Papua New Guinea Road Maintenance and Rehabilitation Project

Sectoral Environmental Assessment and Environmental Management Plan

Prepared for
The Government of Papua New Guinea and The World Bank

October 1997

Carl Bro International
Energy, Water and Environment Division
Papua New Guinea Road Maintenance and Rehabilitation Project

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ENVIRONMENTAL MANAGEMENT PLAN

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<th>Acronym</th>
<th>Definition</th>
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<td>AudAid</td>
<td>Australian Aid Programme</td>
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<tr>
<td>DBST</td>
<td>Double Bituminous Surface Treatment</td>
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<td>DEC</td>
<td>Department of Environment and Conservation</td>
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<td>DOTW</td>
<td>Department of Transport and Works</td>
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<td>EA</td>
<td>Environmental Assessment</td>
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<td>EP</td>
<td>Environmental Plan</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<td>ENB</td>
<td>East New Britain</td>
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<tr>
<td>EU</td>
<td>Environmental Unit</td>
</tr>
<tr>
<td>OD</td>
<td>World Bank Operational Directive</td>
</tr>
<tr>
<td>OOW</td>
<td>Office of Works (Provincial)</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>PNGRIS</td>
<td>Papua New Guinea Resource Information System</td>
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<tr>
<td>SBST</td>
<td>Single Bituminous Surface Treatment</td>
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<td>RMRP</td>
<td>Road Maintenance and Rehabilitation Project</td>
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<tr>
<td>ROW</td>
<td>Right-of-Way</td>
</tr>
<tr>
<td>WMA</td>
<td>Wildlife Management Area</td>
</tr>
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<td>WNB</td>
<td>West New Britain</td>
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PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT
ENVIRONMENTAL MANAGEMENT PLAN

Executive Summary

This environmental management plan has been prepared for the Road Maintenance and Rehabilitation Project (RMRP) to fulfil environmental assessment requirements of both the World Bank and the government of PNG.

The environmental assessment was carried out by using a simple environmental screening methodology to identify any sub-projects with significant impacts requiring full Environmental Plans (EP)\(^1\). This screening focused on the ‘type’ of sub-project and the sensitivity of the environment in which it was located. All other sub-projects were assumed to have only minor impacts and environmental assessment of impacts and recommended mitigation is sectoral. No sub-projects were identified as requiring a full EP.

The sectoral environmental assessment and management plan identified the key activities implemented under the sub-projects, listed the expected impacts from each of these activities, and recommended environmental mitigation measures to reduce these impacts. It was assumed that for all sub-projects with only minor impacts, the project activities would be almost identical and therefore separate environmental assessment is unnecessary.

The recommended mitigation measures are to be implemented either through alterations to design, contractual clauses or as individual items in the Bill of Quantities.

Detailed supervision and monitoring activities were outlined in order to ensure that recommended mitigation measures are followed.

The report makes some recommendations on institutional needs within the Department of Transport and Works (DOTW). It is recommended that DOTW ensure that the environmental officer positions for the recently established environmental unit (EU) within DOTW be approved, as this is the key to any further institutional development of environmental management within the department. Although it is recognised that the government is undergoing a decentralisation at all levels, it will still be important to have some capacity at central level to manage the environmental process. This does not negate support to the provincial levels in future.

Any further support to the environment sector should be closely co-ordinated with the on-going Australian Aid (AusAid) support programme and efforts should be made to ensure that the efforts and experience of other donor-funded projects are taken into consideration.

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\(^1\) The PNG environmental management system identifies ‘Environmental Plans’ rather than ‘Environmental Impact Assessments’ in the legislation and for this reason the term EP is used in this document rather than the more commonly used EIA
Any further discussions on institutional development within DOTW should involve the Department of Environment and Conservation (DEC) Infrastructure Unit as the key responsible people in the country for environmental assessment in the infrastructure sector.

Public participation should be encouraged and managed as recommended in section 7.

Further environmental management support from the Danish Trust Fund should focus firstly on the successful establishment of the new EU and a proposed training and support programme. Further technical assistance requirements should be defined once this unit has been staffed.
1. Introduction

This environmental assessment and management plan has been prepared in order to assess the potential impacts, both negative and positive, associated with the proposed Road Maintenance and Rehabilitation Project (RMRP) and make recommendations on appropriate mitigation measures to reduce these impacts.

The RMRP will involve the funding of some rehabilitation work as well as routine and periodic maintenance for both national and provincial roads. The funding will include support to the reforms initiated within the associated institutions. The Danish Trust Fund is providing support to define the institutional arrangements and staffing and training needs required for effective environmental management in the transport sector, including the preparation of this Environmental Management Plan (EMP).

The project is classified as category B for the purposes of the requirements of Operational Directive (OD) 4.01, as no new road construction is involved and all the work will be carried out within the existing right-of-way (ROW) This means that the environmental assessment is a sectoral EA, a single assessment covering all sub-projects in the programme (see next section).

The format for this EMP follows the recommended World Bank format for a project specific environmental assessment (EA). The format has been adapted to adhere as far as possible to the draft 'Environmental Impact Assessment Guidelines for Roads and Bridges' prepared as part of the PNG National Regravelling and Resealing Project funded by AusAid.

Section 3 provides a brief description of the project activities. In order to properly assess the environmental impacts of the sub-projects, a simple environmental screening methodology has been applied. This environmental screening for road projects has been applied in many other World Bank and donor-funded road rehabilitation projects (ie: Indonesia, Nepal, Philippines, Nicaragua) and is generally considered quite effective in identifying those projects which could be considered particularly problematic. This methodology is described in section 4.

For those projects which are not considered to have significant environmental impacts requiring a project specific EP according to PNG legislation, section 6 provides an assessment of the anticipated impacts of these projects. In section 7, the recommended mitigation measures to effectively minimise these impacts are presented.

The institutional structure of the transport sector in PNG is presently undergoing significant changes. As such, it is important to identify the major constraints to effective implementation of the recommended environmental measures. An important objective of the environmental management work within the sector is to further develop the capabilities within DOTW to effectively address potential negative project impacts as well as to enhance positive impacts. Section 8 includes preliminary recommendations on institutional arrangements and training which could support this objective. Further work in this regard will be supported by the Danish Trust Fund as part of on-going project activities.
2. Institutional and Legislative Framework

2.1 World Bank Environmental Assessment Requirements

World Bank environmental assessment requirements are found in OD 4.01 "Environmental Assessment". This directive stipulates that any project to be funded by the Bank must be categorised according to the degree of severity of environmental impacts anticipated. The PNG Road Maintenance and Rehabilitation Project has been categorised as a 'B' project, which means that a full EIA is not required. The project was categorised as a 'B' project because it involves no new road construction and all the rehabilitation work will be carried out within the existing ROW. There will be little, if any, land acquisition. However, this does not preclude the need for some form of environmental assessment in order to ensure that any anticipated negative impacts are adequately mitigated during implementation.

The Bank OD 4.01 suggests that for projects where 'there are many small, similar investments that do not merit individual project-specific EAs', alternatives to full EAs such as sectoral EAs can be considered. Other alternatives include 'specific environmental design criteria and construction supervision programmes.' In the case of road maintenance and rehabilitation programmes, most of the sub-projects involve identical activities and the environmental effects of these can be predicted in a general sense even before specific projects have been identified.

This EA has adopted a combination of the above approaches. As specific sub-projects have already been identified, the EA is site specific and a preliminary screening has been carried out on the proposed projects. The EMP (section 7) is sectoral and the recommendations made apply to all sub-projects.

The World Bank encourages the strengthening of environmental capabilities within the relevant departments of borrowing countries. To this end, section 9 makes a preliminary assessment of training needs and institutional aspects of environmental management in the transport sector.

2.2 Papua New Guinea Environmental Assessment Requirements

The Department of Environment and Conservation of PNG is currently undergoing a regulatory reform process in order to respond to the public sector reform initiatives. Hence, the current structure for environmental management will probably change to some degree. One of the key strategic directions for the revised framework focuses on a movement away from a central management to a national, provincial and community-oriented management system (DEC, 1996). The recommendations made in this document take this into account.

