Initial Environmental Examination

December 2012

PNG: Port Moresby Power Grid Development Project
Sirinumu Toe-of-Dam Hydropower Plant Replacement

Prepared by PNG Power Ltd. for the Asian Development Bank.
ABBREVIATIONS

ADB — Asian Development Bank
C&PP — Consultation and Participation Plan
DEC — Department of Environment and Conservation
DMP — Drainage Management Plan
DSC — design and supervision consultant
DOE — Director of Environment
EIS — environmental impact statement
EMP — environmental management plan
EMGs — environmental management guidelines
EPAR — Environment (Prescribed Activities) Regulation 2002
EPR — Environment (Permits and Transitional) Regulation 2002
EO — environment officer (existing post in PPL)
ESA — environmental and safety agent (Contractors)
HIV — human immunodeficiency virus
HSP — health and safety plan
IEE — initial environmental examination
IES — international environmental specialist (in PMU through DSC)
IPBC — Independent Public Business Corporation
IR — inception report
LRP — Loss Reduction Program
MMP — Materials Management Plan
MRA — Mineral Resources Authority
NCD — national capital district
NDCP — Noise and Dust Control Plan
NES — national environmental specialist (in the PMU)
NGO — non-governmental organization
PMU — Project Management Unit (in PPL)
PPL — PNG Power Limited
PPE — personal protective equipment
REA — rapid environmental assessment
RP — resettlement plan
SPS — ADB’s Safeguard Policy Statement (2009)
TA — technical assistance
TOD — toe of dam
TOR — terms of reference
TL — transmission line
TDMP — temporary drainage management plan
WMP — Waste Management Plan

WEIGHTS AND MEASURES

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB(A)</td>
<td>decibel (A-weighted)</td>
</tr>
<tr>
<td>masl</td>
<td>meters above sea level</td>
</tr>
<tr>
<td>km</td>
<td>kilometre</td>
</tr>
<tr>
<td>km/h</td>
<td>kilometre per hour</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>m³</td>
<td>cubic meter</td>
</tr>
</tbody>
</table>

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB’s Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the “terms of use” section of this website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.
1. EXECUTIVE SUMMARY

Overview

1. The Asian Development Bank (ADB) is supporting Papua New Guinea (PNG) to develop and expand its energy sector. The government has requested assistance to the Port Moresby Power Grid Development Project (the Project). A project preparatory technical assistance (PPTA) has been undertaken and completed feasibility studies of six subprojects which will eventually be interlinked as part of the Port Moresby grid. The feasibility studies include environmental assessment documents comprising initial environmental examination (IEE) of each subproject and due diligence review (DDR) documenting the audit of existing operations. The Project comprises six sub-projects including: (i) a new substation and new connecting transmission line (TL); (ii) substation capacitor additions; (iii) amendments to the 11kV mesh grid; (iv) loss reduction program (LRP), including energy access project; (v) Rouna 1 hydropower rehabilitation; and (vi) Sirinumu hydropower rehabilitation.

2. The Project proposes to construct new or rehabilitate existing facilities and operate them as part of the power supply grid serving Port Moresby, the capital of PNG. No previous environmental assessment for the subprojects has been completed to date. The investment for subprojects 1 to 4 will take place in and around the Port Moresby area.

3. This report is the initial environmental examination (IEE) for the refurbishment of the turbine in Sirinumu power station. This IEE complies with the provisions of national law (Environment Act 2000) and ADB's Safeguard Policy Statement 2009 (SPS). The IEE has been carried out to ensure that the potential adverse environmental impacts are appropriately mitigated and to present the environmental assessments for the Project. In addressing the potential adverse environmental impacts from the Project it is clear that some measures that ensure impacts are appropriately mitigated are also applicable to other subprojects and operational activities of PNG Power Limited (PPL). The results of this IEE and the DDR will be included as necessary in the operational and maintenance activities of PPL as appropriate and as required under national law and the SPS in order to present a comprehensive analysis of the environmental impacts of the Project.

