods which will be used to prevent bank erosion, and consequent downstream changes, and minimise sediment induced turbidity.
- What are the requirements for gravel or aggregate? What quarry sources will be used? [A quarry management plan may be needed].
- Evaluate methods which will be used to contain, and dispose of wastes at the construction site.
- Describe the vegetation at the bridge site.
- What animals are known to occur in the area? Include fish and other aquatic organisms, and migratory birds.
- Are there habitat corridors along the river bank which need to be protected? What methods will be used to protect these ecosystems or habitats?
- What is the land/water use in the immediate area? What resources of local or traditional importance will be affected by the construction? What arrangements have been made/will be made with local communities to manage the impacts on these resources?

ANNEX 2: ENVIRONMENTAL MANAGEMENT GUIDES

The following is a list of impacts and possible mitigation measures that are contained within Environmental Management Guides (EMG). The contractor is to determine the activity and address the requirements for the EMG. This is not a complete list of possible mitigation measures and the contractor is required to develop additional mitigation measures as may be required to address the particular issue.

A list of the EMGs are given below and in Table 1 which identifies the activity with the corresponding activity. Activities commonly require reference to more than one guide.

- ❖ EMG 1: Land Acquisition, Resettlement and Discovery of Cultural Objects
- ❖ EMG 2: Community Consultation
- ❖ EMG 3: Community Health and Safety
- ❖ EMG 4: Mobilization: Establishment of Contractor's Base Camp and Facilities
- ❖ EMG 5: Mobilization: Establishment and Management of Labour Camps
- ❖ EMG 6: Mobilization: Hiring and Management of Labour
- ❖ EMG 7: Mobilization: Worker Health and Safety
- ❖ EMG 8: Protection of Forest Resources and Sensitive Ecology
- ❖ EMG 9: Clearing of Right of Way and other areas
- ❖ EMG 10: Material Transport
- ❖ EMG 11: Earthworks in Flat to Undulating Areas
- ❖ EMG 12: Earthworks in Steep, Hilly and Unstable Areas
- ❖ EMG 13: Earthworks close to Settlements
- ❖ EMG 14: Soil Erosion and Stormwater drainage
- ❖ EMG 15: Dust, Noise and Vibration Control
- ❖ EMG 16: Waste Management
- ❖ EMG 17: Storage and Handling of Fuel and Lubricants
- ❖ EMG 18: Management of Hazardous Materials: Explosives, Combustibles and Toxic Materials
- ❖ EMG 19: Operation of Borrow Pits
- ❖ EMG 20: Operation of Quarry Sites
- ❖ EMG 21: Operation of Stone Crushing Plants
- ❖ EMG 22: River Gravel Extraction
- ❖ EMG 23: Operation of Asphalt Plants or Asphalt Preparation Areas
- ❖ EMG 24: Construction of Base or Sub – Base Course, Re-gravelling
- ❖ EMG 25: Bitumen Overlay
- ❖ EMG 26: Increased Traffic and Operating Speeds

❖ EMG 27: Site Closure

Table 1: Summary of Activities, Potential Impacts, Mitigation Measures and Supporting EMG

EMG	Activities	Potential Impacts	Mitigation Measures	Supported by EMG
1	Land Acquisition, Resettlement and Discovery of Cultural Objects	<ul style="list-style-type: none"> a. Loss of livelihood and property b. Disturbances on part of affected community c. Disturbance from construction activities d. Safety problems and issues e. Cultural and archaeological areas disturbed. 	<ul style="list-style-type: none"> a. Community consultation and participation. b. Apply Land Acquisition and Resettlement Plan (LARP). c. Grievance Mechanism in place to settle disputes. d. For unexpected cultural finds, stop work and have the find evaluated by the Ministry of Culture. 	EMG 2, 3
2	Community Consultation	<ul style="list-style-type: none"> a. Lack of acceptance of project with local communities. b. Lack of cooperation and development of grievances within local communities. 	<ul style="list-style-type: none"> a. Provide regular briefings with clear and transparent consultation methods to local communities. b. Grievance Mechanism in place to settle disputes. c. Appoint Community Liaison person to contractor's team 	EMG 2,3,4,5,6,13,19,20,22,26
3	Community Health and Safety	<ul style="list-style-type: none"> a. Increased traffic within communities b. Accidents to community caused by contractors operations c. Uncontrolled community access to workplace d. HIV/AIDS exposure from contractor's labour 	<ul style="list-style-type: none"> a. Control traffic speed and movements. b. Repair damage to roads caused by additional wear and tear from haul traffic. c. Control access to worksite and facilities with security fencing. Limit egress to facilities to a controlled check point. d. Prepare HIV/AIDS program that includes advice to community and workers. Community awareness program. 	EMG 2,5,6,15,16,19,20,21,22, 26

ENVIRONMENTAL MANAGEMENT GUIDELINE

4	Mobilization: Establishment of Contractor's Base Camp and Facilities	<ul style="list-style-type: none"> a. Siting of camp can impact on resource base and social conditions; consider location impacts on water, forest, wildlife resources, and social conditions. 	<ul style="list-style-type: none"> a. Site camp away from watercourses so that it does not exacerbate water quality. b. Provide security fencing around camp. c. Buildings properly constructed with secure storage areas; d. Workshop facilities provided with oil and water separators. e. Approved waste handling and management practices; f. Discuss location with local community. 	EMG 2,15,16,17,18,27
5	Mobilization: Establishment and Management of Labour Camps	<ul style="list-style-type: none"> a. External labour force with different social attitudes; b. Introduction of STD and HIV/AIDS; c. Competition for scarce natural resources, deforestation for fuel wood and gardens. d. illegal hunting and fishing by workers 	<ul style="list-style-type: none"> a. Maximise local labour; provide appropriate training and familiarization for outsiders; rules and regulations strictly enforced. b. Locate camps away from villages; c. Do not allow camp to impact on local drinking water; d. Use kerosene for heating e. Provide potable drinking water f. Provide meat rations g. Provide good waste management practices h. Provision of proper washing and sanitation facilities i. Discuss location with local community. 	EMG 2,3,15,16,17,18,27
6	Mobilization: Hiring and Management of Labour	<ul style="list-style-type: none"> a. Conflicts can develop if opportunities to hire unskilled labour are not provided to surrounding communities. 	<ul style="list-style-type: none"> a. Arrange to hire unskilled labour from surrounding communities. b. Arrange piece work contracts with local communities. c. Advise via Community Consultation process 	EMG 2,3,5,,8, 26
7	Mobilization: Worker Health and Safety and Environmental Awareness	<ul style="list-style-type: none"> a. Health and safety of workers compromised by poor work place supervision. b. Increase in accidents and sickness c. Loss of worker productivity 	<ul style="list-style-type: none"> a. Prepare Worker Health and Safety Plan (WHSP) that is compatible with PNG standards. b. Apply plan to workplace c. Training staff and workers in WHSP. d. Worker awareness to environmental issues. e. EMG 2Worker awareness to social issues 	EMG 2,3,8,9,10,11,12,13,15, 16,17,18,19,20,21,22,23, 24,25,26