Presently, basic environmental assessment requirements for Papua New Guinea are outlined in the Environmental Planning Act (1978). This Act stipulates that for major projects, as identified in section 5 of the Act, an EP is required. For those projects whose impacts are, following environmental assessment, deemed to be minor in nature, a full EP is not required, however, an EMP still needs to be prepared. An EMP is a project-specific activity plan designed to minimise the potential negative impacts identified during the environmental assessment process.

Under existing legislation, it is the responsibility of the development proponent (in this case, DOTW) to prepare the EMP as well as to undertake monitoring of the effectiveness of the EMP. It is the responsibility of the 'consent authority' to ensure that the contents of the EMP are appropriate to the development in question. According to the recently produced 'Environmental Impact Assessment Guidelines for Roads and Bridges', the consent authority in PNG is the planning officer of DOTW or the provincial Office of Works (OW). The responsibility of this person includes advising the project...
proponents on the required scope and contents of the EMP. Under normal circumstances, the EMP will become a requirement of the works contract.

The DEC has the responsibility of advising both the proponents and the planning officer in the environmental assessment process and to assist in preliminary project screening in order to determine the extent of environmental assessment required (full EP or only EMP). They must also review completed documents to ensure that negative impacts will be adequately minimised through the recommendations in the EMP.

According to PNG draft guidelines, the steps in the process of preparing an EMP include:

- completion of an environmental assessment
- identification of key issues
- identification of measures required to reduce negative impacts
- identification of effective implementation procedures for the EMP

The AusAid-funded National Roads Regravelling and Resealing Project has provided some draft EIA Guidelines for Roads and Bridges. These guidelines were prepared in close consultation with DEC and provide some sound engineering measures for project implementation in order to minimise negative environmental impacts. These guidelines have, whenever possible, referred to existing specifications found in the DOTW Specification for Road and Bridge Works (DOTW, 1995). This EMP draws extensively from these guidelines in an attempt to maintain consistency in the recommendations.

The DOTW has recently created an Environmental Unit (EU) under the Monitoring and Evaluation Section of the Policy and Planning Division. An important task of this unit will be to ensure that the EMP is properly implemented. Although the full tasks and responsibilities of the unit must still be defined, their role will be considered in this EMP.

The organogram on the following page illustrates the present structure of with both DEC and DOTW with respect to environmental management, as well as possible linkages between the two.
ENVIRONMENTAL MANAGEMENT IN THE TRANSPORT SECTOR
Papua New Guinea
3. Description of the Proposed Project

The proposed Road Maintenance and Rehabilitation Project has a number of components, including:

assistance on rehabilitation as well as routine and periodic maintenance of both national and provincial roads through discreet funding of the Government’s Three Year Road Maintenance and Rehabilitation Programme, focusing on national roads in the first year and provincial roads during the second and third years

technical assistance for the implementation of organisational and management changes in DOTW and support to the newly-established EU

3.1 Types of Works Proposed

The periodic road maintenance and rehabilitation would include:

- upgrade and sealing of 116.2 km in Central, Oro, East New Britain (ENB), West New Britain (WNB) and Manus provinces
- regravelling of 124.4 km in ENB and Manus provinces
- rescaling of 25 km in Manus province

A total of approximately 265 km will be included in the program.

The support to routine road maintenance would include three years of routine maintenance on 600 km of paved roads and 1,200 km of unpaved roads and intensive blading on 1,250 of unpaved roads

Rehabilitation of 45 bridges and the procurement of additional emergency bridges is also included.

It is anticipated that the pavement related works would involve primarily the repair of potholes and defects followed by some surface dressing. Upgrade and sealing would include an asphalt overlay, while the regravelling would involve either single bituminous surface treatment (SBST), double bituminous surface treatment (DBST), basecourse plus DBST or a gravel overlay. The rehabilitation would also consist of repair work to drains, culverts, bridges, retaining walls and slopes.

It is not anticipated that there would be any major widening (and land acquisition), although in some areas, slope stabilisation may require the acquisition of small areas of land on the upper slopes in order to undertake corrective measures.

The project is anticipated to have a number of positive impacts, including a reduction in dust generated, less accidents, and a decrease in travel times. Repairs to drains, bridges and culverts will also have a positive impact in reducing potential slope instability and sedimentation in some areas.

It is not expected that new quarries would be required for the project. The engineers have indicated that existing sources should be sufficient. Additional rock material may be obtained from river sources.

Although details of the actual work to be undertaken is not yet available, major deviations from the assumptions of this EMP should of course be examined more carefully.
4. Environmental Screening

4.1 Screening Objectives

The main objective of environmental screening is to identify which sub-projects will require a full EP and which will be covered under the sectoral EMP. Criteria for environmental screening of road projects have been developed for a number of existing projects in Asia. Generally, screening involves the identification of a combination of factors which determine the extent of study required. Screening is based on the type of activity and the existing environment in which the activity takes place. Thus, if a project involves major construction work and traverses, for instance, a national park, it would undoubtedly require a full EP. On the other hand, if a project involves only regravelling with no widening and traverses flat agricultural areas, it would be covered by the sectoral EMP in section 7.

4.2 Screening Methodology

In order to assess if any of the proposed sub-projects would require more in-depth environmental analysis, a screening methodology was devised based on environmental criteria. Although not all projects were visited in the field, detailed field information was collected from the Papua New Guinea Resource Information System (PNGRIS) GIS system at the DEC. This system maps soil type, slopes, sensitivity to erosion, location of protected areas such as National Parks, Wildlife Reserves and other sensitive areas. This, combined with an examination of the project location on topographical sheets, provided sufficient information on the general nature of the environment to assess the need for further study.

As indicated, screening involves the classification of the type of activity undertaken and the sensitivity of the receiving environment. Thus, there a number of 'combinations' of activities and environment which can lead to the need for detailed EP's. These are outlined as follows:

1. **Works which improve access (from 4wd to all vehicles or from dry season only to year round) to or near to legally protected natural areas (Natural Reserves or Conservation Areas, Wildlife Reserves, natural forests or watershed catchment areas**

   If a proposed sub-project will provide new access in or around these areas the potential for impact is significant and a full EP is recommended.

2. **Works which improve access (from 4wd to all vehicles or from dry season only to year round) to or near to areas of ecological sensitivity (such as mangrove areas, wetlands or coral reefs)**

   If a proposed sub-project will provide new access in or around these areas the potential for impact is significant and a full EP is recommended.

3. **Works which involve major (> 1m) widening in areas of steep slopes >40%), unstable land systems, highly erosive soils and/or areas of settlements or villages**

   Where road rehabilitation requires widening and significant earthworks in very steep areas, the potential for increased erosion and sedimentation and other negative impacts is high. Implementation of such projects need to be carefully considered and should require a full EP. The same is true of areas of high sensitivity to soil erosion. In settled areas, widening will have implications for land acquisition.
4. Works which involve major new structures in steep (>40% slope) areas, unstable land systems and/or highly erosive soils

If a project requires new bridges or large retaining walls in very steep areas or highly erosive soils and the potential for serious environmental impacts (for instance, downstream) is high, a full EP would be required.

5. Works which involve major new structures (bridges, bank protection) and traverse major river crossings

Activities which will affect major river crossings (and potentially increase downstream sedimentation) should have an EP.

6. Works which require the development of a new quarry

If the rehabilitation activities require the development of a new quarry, a full EP should also be completed as the opening of the quarry would undoubtedly involve substantial new land acquisition and environmental impacts.