4. The objectives and scope of this IEE are to (i) assess the existing environmental conditions of the area; (ii) identify potential environmental impacts; (iii) evaluate and determine the significance of the impacts; (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities and cost estimates to address adverse environmental impacts; and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. A consultation and participation plan (C&PP) has been prepared for the Project. This IEE is submitted to ADB by the borrower and the final IEE report will be disclosed to the public through the ADB website and to the public in PNG by PPL.

5. Project Description. The Project will upgrade the PPL's existing facilities and will be carried out on existing equipment and facilities. The site is located about 35km north east of Port Moresby at the Sirinumu Dam as shown on Figure 1.1.

6. The estimated schedule is that actual construction will be started in 2014 and will be completed in the same year (approximately ten months).

7. The project will include refurbishment of the single turbine at Sirinumu power station. The existing intake point at the Sirinumu lake will be refurbished and some valves will be replaced. The penstock will be cleaned and refurbished. The Sirinumu substation will be
modified and upgraded. The subproject requires a 4 km section of the existing Sogeri to Sirinumu access road to be upgraded.

8. **Categorization.** The subproject is classified as Category B in accordance with ADB's SPS, as no significant impacts are envisioned. The overall Project is also environment Category “B” as there are no category “A” subprojects. The IEE was carried out in August 2012 and results of this IEE and the environmental management plan (EMP) will updated at the detailed design stage if necessary by the project management unit (PMU) and approved by ADB.

9. This IEE focuses on the key physical activities in the above outputs which would cause environmental impacts as defined by national law and the SPS. This IEE is based on field reconnaissance surveys, secondary sources of information, and public consultation undertaken specifically for this study.

10. **Implementation Arrangements.** The executing agency (EA) for the Project is the Independent Public Business Corporation (IPBC). The implementing agency will be PPL. A project management unit (PMU) will be set up in PPL (based in Port Moresby) to lead implementation of the Project. PPL will engage Design and Supervision Consultants (DSC) to design and manage the construction of the Project. The facilities will be operated by PPL. The PMU will engage the contractors for construction and will monitor the implementation of environmental and social safeguards by the contractors, assisted by the environmental and social safeguards specialists provided through the DSC.

11. **Policy, Legal and Administrative Framework.** The Project shall comply with requirements of the Environment Act 2000, the Environment (Prescribed Activities) Regulation 2002 (EPAR) which requires registration for Level 2 and Level 3 activities and other codes of practice and environmental initiatives required by the Department of Environment and Conservation (DEC). The Project will also comply with the requirements of the SPS.

12. The project overall is considered a Level 3 activity as the works/investment have a value of 50 million Kina or more. The project involves amendments to existing facilities that are Level 2 or Level 3 activities under the EPAR. PPL will be required to follow DEC guidelines and codes of practice for all installations, however the refurbishment works should not individually involve Level 2 or Level 3 activities. The DEC will still require notification of the scope of the subproject to determine whether or not environmental permits (EP) will be required under the Environment Act. Information provided by a person or company during registration of intention to carry out preparatory works would also be assessed against the activities prescribed in the EPAR in order for Director of Environment to determine the requisite procedures.

13. In order to obtain any necessary EPs, the PMU will submit the notification and disclose the scale and scope of the Project to the DEC. The PMU (assisted by DSC consultants) will progress the environmental clearance of the Project under the Environment Act.

14. **Environmental Management Plan.** Mitigation measures, environmental monitoring, and capacity development are required to minimize the environmental impacts in the pre-construction and construction phases. The DSC and contractors will be tasked with finalizing the detailed design.

15. The main issues relate to planning and fine tuning the design and installation of the refurbishment penstock, turbine hall and turbine and waste disposal. The scale of the works
and the location of the penstock, turbine hall and turbine will be within the PPL Sirinumu compound and away from sensitive receivers. With careful management as set out in the EMP and associated plans traffic interruption and noise and dust during construction will not be major issues.

16. To ensure the construction and waste disposal impacts are mitigated, the PMU assisted by the DSC shall update the assessments made in this IEE and prepare an updated site-specific EMP during the pre construction phase. The updated EMP will be approved by ADB and will include management plans which will form part of the contract documents and will include: (i) waste management; (ii) construction materials management; (iii) erosion and runoff control; (iv) drainage management; and, (v) health and safety.