ENVIRONMENTAL MANAGEMENT GUIDELINE

8	Protection of forest resources and sensitive ecology	<ul style="list-style-type: none"> a. Loss of forest resources b. Loss of sensitive ecology 	<ul style="list-style-type: none"> a. Undertake survey of area before construction commences. b. Avoid areas or transplant elsewhere. 	EMG 2,4,6,9, 11,12,13,16,17,19,20,21, 23,27
9	Clearing of RoW and other areas	<ul style="list-style-type: none"> a. Excessive loss of vegetation b. Loss of ecologically significant vegetation c. Loss of topsoil 	<ul style="list-style-type: none"> a. Define clearing boundaries and show these to machinery operators. b. Permit cleared vegetation to be removed by surrounding communities. c. Limit burning as a disposal measure. d. Recover topsoil and save. 	EMG 1,2,3,4,5,8,10,15,16,27
10	Material Transport	<ul style="list-style-type: none"> a. Creation of dust nuisance b. Spillage of loads 	<ul style="list-style-type: none"> a. Cover fugitive materials with tarpaulins during transport. b. Secure loads properly. c. Driver training 	EMG 2,3,4,8,15,16,17,18
11, 12, 13.	<p>Earthworks excavation. Applies to the following activities:</p> <ul style="list-style-type: none"> a. Excavation activities in mainly flat areas b. Excavation activities in steep and unstable areas. c. Excavation activities close to settlements 	<ul style="list-style-type: none"> a. Removal of vegetation cover. b. Scouring of valley slopes resulting in landslides; c. Damage to and removal of trees, vegetation and topsoil; d. Disruption of natural land contours and vegetation leading to erosion; e. Disruption to natural drainage systems; f. Disturbance in natural drainage patterns; ponding, water logging and water pollution. 	<ul style="list-style-type: none"> a. Limit size and quantity of excavation areas and material. a. Wherever practical re-use as much excavated material in construction site as fill. b. Spoil dump sites selected after consultation with community; c. No dumping allowed in sensitive areas, d. Stockpiles to be secured as stable sites. e. Use soil conservation practices and structures to protect excavated areas Use sand bags or sediment traps to avoid site erosion and prevent sediment leaving the site. Bare areas to be revegetated. f. Ensure that stormwater runoff is channelled runoff to stable outlets for disposal. g. On completion of construction all sites are to be landscaped to re-establish drainage, the sites stabilised, rehabilitated and revegetated. h. Communities to be consulted and revegetation contracts to be arranged with communities. 	EMG 2,3,4,5,6,7,8,9,10,14,15, 16,17,19,20,21,22

ENVIRONMENTAL MANAGEMENT GUIDELINE

		<ul style="list-style-type: none"> g. Surface water pollution and increased sedimentation. h. Damage to gardens and private property. 		
14	Soil Erosion and Stormwater drainage	<ul style="list-style-type: none"> a. Poorly designed drainage systems causing scouring of valley slopes resulting in landslide; b. Disruption to natural drainage systems; c. Surface water pollution and increased sedimentation 	<ul style="list-style-type: none"> a. Roadside stormwater drainage systems to be designed to be stable and to safely carry runoff to stable outlet. Consider length of slope and degree of slope in design with regard to achieving stable drainage systems. b. Minimise runoff being carried within system by reducing catchment area by using extra outlets. c. Use channel protection measures; such as concrete and stone paving, half round corrugated steel pipes, drop structures etc. 	EMG 2,4,8,9,11,12,13,19,20,21,27
15	<p>Dust noise and vibration Control.</p> <p>Applies to:</p> <ul style="list-style-type: none"> a. All excavation activities b. Borrow Pits c. Quarry Operation d. Stone Crushing Plants 	<ul style="list-style-type: none"> a. Dust nuisance in workplace and unpaved roads within residential areas b. Excessive noise in workplace and close to residential areas. c. Excessive vibration hazards to buildings d. Increased worker and community health and safety issues e. 	<ul style="list-style-type: none"> a. Regular dust suppression on unpaved roads and within quarry areas; d. Equipment to be provided with silencers; e. Work within or close to communities limited to normal working hours f. Heavy vibration compactor rollers not to be used in the vicinity of any buildings without prior survey of buildings to determine their risk status. 	EMG 2,3,7,8,9,10,11,12,13,19,20,21,22,23,24,25,26
16	Construction Site Waste Management	<ul style="list-style-type: none"> a. Health hazards from uncollected waste b. Pollution of soil and water resources c. Loss of aesthetics 	<ul style="list-style-type: none"> a. Arrange for all construction and camp site waste to be collected, sorted and either recycled or disposed of to meet DEC standards. 	EMG 2,3,4,5,6,7,8,9,10,11,12,13,17,18,19,20,21,22,23,24,25,27

ENVIRONMENTAL MANAGEMENT GUIDELINE

17	Storage and Handling of Fuel and lubricants	<ul style="list-style-type: none"> b. Improper storage, handling and disposal of fuel and lubricants: a. Soil contamination b. Water pollution c. Fire hazards 	<ul style="list-style-type: none"> a. For quantities stored on-site >2,000 litres. To stored above ground in secure airtight tanks. Fuel hoses provided with snap shut taps. Base of tank to be bunded. b. No refuelling to be done adjacent to water courses. c. All spilt fuel cleaned up. d. Operators trained in fuel handling procedures. 	EMG 3,4,7,8,16,18,19,20,21,22,23,24,25,27
18	Management of Hazardous Materials: Explosives, Combustibles and Toxic Materials	<ul style="list-style-type: none"> a. Health hazards to workers and communities b. Fire and explosion hazard; c. Ground contamination and surface water pollution from pollution runoff; d. infiltration from spills and/or leaks; e. 	<ul style="list-style-type: none"> a. Management of storing hazardous materials in marked areas to avoid possible impacts within the camp and to humans. b. Similar to 1 a: Material could mean aggregates or chemicals or other equipment, that must be well contained so as not to impact on the environment. c. 	EMG 3,4,7,8,10,16,17,23,25,27
19, 20, 21	<p>Operation of Borrow Pits (EMG 19)</p> <p>Operation of Quarry Sites (EMG 20)</p> <p>Operation of Stone Crushing Plants (EMG 21)</p>	<ul style="list-style-type: none"> a. Dust nuisance in workplace b. Excessive noise in workplace c. Excessive vibration hazard to workers d. Increased worker health and safety issues 	<ul style="list-style-type: none"> e. Regular dust suppression in workplaces. f. Spoil heaps to be covered or be sprayed to suppress dust issues. a. Machinery to be provided with silencers; g. Work within or close to communities limited to normal working hours. h. Workers provided with safety equipment. i. Worker's inducted to site via a safety training program. 	EMG 1,2,3,4,6,7,8,10,15,16,17,18,24,27
22	River gravel extraction	<ul style="list-style-type: none"> a. Disturbance in river channel flow, b. sedimentation and impact on aquatic life. 	<ul style="list-style-type: none"> a. After work is completed channel to be returned to natural state. b. River training to be employed to ensure watercourses are not affected and channel flow is maximised for flood events. 	EMG 1,2,3,4,7,8,10,15,16,17,18,27

ENVIRONMENTAL MANAGEMENT GUIDELINE

23	Operation of Asphalt Plants and Asphalt Preparation Areas	<ul style="list-style-type: none"> a. Release of bitumen into the environment and runoff of bitumen into surface water causing water pollution; b. deforestation resulting from the use of fuel wood to heat bitumen; c. Improper use of bitumen drums e.g. as drinking water storage containers. d. Adverse health impacts of solvents and chemicals e. Increased traffic and operating speeds 	<ul style="list-style-type: none"> a. Proper siting of plant away from settlement or village, b. Apply asphalt only on fine days. c. Bitumen drums to be stored in bunded area. d. Use furnace oil for heating. e. Clean-up areas after activity. f. Dispose of drums properly. g. Do not allow drums to be collected for water storage unless persons are educated about the dangers of using these as drinking water storage drums. 	EMG 1,2,3,4,7,8,10,15,16,17,18,19,20,21,22,24,25,27
24, 25.	Pavement Reconstruction. Applies to: Construction of Base or Sub-base Course, Re-gravelling (EMG 24) and Bitumen Overlay (EMG 25)	<ul style="list-style-type: none"> a. Vibration, noise and dust generation, b. traffic and safety problems 	<ul style="list-style-type: none"> a. Stockpiles to be covered and used immediately; b. Stockpiles to be located away from drainage lines. c. avoid storing large quantities of materials so as to minimise sediment being carried into creeks and rivers. d. Limit and supervise haul truck traffic movements through villages. e. Have a traffic management plan in place to minimise traffic disruptions. 	EMG 2,3,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,26,27.
26	Increased Traffic and Operating Speeds	<ul style="list-style-type: none"> a. Road improvement will mean reduced driving times and increased traffic speeds along the road b. Likely increase in traffic accidents to drivers and 	<ul style="list-style-type: none"> a. Evaluate risk area and mitigate accordingly: <ul style="list-style-type: none"> a. For communities consider traffic calming measures e.g. speed bumps. b. For open roads consider speed warning signs. c. Clear road lane marking. d. Driver training to raise awareness 	EMG 2,3,7,10,15,16,19,20,21,22,23,24,25,