4.3 Screening Results

The six sub-projects which were already identified during the mission were checked against the criteria established above to determine their potential impacts on the environment. These included the following projects:

<table>
<thead>
<tr>
<th>Province</th>
<th>Section</th>
<th>Name</th>
<th>Start km.</th>
<th>End km.</th>
<th>Length</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>Baruni - Napa</td>
<td>Napa Napa</td>
<td>0.0</td>
<td>15.5</td>
<td>15.5</td>
<td>Upgrade &amp; Seal</td>
</tr>
<tr>
<td></td>
<td>Napa</td>
<td>Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oro</td>
<td></td>
<td>Kokoda</td>
<td>48.5</td>
<td>77.8</td>
<td>29.3</td>
<td>Upgrade &amp; Seal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morobe</td>
<td>Bululo - Aseki</td>
<td>Aseki Road</td>
<td>0.0</td>
<td>98.0</td>
<td>98.0</td>
<td>Regravel</td>
</tr>
<tr>
<td>ENB</td>
<td>Malabunga - Gaulim</td>
<td>Warangoi</td>
<td>0.0</td>
<td>57.2</td>
<td>57.2</td>
<td>Upgrade &amp; Seal</td>
</tr>
<tr>
<td></td>
<td>Various</td>
<td>Road New Britain</td>
<td>28.1</td>
<td>38.1</td>
<td>10.0</td>
<td>Regravel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hwy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WNB</td>
<td>Kavuvu Br - Gritti</td>
<td>New Britain</td>
<td>297.4</td>
<td>311.6</td>
<td>14.2</td>
<td>Upgrade &amp; Seal</td>
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<tr>
<td></td>
<td>Ck</td>
<td>Hwy</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Manus</td>
<td>Lorengau - Bundralis</td>
<td>East -West</td>
<td>0.0</td>
<td>30.0</td>
<td>30.0</td>
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<td></td>
<td></td>
<td>Road Momote</td>
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<td>56.4</td>
<td>26.4</td>
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<tr>
<td></td>
<td>Lorengau - Momote</td>
<td>Road Momote</td>
<td>0.0</td>
<td>25.0</td>
<td>25.0</td>
<td>Reseal</td>
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</table>

In order to complete the environmental screening, each of the projects was located on the road maps (1:1,000,000 scale published by the DOTW in 1992). The maps in annex 1 show the location of the proposed sub-projects. In order to undertake the environmental screening, these general location maps were overlain with environmental and resource information obtained from the PNGRIS at DEC. This is a GIS-based system which includes basic information such as areas of significant land use, erosion risk, seasonal inundation, tidal flooding, permanent inundation, high slope and forest cover. The PNGRIS maps were prepared as overlays and are therefore not completely accurate due to difficulties with exact locations (geographical co-ordination). For the purpose of preliminary environmental
screening, however, this information is quite adequate. Due to the difficulties with exact map co-
modation, the environmental and resource information extracted from the PNGRIS maps was used to
provide a general description of the environmental constraints for each sub-project.

Each of the identified projects was checked to determine whether they fell under any of the six criteria
that would require the preparation of a full EP.

The environmental screening concluded that none of the sub-projects requires a full EP. No significant
environmental impacts are anticipated from any of these sub-projects, and mitigation of any minor
impacts can be controlled through the EMP presented in section 6.

If new projects are introduced into the program, the Environmental Unit of DOTW will have to screen
these projects according to the above criteria to determine whether more detailed EIA will be required.

4.3.1 Baruni -Napa Napa Road, Central Province

The Baruni - Napa Napa Road runs along the coast not far from Port Moresby at Malara Point. As the
map indicates, the area is largely infertile soil but there are no other environmental considerations of
significance. During the mission some of the team members visited the site and they indicated that the
road was an existing dirt track providing reasonable access. Given these conditions it is not anticipated
that this road would have any serious environmental impacts and any minor impacts can be easily
addressed in the sectoral environmental assessment (SEA, section 5) and EMP (section 6).

4.3.2 Kokoda Road, Oro Province

The Kokoda Road runs east from Kokoda towards Poondetta through a valley. No significant
environmental issues are expected on this sub-project as the road is existing and already provides good
access, does not traverse very steep areas (although it is bounded by steep mountains on both sides)
and no or minimal land acquisition is anticipated. Minor impacts will be covered by the EMP.

4.3.3 Bululo - Aseki Road, Morobe Province

This road runs west from Bulolo to Aseki through the Ekuti Dividing Range. The road is a dirt track
providing reasonably good access, although the latter section would require a four-wheel drive vehicle
during the rainy season. Part of the road runs through relatively steep terrain (especially the latter
section). It is anticipated that there may be some problems with slope stability if significant earth
movements are undertaken in some areas. However, as it is not anticipated that any major widening or
major new structures will be constructed, if sound engineering practices are implemented and adequate
supervision is provided during construction, the implementation of the sectoral EMP should be
adequate to minimise any negative effects.

4.3.4 Warangoi Road and New Britain Highway, East New Britain Province

Both of these sub-projects are located in the eastern part of the province, an area that has suffered
extensive damage with the eruption of Mount Rabaul. These roads are both existing and provide good
access. The maps indicate that the roads traverse primarily areas of high human activity. Again,
because they are existing roads with little anticipated acquisition and major construction, all minor
impacts will be covered by the EMP and sectoral assessment.

4.3.5 New Britain Highway, West New Britain Province

This road covers 14.2 km in the western part of the island near Hoskins. The road is an existing road
with no anticipated land acquisition or major construction. The resource maps indicate that the area is
largely used for human activities and there are no fragile or sensitive environments in the vicinity of the project.

4.3.6 East-West Road, Momote Road, Manus Province

These two sub-projects are located in the eastern part of the remote island of Manus. The PNGRIS indicated that the East-West Road (the Lorengau - Bendralis Road) passes within a kilometre of an existing Wildlife Management Area (WMA) called the Ndrolowa Wildlife Management Area. Information obtained on this WMA area was scant, and discussions with DEC suggested that the WMA covers an area of 5,850 hectares on the south coast of the eastern part of the island. This is a mangrove area. Discussions with the DEC indicated that rehabilitation activities on this road, if carefully undertaken, should not cause problems. The road has been in existence for many years and is the main East-West connection link. As such, it is not providing new access to the area and any indirect impacts associated with improved access would have occurred many years ago.

Although the road is an existing link and the regraveling/resealing will have marginal impact, the road should be designed carefully to provide for adequate access and to ensure minimal impact on the mangrove area.

It is recommended that during construction the supervisory engineer pay special attention to the working methods of the contractors. This would include ensuring that they are properly disposing of the spoil material to avoid undue sedimentation in the runoff. Any drainage structures should also be carefully monitored in order to minimise the risk of downstream sedimentation in the mangrove area.
5. Sectoral Assessment of Environmental Effects

As indicated in the preceding section, none of the sub-projects screened were identified as requiring a project-specific EP due to potential significant environmental impacts. All of the sub-projects, therefore, fall under the SEA and EMP for environmental management.

The SEA assumes that for projects where activities are very similar, the anticipated environmental impacts will also be similar and it is therefore not necessary to prepare separate environmental assessments for each sub-project. Rather, the SEA will cover all of the sub-projects. In order to prepare the SEA and EMP, a generic environmental impact table was prepared. This listed the main activities involved in the rehabilitation work and identified the expected impacts as a result of these activities. The anticipated impacts are based on experiences on other projects of a similar nature.

Acquisition of ROW for Widening or Realignments:

This involves the purchase of land for widening or realignment requirements. Although this activity is not expected to be significant for the sub-projects examined, there may be a few occasions where some land may have to be acquired. In PNG, land acquisition and issues of compensation are often problematic and have, in the past, delayed projects, therefore it will be important to deal with any potential land acquisition questions in an effective and efficient manner. Given the minor scale of this activity, special EP's should not be necessary even if there is some land acquisition.

Clearing of ROW:

During rehabilitation activities, there will be clearing of the existing ROW. In some cases, this ROW will not have been cleared for many years and there will be a significant loss of vegetation along the roadside as a result of the clearing exercise. In the case where there are large trees or other desirable vegetation, it will be important to ensure that these are not removed by the contractors.

Equipment Mobilisation:

Includes the delivery of materials, plant and equipment to the site and involves large transport vehicles which cause air and noise pollution. May also result in traffic and safety problems and damage to vegetation where separate haul roads are provided.