17. The operation of the subproject and the Project overall should have beneficial effects on the environment overall through more efficient provision of electrical power from renewable resources and improved environmental management within PPL.

18. Information Disclosure, Consultation and Participation. The stakeholder consultation process disseminated information including the general public in the vicinity of the project and the authorities in Port Moresby through meetings. Information was provided on the scale and scope of the project and the expected impacts and the proposed mitigation measures in advance by consultation with government departments, local authorities and the general public in meetings. The process also gathered information on relevant concerns of the local community for the Project so as to address these in the project implementation stages. The consultation and participation plan (C&PP) prepared for the Project will guide PPL in requirements for consultations at different stages of implementation.

19. Grievance redress mechanism (GRM). A GRM will be established to receive, evaluate and facilitate the resolution of affected people’s concerns, complaints and grievances about the environmental and social performance at the level of the Project. The GRM is based on accepted and standard practices in PNG and will provide an accessible, time-bound and transparent mechanism for the affected persons to voice and resolve social and environmental concerns linked to the Project.

20. Conclusion and Recommendations. The refurbishment works for the project are restricted to the PPL compound at Sirinumu, the subproject also includes upgrading works along a 4km section of the existing access road. This IEE study has been carried out based preliminary subproject design and therefore should be updated based on the detailed design prepared by the PMU and DSC. In the event that any design details change the locations or scope of the proposed Project subproject the environmental assessment and EMP shall be reviewed and revised accordingly.

21. The impacts from construction and operation will be manageable and no insurmountable impacts are predicted, provided that the EMP is included in the contract documents and implemented properly and fully. IPBC/PPL shall ensure that the EMP is included in the contract documents, and the EMP provisions are implemented and monitored to their full extent. DEC will decide if EPs are required in due course. The PMU will submit to DEC the notice of intent to proceed with works for the Project overall and discuss the need for submission of environmental assessment. For ADB, further environmental assessment is not required as the provisions in the IEE and EMP will mitigate impacts to ensure no significant impacts.
Figure 1.2 - Locality Plan of Sirinumu Dam
2. POLICY AND LEGAL FRAMEWORK

A. Environmental Regulatory Compliance

22. The Project will be governed by relevant laws and regulations of PNG and ADB’s SPS.

23. **Asian Development Bank Requirements.** The SPS stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. The SPS categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The Project as a whole is environment Category “B” and the activities for the Sirinumu hydropower rehabilitation have been categorized as B. Accordingly an IEE has been prepared as the requisite level of assessment to address the potential impacts in line with the SPS. Stakeholder consultation was carried out as part of the IEE and an EMP specifying mitigation measures to be adhered to during implementation has been prepared.

24. The results of this IEE will be integrated with the bidding and project administration documents and if there are changes to the scope an updated IEE and EMP will be compiled by the PMU and approved by ADB.

25. **Government of Papua New Guinea.** The Project will also be governed by PNG laws, regulations, and standards for environmental assessment and management of the government. Table 2.1 summarizes the main requirements for environmental management that will apply to the Project.

26. The main provisions for environmental protection and pollution control are contained in the Environmental Act (2000), the EPAR, and the Environmental (Permits and Transitional) Regulations 2002 (EPTR). The framework also provides the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. Under the EPAR projects are classified as Level 1, Level 2 or Level 3 activities to determine the level of environmental assessment involved. According to the schedules contained in the EPAR the Project is Level 3 as the total investment will exceed 50 million Kina (Schedule 2, section 14.1) but this subproject is not Level 2. A notification under Section 48 will be submitted to the Director of Environment for clarification. The requirements for preparation of submissions will be determined by DEC. Table 2.2 shows the summary of expected environmental regulatory compliance required.