ENVIRONMENTAL MANAGEMENT GUIDELINE

		pedestrians.		
27	Site Closure	<ul style="list-style-type: none"> a. Abandoned construction and camp sites are unsightly. b. Sites are unstable and can erode leading to soil and water pollution. c. Contaminated soils from diesel and bitumen spills 	<ul style="list-style-type: none"> a. At completion of work all sites to be cleared of waste, compaction removed, landscaped, stabilized and rehabilitated. b. Remediate area by removing any contaminated soil. 	<p>EMG 2,4,5,6,7,8,14,15,16,17, 18,19,20,21,22,23,</p> <p>EMG 16 EMG 16</p>

1.1.1 **EMG 1: LAND ACQUISITION, RESETTLEMENT AND DISCOVERY OF CULTURAL OBJECTS**

- Activities: Acquisition of land and resettlement of communities
Discovery of cultural objects
- Potential Impacts: Dissatisfaction on the part of affected communities with compensation offered.
Areas of historical or archaeological significance could be discovered and affected
Other cultural areas (cemeteries) affected

Environmental Mitigation:

Recommended Measures: Advise the local community of the project in advance and wherever possible involve them in planning. The road should be designed so as to minimise affected properties. All land acquisition and payment of compensation should be guided by a Land Acquisition and Resettlement Framework (LARF).

LARF surveys shall be conducted as early as possible during the feasibility study in order to ensure that all affected people are identified and that negotiations can commence and be completed ahead of project implementation.

LARF surveys shall identify any other infrastructure, such as water supplies, schools, and other infrastructure that will be affected or lost as a result of the project.

Adequate compensation shall be provided to all affected landowners according to standardised procedures and agreed-upon prices, in accordance with the accepted practice of the central government the LLG and the LARF.

Identify suitable land for resettlement if this is necessary.

Identify culturally sensitive areas. If a historical or archaeological site is discovered during construction, all activity shall stop until the appropriate authorities have been notified and the find evaluated.

Inform communities of grievance mechanisms available so that they can voice any concerns that they have. Grievances should be dealt with expediently.

Implementation:

Project Design: The road shall be designed so as to minimise the need for property acquisition and resettlement. Widening on only one side should be considered where appropriate to minimise the number of affected properties.

Compensation payments to be made and completed before the contractor mobilises.

Bill of Quantities: The cost of compliance with the above requirements shall either be the Proponents expense or if required to be completed by the contractor shall be the contractor’s cost.

Supervision Note:

Monitoring: The contractor in liaison with the DoW PMU and the Provincial Lands Office shall monitor the following parameters:

Parameters:	Indicators:
The process of land acquisition and compensation:	Ensure that affected parties are satisfied and receive payments promptly (before commencement of works)
Legal requirements	Ensure that legal requirements are being fulfilled.
Grievances	A grievance reporting system has been established and is functioning. Grievances are dealt with promptly.
Discovery of artefacts and cultural Heritage objects	Register or record kept of discoveries.

1.1.2 EMG 2: COMMUNITY CONSULTATION

Activities: Community consultation

Potential Impacts: Lack of cooperation from surrounding communities

Work may not be completed or may be delayed by aggrieved communities.

Environmental Mitigation:

Recommended Measures: Consultation with local and provincial governments, communities and stakeholders along the project route or area is imperative as an absence of consultation often ends up with misinformation and miscommunication that can hinder project activities. Consultation must be carried out prior to the project commencing and this should be frequent throughout the life of the project.

To address these issues and the complex land ownership and cultural environments that often operate within the project area a Community Consultation Plan should be prepared for projects or situations where these issues will arise. The plan will develop methodology for delivering effective and participatory consultation to the affected communities. The plan will address the project's implementation and advise on issues that the project may cause or exacerbate by its construction and operation e.g. location of labour camps, recruiting labour, community safety where haul trucks may pass through villages, dust management within villages etc. The Plan should also include a method for resolving community grievances. Community consultation can also be used to facilitate dialogue in arranging small community based contracts for labour intensive work such as site clearing or rehabilitation. For these situations the plan would recommend that a specialised person a Community Liaison Person be included within the Contractor's team structure to facilitate community consultation.

Implementation:

Pre-construction: Community consultation should commence prior to the contractor mobilising to site to alert the communities about the project and possible opportunities and risks.

Construction: consultation is to continue during construction to pro-actively address as early as possible any issues and grievances.

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense. The contractor will be required to establish a system for the community to report grievances.

Monitoring: The contractor shall monitor the following parameters:

Parameters:	Indicators:
Community is effectively consulted	Community cooperates with project contractor.
Grievance reporting system in place	Record of grievances
Community liaison	Contractor has appointed a Community Liaison person to team.

1.1.3 EMG 3: COMMUNITY HEALTH AND SAFETY

Activities: Applies to all activities where it is possible that the contractor's activities may impact on the community, e.g. passage of haul trucks through villages,

Potential Impacts: Unnecessary accidents and nuisance caused to communities impacted by the contractor's activities.

Environmental Mitigation Recommended

The CEMP will need to identify villages or other urban communities that haul trucks and other machinery will need to traverse on a regular work basis.

The CEMP will need to show how drivers and operators will be instructed and trained to drive and operate vehicles and machinery with regard to community safety in these areas.

The CEMP will show how loads will be secured and dust, noise and vibration controlled in these areas.

A community HIV/AIDS awareness program may be required if there are large numbers of itinerant workers brought into the area.

The contractor will need to determine how the work site will be secured to prevent unauthorised persons from entering the site.

A record of complaints received from the public will need to be maintained. The Contractor is to keep a record of all complaints which will be available to the DoW. Each month details of complaints are to be provided in the Monthly CEMP Report prepared by the Contractor.

Implementation:

Construction: the contractor is to instruct drivers on safe work practices within community areas.

The contractor will prepare a community HIV/AIDS awareness program.

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included in the contractor's Bill of Quantities.

Supervision Note:

Monitoring: The contractor shall monitor the following:

Parameters:	Indicators:
Accidents within communities	Record of accidents kept by contractor
Complaints from communities	Record of complaints and grievances kept by contractor

1.1.4 *EMG 4: MOBILIZATION: ESTABLISHMENT OF CONTRACTOR'S BASE CAMP AND FACILITIES*

Activities: Selection of site for contractor's base camp and support facilities

Potential Impacts: Unnecessary damage to natural resources caused by disregard of site conditions.

Poor site drainage and disposal of effluent with water pollution and loss of water quality.

Soil and water pollution from poor waste management.

Accidents and loss of materials and equipment due to insecure sites.

Environmental Mitigation:

Recommended Measures: The contractor shall consult with the engineer before locating project offices, sheds and construction plants. Camps shall not be located near settlements or near drinking water supply intakes. No trees shall be cut and removal of vegetation shall be minimised. Construction camp sites should be placed on flat ground wherever this is available.

Water and pit latrines shall be provided for employees. Use above-water pit latrines or composting toilets at residential construction sites.

Provide security fencing around camp.

Sewage shall be disposed of into hygienic pit latrines or into a septic tank system. In low-lying areas the latrine areas shall be elevated and constructed on a mound of sandy sediment to control seepage into the local groundwater.

Construction plant, workshop and storage areas shall be contained using a bund or trench, or isolated from other surface runoff, and cleaned and rehabilitated when construction is complete.

Used oil and lubricants shall be recovered and reused or removed from the site by the contractor. Explosives, oil, petrol and grease shall be managed according to the Hazardous Materials Management of this EMP. Solid waste should be managed according to the following hierarchy: recycling, burial or burned. This includes paper used in bitumen spraying. All stores within the construction site shall be properly contained. When feasible, local residents shall be encouraged to scavenge non-hazardous solid wastes that are no longer useful to the project.