Mobilisation of the Labour Force:

Refers to the arrival of an outside labour force for construction activities. These newcomers may be culturally or ethnically different from people in the area and in PNG this can have significant impacts. Potential health impacts are also possible.

Establishment and Operation of Labour Camps:

This refers to the camp established to house the non-resident workforce. The major problems with the labour camps are the pollution caused by waste and sewage disposal and the potential use of local resources in an unsustainable manner (for instance, fuelwood for cooking, hunting and fishing activities).

Establishment and Operation of Base Camps:

The project base camps are where the equipment and machinery is stored when not in use, and where fuels, oils and other materials are stockpiled. The project office may be located here, and sometimes the stone crushing plant or batching plant is on the same location. Occasionally the labour camp and
the base camp are one and the same, but they have been examined separately for the purpose of this SEA. The main potential problems here include contamination of water through spills of oils and fuels or improper storage.

**Establishment and Operation of Asphalt Plants or Asphalt Preparation Areas:**

This refers to the activities associated with the preparation of the concrete or asphalt and could involve a large production plant with conveyors, oil fired aggregate heaters and dryers and batch mixers, or it could simply involve the heating of bitumen over wood fires and hand mixing. Some of the potential environmental problems include spills or improper handling of bitumen and contamination of nearby water sources. May also result in air pollution, particularly dust and smell.

**Operation of Existing Quarry Sites (Terrestrial):**

This refers to the on-going operation of quarry sites which have been established prior to the commencement of present construction activities. The activities associated with this include blasting and the resultant noise and dust pollution. Abandonment of the quarry after material extraction can have impacts of not properly managed.

**Establishment and Operation of Quarry Sites on Riverbanks and near other Water Bodies:**

This involves the use of a mechanical digger for the removal of rocks for crushing. The materials are usually loaded onto large trucks which drive up to the riverbed. These activities can have impacts on bank stability as well as causing increased sedimentation and changes to stream flow.

**Establishment and Operation of Stone Crushing Plants:**

This can be part of the asphalt plant or separate and involves the crushing of stones using large and very noisy equipment. The activity generates substantial amounts of dust and can be very disturbing to nearby settlements.

**Earth Movements Relating to Cut and Fill Activities in Flat Areas:**

This activity would consist of minor cutting and filling activities and could include the removal of roadside vegetation. The main environmental impacts would relate to possible increased sedimentation and erosion.

**Earth Movements Relating to Cutting and Filling Activities in Steep, Hilly or Unstable Areas:**

This involves cutting and filling in areas that are steep and as such could result in significant increased erosion and increasing slope instability unless carefully controlled.

**Earth Movements in the Vicinity of Settlements along the Roadside:**

This could disturb local market activities and affect pedestrian walkways. Even though the earthworks would be undertaken within the ROW, there is the possibility that illegal structures have been constructed which could be affected.

**Drainage Works:**

This includes all drainage works such as culverts and drainage ditches. The main anticipated impacts are the possible effects of increased sedimentation in surrounding water bodies as a result of inappropriate deposition of excavated materials and associated disturbances.
Construction of Base or Sub-Base Course, Regravelling:

This involves the use of heavy, noisy equipment and can cause noise and air pollution disturbances.

Bitumen Overlay:

This includes the laying down of the various bitumen sealing or resealing surfaces such as single bituminous surface treatment (SBST), double bituminous surface treatment (DBST) or asphaltic concrete.

Material Transport:

This includes the transport of all construction materials such as rock, gravel, bitumen, concrete or other material as well as the transport of equipment or machinery. Again, minor environmental impacts would include noise and dust pollution.

Increased Access:

This is actually an indirect impact of the road rehabilitation and the major impacts that could result include increased and unsustainable exploitation of the natural resources in the area.

Increased Traffic and Operating Speeds:

This can result in increased traffic accidents, especially involving children. Increased traffic can also result in some pollution in surrounding water bodies as a result of runoff.
6. Environmental Management and Monitoring Plan

6.1 Implementation of Recommended Mitigation Measures

Annex 2 provides details on the Environmental Management Plan. This annex has been prepared so that the information appears in a logical and straightforward fashion that should make it easy to understand and use, even for persons with minimal understanding of environmental issues. Annex 2 provides a series of topics based on the activities listed in the preceding section, associated anticipated environmental impacts and recommended mitigation measures.

Annex 2 incorporates all of the recommendations made in the 'EIA Guidelines for Roads and Bridges' prepared by AusAid.

For each of the mitigation measures presented, a method of implementation is proposed. Timing is extremely important with respect to effective implementation because some of the recommendations involve additional cost to the contractor and can affect the project budget. The recommended methods of implementation include the following:

- **As a design guideline or recommendation**
  
  This means that the mitigation measure should be included in the initial design of the project. Often, on road maintenance projects where anticipated environmental impacts are minimal, effective mitigation is simply a matter of ensuring that the roads are designed properly to control negative effects. In general, if the design is properly done (as should be the case on this project), there will be NO IMPACTS at all. In a few cases, slight changes to design will eliminate the potential for impacts. Of particular concern in the design stage is the location of material sources. These should be clearly identified and located on maps in order to ensure that no problems ensue once construction starts.

- **As a suggested clause in the contract**
  
  This suggests that there should be a clause in the contract document referring to this particular mitigation measure. There are a number of ways of addressing this. A common method is to simply refer, in the contract, to the Environmental Management Guidelines in existence, detailing any specific aspects not already in the guidelines. The main problem with this is that it assumes that both the government and contractors are familiar with and understand how to implement these guidelines. This is not the case at this time in PNG. Therefore the option of providing very specific clauses in the contract detailing measures and actions required on the part of the contractor is probably the best way to proceed.

- **To be included in the Bill of Quantities (and usually also in the contract)**
  
  This means that the recommended mitigation measure should be included as an item in the Bill of Quantities. This will ensure that the item has been budgeted for and will be implemented as required.

There are two approaches to deal with the incorporation of environmental management costs into the bids prepared. One is to request that the contractors include these costs in their rates. Although this works well in some instances, in many cases the contractors, in remaining competitive, will not adequately reflect the real cost of environmental mitigation in their bids. The second approach, recommended above, presents the mitigation measure as a line item in the Bill of Quantities. There would be an identified extra payment in the contract to ensure that the work is carried out by the
contractor as specified. An example of clauses that could be included in the Bill of Quantities are as follows:

- the definition of exactly how many cubic meters of spoil and excess material must be disposed of
- a definition of how many hectares in total of replanting or revegetation must be undertaken and cost per hectare (or m²)
- cost of recommended erosion control structures (if over and above those that would normally be constructed as part of normal engineering design)

In order to achieve this in practice, it is recommended that the draft contracts be reviewed by an environmental specialist to ensure that the appropriate clauses have been incorporated. This could be undertaken by the staff of the EU in DOTW or the consultant in charge of the project preparation.

6.2 Supervision of Environmental Mitigation

The main objective of environmental supervision is to ensure that the recommended mitigation measures are implemented as required by the contractor. In road rehabilitation projects, environmental supervision is often part of the standard construction supervision. With the development of the EIA Guidelines and training to engineers and supervisors, it is hoped that some expertise will be developed in this area so that the supervisory engineers will be capable of evaluating the adequacy of measures implemented. However, at the current time this expertise does not exist and it will be important to specifically outline exactly what needs to be focused on during the supervision. The sixth column in Annex 2 provides detailed monitoring and supervision recommendations for the engineer in charge of supervision. By including clauses into a contract document and specific items in the Bill of Quantities forming part of the contract, monitoring and supervision of the application of mitigation measures is automatically included in the normal engineering supervision of the contract on a day-to-day basis. Once the Environmental Unit of the DOTW is firmly established, staff could take over some of these supervisory responsibilities. DEC could also participate in quarterly reviews.

Specific details on environmental supervision are included in Annex 2.