At the conclusion of the project, all wreckage, rubbish or temporary works that are no longer required shall be removed

or given to local residents. All temporary structures, including office buildings, shelters and latrines shall be removed to prevent encroachment within the road right-of-way. The natural contours of the site shall be restored. All disabled machinery shall be removed from the project area. Exposed areas shall be planted with suitable vegetation. The engineer shall report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of the works.

Implementation:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor’s own expense and shall be included in the contractor’s Bill of Quantities.

Supervision Note: Before the contractor establishes the site, the contractor is required to confirm the site with the Supervising Engineer. The Supervising Engineer shall ensure that good relations are maintained between workers and local residents and shall mediate disputes. The Supervising Engineer shall ensure that the contractor removes all installations and surplus materials, leaves the work site in a clean condition and restores areas damaged by asphalt mixing.

Monitoring: The contractor shall monitor the following parameters:

Parameters	Indicators
Provision of water and sanitation facilities:	Latrines constructed, no disruptions in local water supplies
Proper site closure:	Natural contours and site appearances restored. Engineer’s report testifying to the restoration of the site.
Campsite established and approved by SE.	Visual verification of site.

1.1.5 EMG 5: MOBILIZATION: ESTABLISHMENT AND MANAGEMENT OF LABOUR CAMPS (Follow EMG 4)

1.1.6 EMG 6: MOBILIZATION: HIRING AND MANAGEMENT OF LABOUR

Activities: Location, management, operation and closure of labour camps

Potential Impacts: Introduction of external labour force with different attitudes resulting in social conflicts.
Introduced health problems such as STDs and HIV.
Deforestation, excessive use of fuel wood.
Competition for scarce natural resources and food supplies.
Pollution of surface and groundwater supplies from unsanitary waste disposal practices.
Development of temporary camp into a permanent settlement.
Illegal hunting or fishing by camp residents in the vicinity surrounding the camp site.

Environmental Mitigation:

Recommended Measures: Camps shall not be located near settlements or near drinking water supply intakes. They shall not negatively impact local residents' access to drinking water. Camps shall not be located in the vicinity of landslides and floodplains.

The camp shall be operated within a self-sufficient infrastructure. No trees shall be cut for fuel wood, and removal of vegetation shall be minimised. To prevent local inflation and the use of local fuel wood supplies, critical food items and alternate fuel for cooking shall be provided by the contractor. Local people shall be given the option to sell surplus food and fuel wood to the contractor if these items are in surplus and if the extraction of this resource is sustainable during the period of the project. The contractor shall prohibit employees from poaching wildlife and cutting trees. The contractor shall be responsible for the action of their workers.

Water and sanitation facilities shall be provided for employees. In water deficient areas, the contractor shall haul water from a source outside the area. Solid waste shall be managed according to the following preference hierarchy:

recycling, burial or burning. Green or organic wastes shall be composted or used as animal food.

Water and pit latrines or septic tanks shall be provided for employees. Use above-water pit latrines or composting toilets or septic tanks at residential construction sites.

Sewage shall be disposed of into hygienic pit latrines or into a septic tank system. In low-lying areas the latrine areas shall be elevated and constructed on a mound of sandy sediment to control seepage into the local groundwater.

The contractor shall recruit, to the maximum extent possible, local persons for the labour force, and shall provide appropriate training where necessary.

The contractor shall inform all new employees on site about the rules and regulations in relation to the camps and the community at large.

Recommended Measures: At the conclusion of work, all wreckage, rubbish, or temporary works shall be removed or donated to local residents. All temporary structures, including sleeping quarters, cooking and food storage structures and latrines shall be removed to prevent encroachment within the right-of-way. Any polluted soil is to be removed. The natural contours of the site shall be restored. The engineer shall inspect and report in writing that the camp has been vacated and restored to pre-project conditions

Implementation:

Project Design:

Bill of Quantities: The cost of complying with the above requirements shall be at the contractor's own expense and should be included in the day work rates for labour, or priced in a separate Environmental Management and Restoration (Labour Camp) line item. For this line item, the consultant will prepare technical specifications for which the contractor will include a cost estimate.

Supervision Note: The engineer shall ensure that good relations are maintained between workers and local residents, and shall mediate disputes. A Community Liaison Worker may need to be employed to undertake community consultation and mediate in disputes.

Monitoring: The contractor shall monitor the following parameters:

Parameters:	Indicators:
Camp is self-sufficient in food, water and fuel:	No complaints from residents, local prices remain stable
Provision of water and sanitation facilities:	Latrines constructed no disruption in local water supplies.
Waste disposal:	Upon completion, camp site is neat and clean and no rubbish and materials remain.

1.1.7 EMG7: MOBILIZATION: WORKER HEALTH AND SAFETY

Activities: All contractor's activities where labour are employed under the contractor's instructions.

Potential impacts: Accidents to labour,
Poor health of labour, increased sickness.
Loss of productivity.

Mitigation Measures:

The Contractor is to provide a safe and healthy working environment that meets the country's labour requirements or a recognised international labour standard.

Health: The Contractor is to ensure that all workers housed in camp accommodation are provided with an adequate and nutritious diet. All workers in malaria infested areas are to be provided with prophylactic medicines while those workers being housed by the Contractor are to be provided with insecticide impregnated mosquito nets. An HIV/AIDS awareness program and provision of protection will be organized for workers where there is a perceived risk of the

infection spreading to workers and into surrounding communities.

Safety Issues: Before commencing work at any site the contractor will evaluate the health risks at the site and will provide safety equipment for all workers.

Before commencing work at any site all workers will be inducted to the site and the contractor will explain the hazards and the safety measures that must be used prior to commencing work.

The contractor will advise hired staff of emergency response numbers to be used in case of accidents. The emergency response numbers are to be posted in a visible location within the workplace.

The contractor will be required to review workplace health and safety at least each month and make changes to procedures as required. The contractor is to provide regular training sessions to all staff and hired labour so that they are aware of the health and safety requirements.

The Contractor will keep a record of accidents and time lost from accidents. This record will be maintained on site and every month a copy will be attached as an annex to the Monthly CEMP Report.

Implementation:

Project Design:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included as the contractor's cost in the contractor's Bill of Quantities.

Supervision Note: The contractor shall ensure that health and safety issues are adequately addressed for all construction activities.

Monitoring:

The contractor shall monitor the following:

Parameters:	Indicators:
Accidents	Accident Record book maintained by contractor
Workers wearing safety equipment	Visual check
Worker health	Proper workplace sanitation and potable water provided on site

1.1.8 EMG 8: PROTECTION OF FOREST RESOURCES AND SENSITIVE ECOLOGY

Activities: All contractor activities that involve clearing and permanent location of structures or infrastructure.

Potential Impacts: Loss of forest resources
Loss of rare and sensitive ecology

Environmental Mitigation:

Recommended Measures: Identify natural areas, particularly environmentally sensitive or fragile areas, locate optional construction sites away from them. Ensure that project personnel are aware of sensitive areas location and are kept away from them. If the project must encroach onto, or pass close to these areas, construct temporary fences or permanent bunds or trenches to confine machines and activities. Use geotextiles or matting to minimise mechanical construction activities in wetlands.

For roads approaching or encroaching on mangrove areas or other wetland areas, ensure that adequate care is taken during construction to minimise sedimentation. This includes proper spoil disposal (see recommendations on erosion control) and careful construction of drainage structures. The road should be far enough away from the wetland area to ensure that there will be no changes to the surrounding water table. If it is expected that the road may have an effect on the water table, the existing alignment shall be altered accordingly in order to minimise this effect.

Implementation:

Project Design: The design shall ensure that the road alignment does not traverse sensitive areas.

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The engineer shall monitor the following parameters:

Parameters: Indicators:

Compliance with requirements: Sensitive areas avoided or measures taken to avoid impacts

1.1.9 EMG 9: CLEARING OF RIGHT OF WAY AND OTHER AREAS

Activities: Land clearing of the right-of-way (ROW) and other areas.

Potential Impacts: Damage to and removal of trees, vegetation and topsoil
Excessive clearing.
Loss of significant ecology.
Excessive smoke from disposal of vegetation.

Environmental Mitigation

Recommended Measures: Before clearing commences consider where it is possible to avoid clearing areas of significant vegetation and the need to establish buffer zones that may be required to protect waterways.

Clearing boundaries need to be physically established and shown to machinery operators to avoid buffer zones and areas of ecologically significant vegetation. Avoid machinery damage to remaining vegetation.

Explore alternatives to burning to dispose of the material e.g. use as building materials, being offered to surrounding communities for fuel wood, or converting the vegetation to a vegetative mulch for use in revegetation via a tree chipping machine.

Vegetative material that cannot be removed must be allowed to dry so as to produce a “clean fire” with limited smoke.

Ensure that any burning is undertaken in calm conditions to avoid smoke being dispersed over a wide area.

Before burning check the wind conditions so that smoke from any fires does not aggravate surrounding communities.

Implementation:

Project Design: Delineate the clearing limits on the plan of the work area.

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor’s own expense and shall be included in the contractor’s Bill of Quantities.

Supervision Note:

The engineer shall show the clearing boundaries to the contractor.

Monitoring:

The contractor shall monitor the following:

Parameters:	Indicators:
Clearing kept within defined boundaries	Visual verification
All cleared material disposed of properly	Cleared material removed not burnt on site.

1.1.10 EMG 10: MATERIAL TRANSPORT

Activities: All activities where excavated or other materials are transported by haul truck.

Potential Impacts: Creation of dust nuisance in workplace and within communities which are traversed by haul roads.
Accidental spillage of loads in workplace or within communities.

Environmental Mitigation:

Recommended Measures: Ensure that loads are properly secured.

Ensure that all loads that contain fugitive materials are covered by tarpaulins.

Driver training with regard to maintaining speed set by employers and need to drive carefully at all times and especially within residential areas.

Implementation:

Project Design:.

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included as the contractor's cost in the Bill of Quantities.

Supervision Note:

The Supervising Engineer shall ensure that the contractor complies with the requirements especially that loads are covered.

Monitoring:

The contractor shall monitor the following:

Parameters:	Indicators:
Loads are properly secured	Visual verification
Loads with fugitive materials are covered by tarpaulins	Visual verification
Drivers understand requirements	Interview drivers

1.1.11 EMG 11: EXCAVATION ACTIVITIES: IN MAINLY FLAT AREAS

Activities: Movement and disposal of surplus excavation materials.

Potential Impacts: Increased erosion and slope instability
Destruction of private property, crops and irrigation systems
Disruption to natural drainage systems
Surface water pollution and increased sedimentation
Carelessly dumped spoil is aesthetically displeasing
Disruption to pedestrian walkways and local market areas

Environmental Mitigation:

Recommended Measures: The first priority is to strip and store topsoil for later use in revegetation of construction works. All other excess material shall be disposed of in locations or landfills that will not promote instability and result in destruction of property, vegetation, irrigation and drinking water supply systems. Where possible, spoil should be used to backfill quarries or waste disposal pits before they are revegetated. Care shall be taken to avoid disposal near wetlands or in areas that will inconvenience or deprive local residents of their livelihood. Acidic and saline spoil shall not be spread on agricultural land. Spoil can be disposed of in designated areas locally after discussions with landowners or community groups. If so a clear level site must be prepared on which the spoil can be dumped. Close to market areas, discussions must be held with the local community and pedestrian walkways should not be blocked off.

Ground disturbance shall be phased so that it is limited to areas of a workable size.

Construction should be phased so that large areas of soil are not laid bare during the wet season. If the spoil heap or stockpile containing fine soil particles is to remain bare for long in a high rainfall area, it should be covered with a

tarpaulin or a plastic sheet to prevent erosion and sediment runoff. Exposed areas shall be planted with suitable vegetation at the earliest opportunity in order to minimise the time surfaces remain bare.

Excess spoil may be dumped in a landfill that is constructed using a series of small spoil level benches to prevent slope overloading. If feasible, spoil material shall be disposed of in an abandoned quarry or borrow pit as a means of restoring the natural contour. The stockpile or spoil heap location should be chosen to avoid blocking surface runoff or drainage lines. If this is not a ridge crest or flat plain site, the base should be levelled. The stockpiles or spoil heaps must be subject to stability calculations to safeguard against major slips occurring.

At completion all spoil disposal areas (where spoil has either been temporarily stored or disposed) are to be landscaped, drainage systems re-established, covered with topsoil and revegetated. Any access roads that are no longer going to be used are to be ripped to remove compaction and revegetated.

Implementation:

Project Design: Mass balance techniques shall be employed in designing cut and fill along the road alignment. Safe tipping areas for surplus materials shall be identified in the project design specifications and plan drawings.

Bill of Quantities: A separate line item shall be included for excavation and environmentally safe disposal of $xx \text{ m}^3$ of spoil and excess material resulting from excavation of; earthen drains, de-silting existing drains and culverts, clearing landslide debris and other activities where excess excavated materials are to be disposed of. For any revegetation activities, the Bill of Quantities shall include a clause for partial payment of 50% to the contractor when planting is complete. The remaining 50% shall be paid once the seedlings have taken root or for two growing seasons.

Supervision Note: The contractor may locate but the engineer will approve environmentally sound tipping areas in addition to those that may have already been specified in the project design. The engineer shall consult with local residents when identifying new tipping areas. The engineer shall also ensure that the contractor and construction work force are aware of and comply with the disposal restrictions.

Monitoring: The contractor shall monitor the following parameters:

Parameter	Indicator
Materials dumped correctly	Materials dumped in sites approved by engineer
Stability of spoil area:	Presence of slides, scouring, erosion or destruction of property in valleys, disruption of water supply systems and irrigation systems, complaints from local residents.
Vegetative cover is maintained.	Survival rate of plants.

1.1.12 **EMG 12: EARTHWORKS: IN STEEP, HILLY AND UNSTABLE AREAS**

1.1.13 **EMG 13: EARTHWORKS IN THE VICINITY OF SETTLEMENTS ALONG ROADSIDE (REFER TO EMG 11 AND 12)**

Activities: Cut and fill operations in steep, hilly or unstable areas

Potential Impacts: Accelerated erosion and sedimentation

Slope instability and landslides

Destruction of vegetation and private property

Siltation of surface waters

Water pollution

Environmental Mitigation:

Recommended Measures: Exposed slopes shall be stabilized and protected using conventional soil conservation and bio-engineering structures in conjunction with civil engineering techniques. Slopes shall be planted with appropriate vegetation as soon as possible using previously stockpiled topsoil. The planting on slopes shall follow recommendations made in standard bio-engineering references.

In the short term, all areas susceptible to erosion shall be protected by either temporary or permanent drainage works. Measures shall be taken to prevent ponding of surface water and scouring of slopes. Newly eroded channels shall be backfilled and restored to natural contours. Drains and culverts shall be designed to remove all runoff water without scour. Steep slopes may need to be stabilized by being stepped or the toe stabilized using plastic coated gabion baskets filled with stones. Site plans should include all drainage plans suggested for construction sites.

Control structures shall be installed at the onset of construction. This may need to include silt traps along the flow lines.

If the road is on loose or unstable rock, low slope batters will be required, otherwise steep cuts will need to be stabilised

with steps or horizontal benches. The Design Engineer will be required to specify the stable batter slope for the particular situation. Revegetation of batters will be necessary.

During construction, vehicles are to use defined tracks.

Major earth movement operations shall be limited to the dry season.

Implementation:

Project Design: Exposed slopes shall be stabilised using bio-engineering techniques specified in the design specifications and plan drawings.

Bill of Quantities: The surface area (xx m²) of exposed slopes is to be stabilised and the types of vegetation to be planted shall be listed. It shall be stated that the area is to be covered in topsoil and revegetated. Following revegetation the area shall be maintained for a period of 12 months including watering. For any revegetation activities, the Bill of Quantities shall include a clause for partial payment of 50% to the contractor when planting is complete. The remaining 50% shall be paid once the seedlings have established to the satisfaction of the Supervising Engineer.

The contract for replanting and maintaining the trees or vegetation can be awarded to local people or an NGO if at all possible.