6.3 Environmental Monitoring

A very important aspect of environmental management is environmental monitoring. Monitoring has two aspects. The first and simplest is compliance monitoring which basically ensures that mitigation measures are properly implemented. This is part of the supervisory activities discussed above and is generally the one that most monitoring programmes focus on. Detailed monitoring recommendations are included in Annex 2, including suggested parameters and indicators.

The second aspect of environmental monitoring is impact monitoring. The main objective of impact monitoring is to determine whether the environmental mitigation measures implemented prove to be effective in reducing anticipated impacts. This monitoring allows the mitigation measures to be modified if the original measures prove to be ineffective.

Impact monitoring is the most difficult type of monitoring as it sometimes requires long term programmes, some existing expertise and adequate funding. Obviously, a clear commitment to effective environmental management is necessary in order for an impact monitoring programme to be successful.
It is anticipated that in the longer term the Environmental Unit should be able to develop some impact monitoring programmes.
7. Institutional Requirements for Effective Implementation of EMP

7.1 Public Participation

World Bank requirements stipulate that the involvement of the public in any project is an important aspect of environmental management. Any road construction project in PNG is likely to have at least some impacts on local people, and their involvement at the earliest stages of project feasibility is essential, particularly where any land acquisition, however minor, is required. In addition, the particular conditions in PNG make it important for villagers to be directly involved in the maintenance works, requiring a more creative and flexible approach to contracting than is normally the case.

In PNG, the DOTW works very closely with the Department of Lands in order to ensure that land acquisition is addressed at the earliest possible stages. It is recommended that this structure continue to be applied in the present project as land acquisition is anticipated to be minimal.

It is important that the public be advised and consulted very early in the project planning cycle in order to ensure that their concerns are properly addressed. This should be done by the government department designing and supervising the construction of the project. This could be simply a public notification of the intent to commence with the project and the name of the contact person within DOTW or the provincial offices responsible (this could also be someone in the Department of Lands). This person should maintain involvement throughout the life of the project and be available for discussions with the local people.

7.2 Staffing, Technical Assistance and Training Requirements

7.2.1 Requirements within DOTW National Capital District

DOTW has recently established an Environment Unit under the Policy and Planning Division, Monitoring and Evaluation section. Two positions have been proposed for environmental officers. These positions have yet to be approved by the Department of Personnel. Given the current freeze on the hiring of new staff within government departments, it is not at all assured that these positions will be approved. In addition, the staffing of these positions with qualified people will be difficult, and may take some time even if the positions are approved. However, as this is the 'model' currently proposed by the government, it is important to examine how this unit could be effectively developed to meet environmental management requirements within the transport sector. Discussions with the head of the division have lead to the development of proposed Terms of Reference for the unit. The initial focus of the unit would be very much that of screening and data collection and synthesis with a longer term perspective to developing the capacity within the department. Proposed responsibilities could include:

1. Establishment a comprehensive database for preliminary project screening (including roads, environmental conditions including sensitive areas, protected areas and other relevant information)

2. Undertaking preliminary screening of all infrastructure projects falling under the jurisdiction of DOTW to identify the need for environmental studies as per World Bank requirements and PNG regulations

3. Co-ordination with DEC and other agencies with respect to obtaining the appropriate approvals for these projects

4. Liaison with the project management offices of all donor-funded projects (OECF, Burns Peak Project, Ramu Highway, Highlands Highway, Regravelling and Sealing Project, European Union...
Roads Project, IBRD Roads Maintenance and Rehabilitation Projects), in order to ensure that any environmental work being carried out by them is closely co-ordinated with the unit.

5. Organisation training seminars and workshops (in close co-ordination with DEC) for environmental management of transport projects.

6. Co-ordination with DEC on the further discussion and approval of environmental management guidelines for road and bridge projects.

7. Development of procedures for effective environmental management within the infrastructure (transport) sector. This should include the design of an effective supervision and monitoring system for environmental impacts. This would involve close co-ordination with DOTW at provincial level as well as the Provincial Administration and could include the further development of contractual clauses related to environmental matters.

8. Development of environmental management guidelines for other infrastructure projects under the jurisdiction of DOTW.

9. Provision of input to a revision of the standard specifications for road and bridge construction in order to ensure that existing practices take into account more fully environmental aspects.

One of the main problems with effective environmental management of road projects is that the gap between the skilled environmental people, if any, at the central level, and the field implementation is quite large. Given the general lack of awareness of the district engineers, supervision engineers and contractors on environmental matters and the unlikelihood in the short term of the provision of any real support from the centre, effective environmental management is problematic. The current development of training programmes for provincial people funded by AusAid is a step in the right direction, particularly as these courses appear to be very practical in nature with the objective of providing simple, useful information to those who need it most.

Another problem with the creation of an environmental unit as the key implementing force for environmental management is that environmental assessment tends to become removed from the project cycle, particularly if the unit is not in a position of sufficient influence and power to have access to timely project information. One way of overcoming this is to use the unit as a means of disseminating environmental training and awareness to those sections of DOTW that do require the skills, such as the design units. To do this, key persons identified from a number of critical sections could be provided with environmental training through the EU.

7.2.2 Requirements within DOTW Provincial Level and Provincial Offices

As indicated above, one of the problems with environmental management of roads and bridges is the gap between environmentally skilled staff at the centre and the implementation field staff. Current training courses in environmental management are starting to address this at the provincial level. Short one-day courses on general environmental awareness and longer one to two week courses on environmental management will be undertaken in the coming months (see Annex 3). Discussions with both DOTW and DEC indicate that the effectiveness of these initial courses should to a large extent determine the direction of future training. This will also be further developed when the support to the EU of the Capital District is provided, as it is assumed that the training will have been implemented by then.
7.2.3 Technical Assistance

Any proposed technical assistance, even short term, would have to be delayed until the environmental officer positions have been approved and qualified people hired. Once this has taken place, some short term technical assistance would be appropriate.

**Recommended Short Term Technical Assistance**

Assistance appropriately timed to support the development of the unit is essential. As part of the present Danish Trust Fund support to the unit, it is proposed that the environmental consultant return once the unit has been established to work with the new staff in developing a mandate, undertake a further training needs assessment (which should explicitly take into account the on-going training programme supported by AusAid), and generally support the unit in its initial phase of operation. Support could be provided to the unit in order to ensure that the environmental requirements of the RMRP are being implemented as recommended in this document. Details on the most effective approach to improving overall environmental management will be developed as subsequent phases to Danish Trust Fund support. Further recommendations on more specific technical assistance that could be longer term should be developed at that time as well.

7.3 The role of DEC

Although some reference has been made to DEC, their explicit role in the environmental assessment of the transport sector has not been discussed. The DEC has an existing infrastructure unit under the Assessment and Planning section of the Environment Division. This unit has two staff members whose role is the co-ordination and support of environmental work on all major infrastructure projects. Discussions with those responsible within DEC indicate a strong support for the development of environmental management skills within the line departments, as they recognise their limitations. This unit has been closely involved in the development of the draft Environmental Impact Assessment Guidelines for Roads and Bridges. Their continued involvement in any further institutional development work within environmental management at DOTW should be fully encouraged.
8. Conclusions and Recommendations

The main conclusions to be drawn from this report are as follows:

Preliminary environmental screening on the identified sub-projects do not indicate any significant potential environmental impacts that would require a full EIA. All of the sub-projects can be managed effectively through the implementation of a Sectoral Environmental Assessment and Environmental Management Plan as described in the report.

Should there be any changes to the sub-projects, it is recommended that these new projects be screened in the same manner to ensure consistency in methodology and to ensure that new projects do not have significant impacts.

The EMP as developed in this report is simple and relatively easy to implement, even with limited skills at the implementation field level. Recommendations on inclusion of recommended mitigation measures in the design, contract and bill of quantities should enable the government staff and supervisory engineers to easily determine whether measures have been met once the projects are implemented.

The main recommendations are as follows:

DOTW should ensure that the environmental officer positions are approved, as this is the key to any further institutional development of environmental management within the department. Although it is recognised that the government is undergoing a decentralisation at all levels, it will still be important to have some capacity at central level to manage the environmental process. This does not negate support to the provincial levels in future.

Any further support to the environment sector should be closely co-ordinated with the on-going AusAid support programme and efforts should be made to ensure that the efforts and experience of other donor-funded projects are taken into consideration.

Any further discussions on institutional development within DOTW should involve the DEC Infrastructure Unit as the key responsible people in the country for environmental assessment in the infrastructure sector.

Public participation should be encouraged and managed as recommended in section 7.

Further environmental management support from the Danish Trust Fund should focus firstly on the successful establishment of the new EU and a proposed training and support programme. Further technical assistance requirements should be defined once this unit has been staffed.
9. References


5. World Bank, 199. *Environmental Assessment Sourcebook*, Volume I:


ANNEX 1: Maps: Location of Sub-projects
PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT

Road Location Map:
Baruni - Napa Napa, km. 0.0-15.5, Central Province
**PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT**

**Road Location Map:**
Kokoda Road, km 48.5-77.8, Oro Province

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The map shows the road location from km 48.5 to 77.8 of the Kokoda Road in Oro Province, Papua New Guinea. Major locations and landmarks are marked on the map, including Ambush Point and Tatutu. The map also indicates the proposed project by the IBRD (International Bank for Reconstruction and Development) with a scale of 1:1000,000.
PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT

Road Location Map:
Bululo - Aseki, km. 0.0-98.0, Morobe Province
PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT

Road Location Map:
Warangoi Road, km. 0.0-57.2, East New Britain Province
New Britain Highway, km. 28.1-38.1, East New Britain Province

SCALE 1:1000 000
PAPUA NEW GUINEA ROAD MAINTENANCE AND REHABILITATION PROJECT

Road Location Map:
New Britain Highway, km. 297.4-311.6, West NEw Britain Province

SCALE 1:1000 000

Scales: 10 0 10 20 30
Kilometres

IBRD Proposed Project
QUARRIES (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
- Landslides and slope instability
- Disruption to natural drainage patterns
- Noise, vibration and dust generation
- Increased accidents

**Environmental Mitigation:**

**Recommended Measures:** Quarry site locations identified in the design should only be used as a guide. The contractor is responsible to ensure the suitability of the sites proposed and to obtain approval from the engineer.

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. Stripped material should be kept for site rehabilitation. Ditches 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 should clearly state the methods which will be used for containment of sediment-loaded runoff and contaminants.

The contractor should initiate and undertake activities in the quarry during the day.

Measures should be taken to reduce dust emission from the loads, to avoid possible loss of loads and to control any accidents as a result of the more frequent traffic of heavy vehicles in the vicinity of the quarry site.

The contractor shall ensure that surrounding areas are cleared of people well before any blasting and that a warning siren is used.

The quarry site should be restored after project completion. It should be left in a stable condition without steep slopes. Previously stored stripped material should be spread to approximate natural contours to promote natural revegetation. The quarry should be drained and no stagnant water should remain.
QUARRIES (TERRESTRIAL AND RIVER) continued:

### 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. Exposed areas shall be planted with suitable vegetation at the earliest opportunity. Areas to be quarried and the removal sequence shall be identified. The channel and bank stability at the site shall be ensured. 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.
QUARRIES (TERRESTRIAL AND RIVER) continued:

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.

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea, as well as Group 18: River Training and Bank Protection in the Standard Specifications

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 engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper site location:</td>
<td>Review location to ensure that the quarry is properly located and that material removal is being done in approved areas only</td>
</tr>
<tr>
<td>Implementation of erosion control:</td>
<td>No presence of fresh gullies or increased turbidity, no other evidence of erosion</td>
</tr>
<tr>
<td>Proper site closure:</td>
<td>Natural contours and vegetation restored.</td>
</tr>
<tr>
<td>Safety:</td>
<td>During blasting, ensure that adequate warning signals are being used.</td>
</tr>
</tbody>
</table>
BORROW PITS

**Activities:** Identification, operation and closure of sites for the extraction of loose material other than stone

**Potential Impacts:** Disruption of natural land contours and vegetation resulting in accelerated erosion
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 areas or drainage areas.

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 without steep 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 raked or loosened. 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 has 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.
BORROW PITS continued:

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.

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

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 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 if material is extracted in areas where local people own land or have activities.

Monitoring: The engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper site location:</td>
<td>Review location to ensure that the quarry is properly located and that material removal is being done in approved areas only</td>
</tr>
<tr>
<td>Implementation of erosion control:</td>
<td>No presence of fresh gullies or increased turbidity, no other evidence of erosion</td>
</tr>
<tr>
<td>Proper site closure:</td>
<td>Natural contours and vegetation restored.</td>
</tr>
</tbody>
</table>
SPOIL AND CONSTRUCTION WASTE DISPOSAL

**Activities:** Disposal of surplus construction material, cut material, drainage cleaning debris and landslide mass

**Potential Impacts:**
- Scouring of valley slopes resulting in landslides
- Damage to and removal of trees, vegetation and topsoil
- 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

**Environmental Mitigation:**

**Recommended Measures:**

The first priority shall be to use excess material in the construction works. Discarded materials that cannot be used in construction and fill may, if suitable, be used for bio-engineering measures. 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.

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 spoilheap or stockpile containing fine sediments is to remain bare for long in a high rainfall area, it should be covered 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.

Spoil material may be discharged to a landfill that is constructed using a series of small spoil 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 spoilheap location should be chosen to avoid blocking surface runoff or drainage lines. If this is not a ridgecrest or flat plain site, the base should be levelled and contained. The stockpiles or spoilheaps must be subject to stability calculations to safeguard against major slips occurring.

Environmental Management Plan, Annex 2
SPOIL AND CONSTRUCTION WASTE DISPOSAL continued:

**Implementation:**

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

**Contract Clause:** The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

**Bill of Quantities:** A separate line item shall be included for excavation and environmentally safe disposal of xx m$^3$ of spoil and excess material resulting from excavation of new earthen drains and filled up existing drains and culverts, cleared landslide debris and other estimates of excess materials. 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 identify environmentally sound tipping areas in addition to those specified in the project design specifications. 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 engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability of spoil area:</td>
<td>Presence of slides, scouring, erosion or destruction of property in valleys, disruption of water supply systems and irrigation systems, complaints from local residents.</td>
</tr>
<tr>
<td>Vegetative cover is maintained</td>
<td>Survival rate of plants. Watchman on site.</td>
</tr>
</tbody>
</table>
ESTABLISHMENT AND OPERATIONS OF BASE (CONSTRUCTION) CAMPS

**Activities:** Location, operation and closure of base camps and shops.

**Potential Impacts:**
- Temporary air and noise pollution from machine operation
- Water pollution from storage and use of fuel, oils, solvents and lubricants
- Disturbances to local residents

**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.

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

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.
ESTABLISHMENT AND OPERATIONS OF BASE (CONSTRUCTION) CAMPS continued:

Implementation:

Project Design:

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

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 day work rates for labour, or priced in a separate ‘Environmental Management and Restoration (Base Camps) line item. For this line item, the consultant shall 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. The 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 engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of water and sanitation facilities:</td>
<td>Latrines constructed, no disruptions in local water supplies</td>
</tr>
<tr>
<td>Proper site closure:</td>
<td>Natural contours and site appearances restored. Engineer’s report testifying to the restoration of the site.</td>
</tr>
</tbody>
</table>
LABOR CAMPS LOCATION AND OPERATION

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

**Potential Impacts:**
- Introduction of external labour force resulting in social conflicts
- Deforestation, excessive use of fuelwood
- 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 fuelwood, and removal of vegetation shall be minimised. To prevent local inflation and the use of local fuelwood 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 fuelwood to the contractor if these items are in surplus and if the extraction of these resources 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 shall be provided for employees. Use above-water pit latrines or composting toilets 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.
LABOR CAMPS LOCATION AND OPERATION continued:

Environmental Mitigation:

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. The natural contours of the site shall be restored. The engineer shall report in writing that the camp has been vacated and restored to pre-project conditions.