Provide a cost for site stabilization.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:

Indicators:

Materials dumped correctly

Materials dumped in sites approved by engineer

Stability of spoil area:

Presence of slides, scouring, erosion or destruction of property in valleys, disruption of water

supply systems and irrigation systems, complaints from local residents.

Vegetative cover is maintained. Survival rate of plants.

1.1.14 EMG 14: SOIL EROSION AND STORMWATER DRAINAGE

Activities: All contractors activities where slopes are disturbed or excavation creates exposed slopes that have the potential to be unstable and erode (roadside batters and fill areas). Roadside drainage systems.

Potential Impacts: Poorly designed drainage systems causing scouring of valley slopes resulting in landslide;
Disruption to natural drainage systems;
Surface water pollution and increased sedimentation

Environmental Mitigation:

Recommended Measures: Protection may include construction of; diversion channels above work areas, temporary bunded channels across excavated areas to provide short term protection, sediment barriers, erosion nets, drop structures at the outlets to drainage ways, sediment traps, and limiting the disturbed area, etc. These measures will also provide a degree of protection from uncontrolled storm water runoff.

For finished work areas show how the work will be stabilized to prevent soil erosion and sediment damage to the completed work. Show how stormwater arising above the site is to be controlled to avoid damaging construction areas and formed channels. Show how stormwater will be safely disposed of to natural drainage ways without eroding the channel.

Roadside stormwater drainage systems to be designed to be stable and to safely carry runoff to stable outlet. Consider length of slope and degree of slope in design with regard to achieving stable drainage systems.

Minimise runoff being carried within system by reducing catchment area by using extra outlets.

Use channel protection measures; such as concrete and stone paving, half round corrugated steel pipes, drop structures etc.

Soil stabilisation may include: soil erosion protection matting
erection of sediment fences

vegetative methods

mulching from use of chipped material sourced from clearing vegetation

other methods including rock armouring (Reno mattresses)

Implementation:

Project Design: Exposed slopes shall be stabilised using bio-engineering techniques specified in the design specifications and plan drawings.

Bill of Quantities: Where revegetation is required the Bill of Quantities shall include a clause for partial payment of 50% to the contractor when planting is complete. The remaining 50% shall be paid once the seedlings have established to the satisfaction of the Supervising Engineer.

The contract for replanting and maintaining trees or vegetation can be awarded to local people or an NGO if at all possible.

Provide a cost for site stabilization.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:	Indicators:
Stability of area:	Site is stable and there is no indication of active erosion. All erosion control measures are functioning as planned and are stable.
Stormwater systems	All stormwater systems are stable are not eroding and deliver stormwater runoff safely to stable discharge area.

1.1.15 .EMG 15: DUST NOISE AND VIBRATION CONTROL

Activities: Earthworks, construction of base and sub-base course, re-gravelling, material transport, equipment mobilisation, establishment and operation of stone-crushing plants

Potential Impacts: vibrations, noise and dust generation, traffic and safety problems and damage to roadside vegetation.

Environmental Mitigation:

Recommended Measures:

DUST: The contractor shall ensure that road surfaces and work areas are sprayed with water during construction in dry and windy periods to control dust generation. Wind breaks or fences shall be installed around cement-batching plants and stone-crushing plants as deemed necessary. Fill and quarry loads being carried on haul trucks on public roads shall be covered with tarpaulins. Where increased movements occur from the contractor's vehicles passing through built up areas the contractor is to enforce strict speed restrictions to reduce dust emissions and to spray water as required to ensure that dust does not create a nuisance for the community.

NOISE: Equipment shall be maintained to manufacturers noise specifications. Noise-generating activities shall be carried out during normal working hours where local

communities are resident. Where blasting or excessively noisy activities are required the local communities living close to the site and who may be affected by the activity shall be advised of any blasting or unusually noisy activities.

Mobilisation of equipment shall be well coordinated. During transportation to site, authorities and local residents will be advised by way of prior announcement. Escort vehicles with indicator lights are to be used.

VIBRATION: Before using heavy compactor rollers the presence of any buildings must be established and the vibration impact zone assessed for the particular equipment. The use of vibration emitting machinery is not allowed within this zone and instead ordinary rollers are to be used. Before using any vibration emitting equipment the condition of adjoining buildings should be assessed so as to be able to substantiate any claims that may arise from adjoining households.

Implementation:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters: Indicators:

Compliance with requirements: Noise, dust and vibration control procedures implemented. No visible dust generation during construction phase. Dust is acceptable within communities where contractor's vehicles are required to pass through. Noise is acceptable at the work site and within surrounding communities. Heavy compactor rollers not being

used close to communities. Use is not permitted inside assessed vibration zone.

1.1.16 CONSTRUCTION SITE WASTE MANAGEMENT

Activities: All construction site activities that generate non-toxic wastes.

Potential Impacts: Loss of aesthetics from uncollected waste. (Untidy sites)
Hazards to environment from uncollected waste
Sources of pollution from uncollected and poorly disposed waste.

Environmental Mitigation:

Recommended Measures: Arrange for all construction site and camp waste to be collected, sorted to be either recycled or disposed of in an approved dumping site. The dumping site may need to be approved by DEC.

Implementation:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included as the contractor's cost in the Bill of Quantities.

Supervision Note:

The Supervising Engineer shall ensure that the contractor complies with the requirements.

Monitoring:

The contractor shall monitor the following:

Parameters:	Indicators:
Waste collected from construction and camp sites	Visual verification
Camp and construction sites are left clean and tidy	Visual verification

1.1.17 EMG 17: STORAGE AND HANDLING OF FUEL AND LUBRICANTS

Activities: Applies to all fuel storage and handling facilities and refuelling.

Potential Impacts: Soil and water contamination
Explosion and fire hazard.

Mitigation Measures:

Recommended Measures: For fuel storage facilities that may require storage of quantities >2,000 litres of fuel the fuel is to be stored in overhead tanks above a concrete bunded platform that can hold 150% of the tank capacity.

The facility must not be sited within 20m of a watercourse. The platform is to drain to an oil and water separator.

All fuel dispensing equipment must be provided with automatic snap shut valves.

Fire extinguishers are to be provided at the tank site and on any fuel trucks.

Fuel trucks are to have fuel clean up kits on the truck.

Any spills are to be cleaned up and contaminated soil removed.

Machinery operators are to be trained in safe fuel handling procedures.

Implementation:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included as the contractor's cost in the Bill of Quantities.

Supervision Note:

The Supervising Engineer shall ensure that the contractor complies with the requirements.

Monitoring:

The contractor shall monitor the following:

Parameters:	Indicators:
Fuel handling facilities comply with EMG Machinery operators understand fuel handling procedures	Visual verification Verify operator's understanding of fuel handling procedures

1.1.18 EMG 18: MANAGEMENT OF HAZARDOUS MATERIALS: EXPLOSIVES, COMBUSTIBLES AND TOXIC MATERIALS

Activities: Storage of explosives, petrol, diesel, oil and lubricants, bitumen and solvents; disposal of used oil, lubricants and solvents

Potential Impacts: Fire and explosion hazards
Ground and surface water pollution as a result of polluted runoff and infiltration from spills and/or leaks from improperly discarded oils and lubricants

Environmental Mitigation:

Recommended Measures: Hazardous material shall not be stored near surface waters or other drainage areas. All used lubricants and oils shall be collected and recycled or disposed off site. Plastic sheeting shall be placed under hazardous material storage areas to collect and retain leaks and spills. Contaminated runoff from storage areas shall be captured in ditches and ponds with an oil trap at the outlet. Contaminated and worn plastic sheeting shall be packed into drums and disposed off site. All fuel drums should be contained in an earthen bund which will contain the potential spillages within the bund area for later disposal in designated areas.

Implementation:

Bill of Quantities: The cost of compliance with the above requirements shall be at the contractor's own expense and shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:

Indicators:

Compliance with requirements: Hazardous materials management procedures implemented. No visible puddles of oil or oil contaminated soil.

1.1.19 EMG 7: OPERATION OF BORROW PITS

Activities: Identification, operation and closure of sites for the extraction of loose material other than rocks for crushing.

Potential Impacts: Disruption of natural land contours and vegetation resulting in accelerated erosion.

Dust and noise.

Disturbance in natural drainage patterns, ponding and water logging and water pollution.

Environmental Mitigation:

Recommended Measures: Materials location shown in design documents are provided as a guide only. It is the contractor's responsibility to verify the suitability of all material sources and to obtain the approval of the engineer. Pits shall not be located in natural drainage areas.

The contractor is to have obtained any licences or approvals prior to commencing work. These are to be verified by the Supervising Engineer before commencing work.

The surface of borrow pits shall be minimised. The clearing of trees and vegetation shall be discouraged. Stripped material shall be stored so as not to disrupt natural drainage and shall be protected so as not to erode into surface waters. Topsoil shall be stored in specific piles and the utilisation of excess topsoil shall be discussed with local residents. The ponding of surface waters shall be prevented through adequate drainage.

The site is to be restored after construction activities have ceased. The site shall be left in a stable condition and landscaped to provide stable slopes. Stripped materials shall be spread to pre-extraction contours to promote natural percolation, re-growth of natural vegetation and natural drainage. In very steep areas, used borrow areas shall be

restored with adequate slope and cross drains at regular intervals to facilitate drainage.

The contractor shall prepare a site revegetation plan. Where possible the plan should involve local groups to provide materials and for implementation. The plan should include the names of contact landowners and/or community groups, summarised discussions of and decisions on what will be planted, a list of seedlings/stock to be provided and by whom, an agreed price and an agreement on planting and tending.

All compacted ground surfaces shall be ripped to remove compaction. Site restoration work shall be conducted before equipment is allowed to leave the site. The engineer shall report in writing that the necessary environmental restoration work has been adequately performed before acceptance of the works.

If trees and vegetation are to be removed, then the cost of replanting and maintenance for a 12-month period shall be indicated in the Bill of Quantities. Contracting for replanting and maintaining of the trees and vegetation can be awarded to local people.

Implementation:

Project Design: Using the site criteria specified under the requirements above, the consultant shall specify borrow pit locations in the design specifications and on plan drawings. If additional borrow pits are required after construction is started, the contractor shall use the above criteria to select new pits, with the written approval of the engineer.

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials or priced in a separate item for 'Environmental Management and Restoration of Borrow Pits' line. For this line item, the consultant will prepare technical specifications for which the contractor will include a cost estimate. For any revegetation activities, the Bill of Quantities shall include a clause for partial payment of 50% to the

contractor when planting is complete. The remaining 50% shall be paid once the seedlings have taken root or for two growing seasons.

Supervision Note: The Supervising Engineer shall make sure that the borrow pits are operated and closed according to the requirements. The engineer shall ensure that local residents are consulted and approve the borrow pit site if material is extracted from areas where local people own land or have activities.

Monitoring: The contractor shall monitor the following parameters:

Parameter:	Indicator:
Site location:	Review location to ensure that the quarry is properly located and that material removal is being removed from approved areas only.
Site is closed and stabilized:	Site landscaped, drainage lines reinstated, site revegetated and any compaction in access roads removed.
Implementation of erosion control:	No presence of fresh gullies or increased turbidity, no other evidence of erosion Proper site closure: Natural contours and vegetation restored.

1.1.20 EMG 20: OPERATION OF EXISTING QUARRY SITES (TERRESTRIAL AND RIVER)

Activities: Identification, operation and closure of sites for the extraction of stone and aggregate

Potential Impacts: Disruption of natural land contour and vegetation

Accelerated erosion and sedimentation

Landslide and slope instability

Disruption to natural drainage patterns

Noise, vibration and dust generation

Increased accidents

Environmental Mitigation:

Recommended Measures: Quarry site locations that have been identified in the design should only be used as a guide. The contractor is responsible for selecting the sites and to obtain approval from the engineer. Any approvals and licences are to be obtained by the contractor before commencing work. These are to be sited and approved by the Engineer who will then authorise the contractor to commence work.

Sites should be located away from population centres, drinking water intakes and streams and cultivated land. They should be located in structurally stable areas regardless of distance from the construction site.

Vegetation clearing should be minimised. Topsoil is to be stripped and stockpiled for later site rehabilitation. Drains should be dug to facilitate the runoff of water and control erosion. Ponding should be controlled by temporary drains released into natural drainage networks. The contractor is to clearly state the methods which will be used for containment of sediment laden runoff and other possible contaminants.

The contractor should undertake activities in the quarry only during daylight hours.

Loads are to be covered by tarpaulins to reduce dust emission from loads transported by haul trucks on public roads. Prior to commencing work all drivers employed by the contractor, especially haul truck drivers are to be checked out to ensure that the driver can operate the vehicle competently and safely. This includes the need to secure loads. Where contractor's vehicles pass through villages or residential areas the contractor is to ensure that drivers are aware of the need to reduce speed and travel safely through these areas.

The contractor shall ensure that surrounding areas are cleared of people and communities warned well before any blasting commences. A warning siren is to be used.

The quarry site should be restored after project completion. It should be rehabilitated and left in a stable condition by being landscaped and revegetated. Previously stored topsoil should be spread to approximate natural contours to promote natural revegetation. The quarry should be drained and no stagnant water should remain.

Environmental Mitigation:

Recommended Measures: The contractor shall prepare a site revegetation plan. Where possible the plan should involve local groups to provide materials and for implementation. The plan should include the names of contact landowners and/or community groups, summarised discussions of and decisions on what will be planted, a list of seedlings/stock to be provided and by whom, an agreed price and an agreement on planting and tending.

In limestone areas, steps should be taken to avoid contamination of underground drainage systems. In case of the presence of burial sites, there should be a plan developed to facilitate the recovery and re-burial of human remains.

River bed extraction sites and quarry site access roads shall also be restored. If the roads are to be permanently closed the roads are to be ripped to remove compaction before being rehabilitated. Exposed areas shall be planted with suitable

vegetation at the earliest opportunity. Channel and bank stability shall include methods which will be used to protect the channel banks, to avoid discontinuity in the riverbeds, and to minimise erosion impacts and sediment loading shall be described.

Extraction of rocks, gravel and sand from small rivers and streams shall be discouraged. If necessary, extraction points shall be spread out along the length of the river to minimise disruption in river flow and to prevent instability. The depth of material removal at any one location shall be limited and extraction areas shall be selected where there is little or no fine material. Local residents and water users shall be consulted to ensure that irrigation intakes, domestic use and local fishing are not disrupted.

Implementation:

Project Design: Using siting criteria specified under the requirements above, the consultant shall designate quarry locations in the design specifications and on plan drawings. If additional quarries are required after the construction is started, then the contractor shall use the above criteria to select new quarry sites, with written approval of the engineer.

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials or priced in a separate item for 'Environmental Management and Restoration of Quarry Sites' line. For this line item, the consultant will prepare technical specifications for which the contractor will include a cost estimate. For any revegetation activities, the Bill of Quantities shall include a clause for partial payment of 50% to the contractor when planting is complete. The remaining 50% shall be paid once the seedlings have taken root or for two growing seasons.

Supervision Note: The engineer shall make sure that the quarries are operated and closed according to the

requirements. The engineer shall ensure that local residents are consulted if material is extracted from riverbeds.

Monitoring: The contractor shall monitor the following parameters:

Parameter:	Indicator:
Proper site location:	Review location to ensure that the quarry is properly located and that material removal is being done in approved areas only
Implementation of erosion control:	No presence of fresh gullies or increased turbidity, no other evidence of erosion. Proper site closure: Natural contours and vegetation restored.
Safety:	During blasting, ensure that adequate warning is given to the workers and surrounding communities.

1.1.21 EMG 21: ESTABLISHMENT AND OPERATION OF STONE CRUSHING PLANTS (refer to EMG 19 & 20)

1.1.22 EMG 22: RIVER GRAVEL EXTRACTION

Activities: Applies to extraction of gravel from water courses.