Implementation:

Project Design:

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the EMP and the Site Containment Bund and Site Containment trench requirements in the standard specifications.

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.

Monitoring: The engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameters:</th>
<th>Indicators:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp is self sufficient in food, water and fuel:</td>
<td>No complaints from residents, local prices remain stable.</td>
</tr>
<tr>
<td>Provision of water and sanitation facilities:</td>
<td>Latrines constructed, no disruption in local water supplies.</td>
</tr>
<tr>
<td>Waste disposal:</td>
<td>Upon completion, camp site is neat and clean and no rubbish and materials remain.</td>
</tr>
<tr>
<td>Proper site closure:</td>
<td>Natural contours and appearance restored. Engineer’s report testifying to restoration of the site.</td>
</tr>
</tbody>
</table>
EARTHWORKS AND SLOPE STABILISATION/EROSION CONTROL

Activities: Cut and fill operations

Potential Impacts:
- Accelerated erosion and sedimentation
- Slope instability and landslides
- Destruction of vegetation and property
- Siltation of surface waters
- Water pollution

Environmental Mitigation:

Recommended Measures: Exposed slopes shall be protected using conventional civil engineering structures in conjunction with bio-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. On steep slopes culverts may need to be stepped using rock slabs or gravel gabion baskets. 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, the batters will need to slope gently, and high batters will need steps or horizontal benches. Revegetation will be necessary.

During construction, vehicles should be kept on defined tracks.

Major earth movement operations shall be limited to the dry season.
EARTHWORKS AND SLOPE STABILISATION/EROSION CONTROL continued:

Implementation:

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

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

Bill of Quantities: The surface area (xx m²) of exposed slopes to be stabilised and the types of vegetation to be planted shall be listed. It shall be stated that the plantations 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 taken root or for two growing seasons.

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

Supervision Note:

Monitoring: The engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetative cover is maintained:</td>
<td>Survival rate of plants</td>
</tr>
</tbody>
</table>

Environmental Management Plan, Annex 2
USE OF BITUMEN

**Activities:** 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 fuelwood to heat bitumen
- Air pollution, smell

**Environmental Mitigation:**

**Recommended Measures:**

The contractor shall use bitumen emulsion. Fuelwood shall not be used for heating bitumen.

Asphalt batching plants shall be located at least 300-500 m 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 should 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.
### USE OF BITUMEN continued:

**Implementation:**

**Project Design:**

**Contract Clause:** The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

**Bill of Quantities:** Bitumen emulsion shall be specified in the materials to be supplied by the contractor.

**Supervision Note:**

**Monitoring:** The engineer shall monitor the following parameters:

<table>
<thead>
<tr>
<th>Parameters: Compliance with requirements:</th>
<th>Indicators: No use of fuelwood, proper management of site</th>
</tr>
</thead>
</table>

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Environmental Management Plan, Annex 2
EXPLOSIVES, COMBUSTIBLES AND TOXIC MATERIALS
MANAGEMENT

**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 and 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.

**Implementation:**

**Project Design:**

**Contract Clause:** The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

**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:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with requirements</td>
<td>Hazardous materials management procedures implemented. No visible puddles of oil or oil contaminated soil</td>
</tr>
</tbody>
</table>
DUST AND NOISE CONTROL

Activities: Earth movements, construction of base and sub-base course, regravelling, material transport, equipment mobilisation, establishment and operation of stone-crushing plants

Potential Impacts: vibrations, noise and dust generation

Environmental Mitigation:

Recommended Measures: 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, and quarry loads or load fill loads being carried in open trucks shall be sprayed with water.

Equipment used shall be as modern and well-maintained as possible (with mufflers where appropriate) to control noise pollution. Noise-generating activities shall be carried out during normal working hours. Local residents shall be advised of any planned blasting or other unusual noisy activities.

Implementation:

Project Design:

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

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:

<table>
<thead>
<tr>
<th>Parameters: Compliance with requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators: Noise and dust control procedures implemented. No visible dust generation during construction phase and acceptable noise levels.</td>
</tr>
</tbody>
</table>
### PROTECTION OF NATURAL AREAS AND SENSITIVE ECOLOGICAL SITES

<table>
<thead>
<tr>
<th>Activities:</th>
<th>Increased access as a result of new road operation</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Potential Impacts:</th>
<th>Unplanned urbanisation and settlements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncontrolled exploitation of natural resources in the new project area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Mitigation:</th>
</tr>
</thead>
</table>

**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.

For roads approaching legally-protected areas, ensure that the issues have been discussed with the appropriate government agency and that they are aware of the potential long-term impacts.
PROTECTION OF NATURAL AREAS AND SENSITIVE ECOLOGICAL SITES

<table>
<thead>
<tr>
<th>Implementation:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Design:</strong></td>
</tr>
<tr>
<td><strong>Contract Clause:</strong></td>
</tr>
<tr>
<td><strong>Bill of Quantities:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supervision Note:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitoring:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters:</th>
<th>Indicators:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with requirements:</td>
<td>Sensitive areas avoided or measures taken to avoid impacts</td>
</tr>
</tbody>
</table>
**LAND ACQUISITION, RESETTLEMENT AND SOCIAL ISSUES**

**Activities:** Acquisition of and clearing of the right-of-way, road operation

**Potential Impacts:**
- Dissatisfaction on the part of affected communities with indemnities offered
- Disturbances from construction activities,
- Safety problems
- Areas of historical or archeological significance could be discovered and affected
- Other cultural areas (cemeteries) affected

**Environmental Mitigation:**

**Recommended Measures:** Advise the local community of project plans in advance and wherever possible involve them in planning. The road should be designed so as to minimise affected properties.

- Surveys shall be conducted as early as possible during feasibility in order to ensure that all affected people are identified and that negotiations commence.

- 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 provide to all affected landowners according to standardised procedures and agreed-upon prices, in accordance with the accepted practice of the government and municipalities.

- If possible, 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.

- All required safety measures shall be implemented. This includes occupational health and safety requirements on construction sites and in work camps.

- Maximise the opportunities for local people on the project. This could include hiring of day labour for gravel crushing, maintenance of revegetation areas, and any other activities.

- Communities and landowners shall always be consulted on the disposal areas and stockpiles for spoil material.
LAND ACQUISITION, RESETTLEMENT AND SOCIAL ISSUES
continued:

Implementation:

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

The road shall be designed with all required measures to ensure a safe environment. This shall include the appropriate road signs, pull-off bays for buses and pedestrian crossings.

Contract Clause: The contractor shall comply with the environmental mitigation measures specified in the Environmental Management Plan (EMP) for this project and the Environmental Impact Assessment Guidelines for Papua New Guinea.

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:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>The process of land acquisition and compensation:</td>
<td>Ensure that affected parties are satisfied</td>
</tr>
<tr>
<td>Legal requirements:</td>
<td>Ensure that legal requirements are being fulfilled.</td>
</tr>
</tbody>
</table>
ANNEX 3: The PNG National Roads Regravelling and Sealing Project: Proposed Training Courses
PNG EIA GUIDELINES FOR ROADS AND BRIDGES TRAINING

PROPOSED TRAINING COURSES

Introduction

These course outlines have been designed to assist trainers to present appropriate courses in EIA and EMP procedures, and the use of the roads and bridges EIA guidelines.

The topics which could be covered in each session are listed, and the courses set out in one possible logical sequence. The level of background information required to present these courses is not very great. The PNG State of Environment report produced for the UNCED World Summit in Rio in 1992 is a useful source document.

Provided they are approached in advance, staff in the Environment and Conservation Divisions of DEC, and staff of the National Museum could provide additional source material. In Port Moresby, DEC staff could present a demonstration workshop on the use of PNGRIS, as could staff of the National Mapping Bureau. Technical staff of the Land Studies Department at Unitech can also do this in Lae.

DEC staff are also available to assist with the production of specific course inputs. They could run the initial workshops as train-the-trainer exercises, but would need some time and assistance to prepare course materials and handouts.