Potential Impacts: Disturbance and alteration of channel flow which may result in accelerated stream bank or channel erosion.

Downstream water quality impacts from stream channel disturbance on aquatic life and human communities.

Downstream water quality impacts from pollution arising from refuelling and vehicle movements within the channel on human communities.

Noise and activity affecting fauna especially birdlife that use the gravel banks for seasonal nesting habitats.

Environmental Mitigation:

Recommended Measures: Do not open or locate pits immediately above communities where operations may compromise water quality.

After work is completed the excavation pit is to be smoother and the river channel re-established to avoid the channel being forced in another direction.

No vehicle washing or refuelling to be allowed within the river channel especially if there are communities downstream who are using the river for their own activities.

Establish whether the gravel banks are being used as bird refuges and avoid extracting gravels at this time.

Use measures to control dust as required.

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials.

Supervision Note: The Supervising Engineer shall make sure that the gravel extraction pits are operated and closed according to the requirements. The Supervising Engineer shall ensure that local residents are consulted when material is extracted from riverbeds.

Monitoring: The contractor shall monitor the following parameters:

Parameter:	Indicator:
Site approved by local communities	Check with communities
Licence obtained if necessary	Verify licence
Channel stabilised	Verify channel stability after a flood

1.1.23 EMG 23: OPERATION OF ASPHALT PLANTS AND ASPHALT PREPARATION AREAS

Activities: Location, preparation and application of bitumen compound to road surfaces.

Potential Impacts: Release of bitumen into the environment and runoff of bitumen into surface waters causing water pollution

Deforestation resulting from the use of fuel wood to heat bitumen

Air pollution, smell

Environmental Mitigation:

Recommended Measures: The contractor shall use bitumen emulsion. Fuel wood shall not be used for heating bitumen.

Asphalt batching plants shall be located at least 300-500m downwind of any settlements or inhabited areas and at least 150 m from any water bodies, streams or rivers.

Bitumen shall not be applied during strong winds and rains. No bituminous materials shall be discharged into side drains, nearby trees, vegetation and private property shall be protected during bitumen spraying work.

Oil and bituminous products shall be stored at a contained location away from natural drainage areas.

Bitumen drums shall be stored in designated locations and not scattered along the road. After construction, the contractor shall ensure that the bitumen preparation area is properly cleaned up and that all wastes are properly disposed (see environmental mitigation requirements for Base Camps relating to wastes). During site clean-up, the contractor shall burn all spilled fuel oils.

Implementation:

Project Design: Any licences that may be required for extraction of gravel from water courses will need to be noted in the EMP.

Project Construction: If required the contractor is to obtain any licences for extraction of gravel from river channels. A copy of the licence is to be provided to the DoW Supervising Engineer.

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters: Indicators:

Compliance with requirements: No use of fuel wood, proper management of site.

1.1.24 EMG 24: PAVEMENT CONSTRUCTION OF BASE OR SUB – BASE COURSE, REGRAVELLING (refer to EMG 5)

Activities: Applies to all construction activities for sub-base and base course and re-gravelling of road.

Potential Impacts: Noise, dust and vibration

Water quality impacts from materials washing into watercourses.

Traffic management issues caused by delays and detours.

Environmental Mitigation:

Recommended Measures: The contractor shall control dust, noise and vibration using EMG 15.

Where heavy compactor rollers are used these are not to be used within their vibration hazard zone in the vicinity of buildings. If they are to be used then the contractor is to undertake a survey of the existing buildings to evaluate them for any existing cracks or other defects to deflect possible spurious claims arising from the use of this machinery.

Implementation:

Project Design:

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:

Indicators:

Machinery operated in accordance with dust, noise and vibration requirements.

Visual verification

1.1.25 EMG 25: BITUMEN OVERLAY (Refer to EMG 23)

1.1.26 EMG 26: INCREASED TRAFFIC AND OPERATING SPEEDS

Activities : Applies to all contractor's vehicles (especially heavy haul trucks) whereby improved road conditions are created during construction.

Potential Impacts: Increase in speed and resulting traffic accidents.

Increased dust nuisance to communities and workers along transport or access routes.

Environmental Mitigation:

Recommended Measures: The contractor shall ensure that vehicle operators comply with speed restrictions. On arrival all drivers are to produce a valid licence. All drivers are to be inducted into the project by being checked regarding their competency to handle the vehicle that is allocated to them and they are to be aware of the speed limits imposed by the contractor. All drivers are to sign an agreement that states after two warnings they will be dismissed.

Dust, noise and vibration are to be mitigated using EMG 15.

Implementation:

Project Design: During design the issue of increased speed and traffic volume is to be assessed and measures applied to address this which may include, traffic calming devices (speed bumps etc.), lane marking on sealed roads, use of cautionary signs.

Bill of Quantities: The cost of compliance with the above requirements shall be included in the contractor's rate for supplying materials.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:

Indicators:

Machinery operated in accordance with dust,

Visual verification

1.1.27 EMG 27: SITE CLOSURE

Applies to: All construction sites and contractor's facilities, base camp, borrow pits, quarries, extraction areas, waste dumps etc..

Potential Impacts: Unfinished appearance to completed work areas, lack of aesthetics,

Waste left lying around which may provide hazards for local communities, and a source of water and soil pollution.

Environmental Mitigation:

Recommended Measures: On completion of work at all work areas the contractor will arrange for all waste to be removed, the site landscaped and reshaped to re-establish drainage lines. The area stabilised by protective rehabilitation works which may include ripping of access tracks to remove compaction.

When all work is completed the contractor is to remove all machinery, vehicles and discarded machinery from the site. All borrow pits and quarries are to be closed by being rehabilitated. All waste dumps, spoil dumps etc. are to be levelled. All disturbed areas are to be topsoiled and revegetated as required.

At the conclusion of the project the Supervising Engineer or his representative is to inspect the site and confirm that it is stable and meets closure requirements.

At this time the local landowner/s should also approve the closure of the construction facilities.

Implementation:

Project Design:

Bill of Quantities: The cost of compliance with the above requirements shall be included as a contractor's cost. If the site is not adequately closed and restored the Supervising Engineer may arrange for the site to be restored and the cost deducted from the Final Payment made to the contractor.

Supervision Note:

Monitoring: The contractor shall monitor the following parameters:

Parameters:	Indicators:
Site closed, stable and rehabilitated.	Visual verification
All waste removed	Visual verification

1.2 Monitoring of Work

Similar to monitoring the civil works the contractor is also required to monitor compliance with the CEMP, thus the prime responsibility for monitoring of the CEMP belongs to the contractor¹⁶. As the contractor reports to the Supervising Engineer all issues regarding monitoring and compliance with the CEMP are channelled through the Site Engineer.

DoW will advise the contractor on the frequency of monitoring the CEMP but this is normally expected to be monitored weekly. The contractor will monitor the CEMPO work using a checklist of activities drawn up by the contractor which is to be included in the CEMP. DoW will approve the CEMP and the monitoring checklist submitted by

¹⁶ The DoW will also monitor the work but this will be on "as required" basis. It is also possible that other organizations may also monitor the work. Should other organizations monitor the contractor's work the contractor is obliged to report this the DoW Supervising Engineer.

the contractor. Completed monitoring checklists are to be sent by the contractor to DoW each month attached to the monthly report.

The Employer (DoW) will also monitor the work and if work is non-compliant with the CEMP, the Employer will issue a Defects Notice to the contractor. Where work is seriously non-compliant the Employer may instruct the Contractor to stop work.

1.3 Staff and Worker Training

The CEMP is to provide details of the staff and worker training and awareness programs that will be required for the contractor's staff to ensure compliance with the CEMP. Awareness of staff and workers to safety and environmental regulations, the CEMP requirements and in special circumstances where work will need to be carried out within or adjacent to protected areas or areas of cultural heritage will be particularly important. The CEMP will show who will be responsible for implementing staff and worker training and how the program will be introduced to ensure that all workers are aware of the CEMP procedure requirements before commencing work. The program will also require on-site and toolbox meetings to discuss and confirm the procedure's requirements.

1.4 Reporting

xv.