As each course will need to deal with a particular project or activity it is not possible to develop a generic course. A set of formal lectures to be read out by a course coordinator would be no more useful than simply handing out the guidelines, and such a style of presentation would eliminate the possibility of maintaining an interactive program, which is important to ensure that participants can become involved in the EIA and EMP processes.

Course Contents

Two levels of training, and two course outlines are required for this project. These are:

A one-day workshop involving local project engineers, works supervisors, and operators which covers the basic principles and use of the guidelines. This course should be available in both English and Tok Pisin.

A one to two week course for provincial works planners and supervisors and other project staff who wish to know more about environmental management, and who can then train field staff in the use of the guidelines. The course outline could form the basis of a longer or shorter course. In a longer course more time could be spent on background information. In a shorter course the focus should be on the practical aspects - how to use the guidelines for carrying out an EIA and producing an EMP.
Short Field Course in the Use of EIA and EMP Guidelines

The course should be an informal introduction to the principles and use of the guidelines involving local staff and giving them confidence to use the guidelines. The framework trialed two highlands roads projects proved useful there, and could be modified to deal specifically with guidelines. Three DEC staff members (Joe Katape, Onike Kimui and Luke Tenilaay) and the big Officer (Russell Jones) were involved in those workshops and could probably assist with this.

Key messages to pass on during this session are:

- The process is not a tick-and-flick thoughtless use of proforma or standard methods. The process of environmental management involves thinking about the local environment and using common sense solutions to management problems.
- Address local issues and problems, it is essential that local stakeholders identify issues of concern.
- Although the methods of dealing with problems will be similar in many situations, and that there may be standard or common designs which can be used in many projects, the appropriate management solution must suit the local situation, and must be acceptable to the local community.
- Time and effort spent in the planning and design phases of the project to avoid environmental damage, will save time and cost later since such damage commonly results in disputes, delays, and compensation claims.

Outline of a slightly modified program, based on that used in Mendi and Wabag is as follows.

Introduction, what is meant by environment, local issues
Existing environmental problems and the issue of project impacts
Basis questions and discussion at outset
Policy background: ESD, how international policies are reflected in PNG
PNG Acts which relate to road projects
Australian legislation which impinges on projects such as this [EP(IP) Act]
Project EIA and management procedures with a focus on roads and bridges
Defining the scope of the study/what baseline information is needed
Description of the existing environment and identifying potential problems.
Evaluating alternative approaches to achieving the same result
Resolving conflicts
Integrating environmental issues into engineering design, construction plans

Stress throughout that (as in all resource management decisions) there is no single right answer

Discussion: address questions, concerns, matters of comprehension

Break

Group participation in discussion of specific impacts and amelioration methods,
use of guidelines and checklists and management suggestions
Use of environmental appraisal forms and management recommendations.
How these can be used by project managers, field supervisors, field crews.
Reporting to DEC and DOW. Monitoring and evaluation of methods used.

Include some discussion on how to deal with environmental problems which may emerge as a project proceeds, the importance of understanding the process in order to be flexible, and respond to such problems.

Use of a participatory approach is recommended, to encourage people to identify the local problems and issues, and to suggest methods of management which will avoid or minimise negative acts. The focus should be on managing the projects locally, and involving the local community in processes.
One to Two Week Training Course in EIA, EMP

The units may be days, or sessions of 2-3 hours. An effective course could be run over a 5-7 day period. A 10 day course would allow more background explanation to be included, but such a course would be most suitable for people who already have tertiary training.

It is expected that participants in this course will be project managers and senior works supervisors, to whom they will train others in the use of the EIA/EMP guidelines.

The same messages must be passed on to these future trainers:

The process is not a tick-and-flick thoughtless use of proforma or standard methods. The process of environmental management involves thinking about the local environment and using common sense solutions to management problems.

To address local issues and problems it is essential that local stakeholders be involved, and that they identify issues of concern.

That although the methods of dealing with problems will be similar in many situations, and that there may be standard or common designs which can be used in many projects, the appropriate management solution must suit the local situation, and must be acceptable to the local community.

That time and effort spent in the planning and design phases of the project to avoid environmental damage, will save time and cost later since such damage commonly results in disputes, delays, and compensation claims.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Proposed lecture contents/practical work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Meaning of terms including: environment, biophysical, socioeconomic,</td>
<td>Environment management concepts for construction projects, stakeholder relations, development projects,</td>
</tr>
<tr>
<td></td>
<td>community, stakeholder, development project, management authority,</td>
<td>management authority, ecology, strategy, sustainability.</td>
</tr>
<tr>
<td></td>
<td>consent authority, ecology, strategy, sustainability.</td>
<td>Discussion of various aspects of what environment includes, how to consider people as part of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environment, information base for environmental study.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concepts of structure and dynamics, ecosystems, habitat, ecological sustainability.</td>
</tr>
<tr>
<td>PNG physical environment</td>
<td>Basic landforms (including rivers) and land systems, broad climatic</td>
<td>Formation processes and controls (soils, vegetation, coral/other marine systems), natural hazards and</td>
</tr>
<tr>
<td></td>
<td>zones and seasonal regimes. Sufficient discussion of process to enable</td>
<td>environmental hazards.</td>
</tr>
<tr>
<td></td>
<td>critical environmental factors to be identified for proposed</td>
<td>Discussion of what are sensitive ecosystems, and fragile or unstable landscapes. Stress the importance</td>
</tr>
<tr>
<td></td>
<td>developments in specific areas/regions.</td>
<td>of slopes, soil or sediment behaviour, vegetation cover, seasonal patterns of flows, wave action,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sediment movement, seasonal reversals of sediment movement (etc.) and the impacts of human disturbance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in accelerating natural erosion or destabilising patterns previously in equilibrium.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical exercise on topographic and thematic maps, different map scales, selected airphotos,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>satellite imagery as data sources.</td>
</tr>
<tr>
<td>Unit</td>
<td>Topic</td>
<td>Proposed lecture contents/practical work</td>
</tr>
<tr>
<td>------</td>
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<td>----------------------------------------</td>
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</tbody>
</table>
| 4    | PNG social environment          | Very brief historical (including prehistoric) overview of PNG settlement and the development of agricultural systems. Present population, distribution, language, social structures, traditional association with land, issues of land tenure. Regional differences in social organisation and in values. The importance of socioeconomic issues and variables to any project or infrastructural undertaking in PNG. The issue of community perception to environmental management. The need to consider how issues such as women in development, or poverty alleviation, can be addressed in a culturally appropriate way.  
Practical exercise on PNGRIS, and some of its uses and limitations. |
| 5    | Environmental issues | Suggest using a workshop/open discussion format. Conservation value, landuse/allocation conflicts, areas of poorly defined traditional cultural importance, land rehabilitation, local employment, migrant workers, land acquisition, crop compensation. Biophysical impacts. (Use group discussion to elucidate the issues, and be prepared to address a wide range of possible responses. If the initial response is poor, introduce a few issues to stimulate discussion).  
For a 2 week course | Weekend homework exercise involving going through and commenting on aspects of good and bad environmental reports. |
| 6    | EIA | The concept of environmental appraisal. Discussion of appraisals in case studies from PNG EPs or EMPs. Discussion of common issues and potential impacts in PNG infrastructure projects. Stress the importance of this process in saving time and cost over the life of the project, as well as contributing to sustainability. Go through guidelines systematically and in detail. Discussion of each of the items in the checklists, and on how the checklists can be used for environmental impact assessment.  
Field exercise and follow-up workshop using EIA checklists on a local road or bridge project |
| 7    | EMPs and EPs | Deriving a management plan from the EIA report. Note that this requires people to think about their project situation and to use common sense in their approach to dealing with local issues. Steps include description or acknowledgment of the existing environment, identification of specific impacts which will be associated with various project activities. Discuss the use of simple activity plans or integrated project EMPs. Mention the way in which a formal EP is used as part of a project management plan. Go through the management planning guidelines in detail. Discussion of the use of the management suggestions, introducing more detailed and more specific recommendations for local situations. |