### Table 2.1 - Key Environmental Laws of PNG

<table>
<thead>
<tr>
<th>Statute</th>
<th>Outline</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment Act 2000</td>
<td>Conservation of environment, improvement of environmental standards and control and mitigation of environmental pollution.</td>
<td>The provisions of the Act apply to some of the Project interventions in the construction stage.</td>
</tr>
<tr>
<td>Environmental (Prescribed Activities) Regulation (EPAR), 2002</td>
<td>Provides prescription of Level 1, Level 2 (Category A or Category B) and Level 3 activities in two schedules by regulation.</td>
<td>The subproject is not an existing activity that is categorized as Level 2 or Level 3. However DEC have requested notification of all subprojects in Project as required under section 48 of the Environment Act 2000, DEC will decide on the requisite administrative requirements and need for application for clearance and environmental permit in due course.</td>
</tr>
</tbody>
</table>

---

1 Consultation with the DEC during the course of environmental assessment indicated that notification of all subprojects is required for DEC to decide on categorisation once the detailed scope of the subprojects is defined in due course.
Environmental (Permits and Transitional) Regulations (EPTR), 2002
Prescribes processes & requirements for obtaining Environmental Permit (EP) by regulations, an Inception Report and Environmental Impact Statement (EIS) must accompany the permit application. The Department of Environment and Conservation (DEC). Projects are classified according to impact on the environment (see EPAR).

Environmental (Amendment) Act (2002)
Section 64 of the Principal Act is repealed and is replaced. This section of the Act permits that the regulations may provide for dispensation of notification, referral and consultation requirements under the Environmental Act in such circumstances as are prescribed.

Mining Act 1992
Responsibilities for mining and quarries to Mineral Resources Authority but in practice to ensure public health for residents by providing primary and public health services, sanitation, water supply, vector and infectious disease control, etc. Project must integrate community health and hygiene of the residents and workers in the construction stage, and take forward appropriate issues to the operational stage.

Table 2.2: Environmental Regulatory Compliance

<table>
<thead>
<tr>
<th>Component Description</th>
<th>PNG Category in accordance with EPAR</th>
<th>Environmental Assessment</th>
<th>ADB Category in accordance with SPS</th>
<th>Environmental Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Project &gt;50M Kina</td>
<td>Level 3</td>
<td>EIS and EMP</td>
<td>Category B</td>
<td>IEE &amp; EMP</td>
</tr>
<tr>
<td>Refurbishment of TOD turbine &lt;2MW, turbine hall and penstock.</td>
<td>Level 1</td>
<td>Follow codes of practice</td>
<td>Category B</td>
<td>IEE &amp; EMP</td>
</tr>
<tr>
<td>Management of oils and lubricants, and waste disposal (solid and liquid).</td>
<td>Level 1</td>
<td>Follow codes of practice</td>
<td>Category B</td>
<td>IEE &amp; EMP</td>
</tr>
</tbody>
</table>

C. Occupational Health and Safety

28. During construction, the project will conform to the labor laws and occupational and health related rules as outlined in Table 2.3, PPL in-house safety practices and ADB’s health and safety guidelines, in line with SPS.²

Table 2.3 Relevant Employment Laws

<table>
<thead>
<tr>
<th>Title</th>
<th>Year</th>
<th>Overview</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Year</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment Regulations</td>
<td>1980</td>
<td>Act calls Provides for safe and healthy conditions for work, equipment etc.</td>
</tr>
</tbody>
</table>


D. **International Conventions**

29. PNG is a party to several international conventions relevant to environmental management (Appendix C). None of these conventions have direct or specific relevance for the project.
3. DESCRIPTION OF THE PROJECT

A. Background

30. The project includes refurbishment at the intake structure, refurbishment of the existing turbine in the toe-of-dam (TOD) substructure, reconditioning the generator (if necessary) and associated works with miscellaneous valves, in particular the guard or isolating valve, needs to be replaced or refurbished. The cone valve also needs to be replaced. The project can be completed using the existing access which will be upgraded under the Project.

B. Description of Existing Conditions and Proposed Activities

31. The Port Moresby grid experiences serious instability problems with frequent system outages. The unreliability of the overall system is exacerbated by the poor condition of some of the power generation facilities.

32. The existing hydropower plant at Sirinumu is located below a rock-fill dam across Laloki River and consists of a powerhouse located at the toe of the dam with generator and substation. The installed capacity of the Sirinumu plant is 1.6MW with a single vertical axis turbine coupled to an induction generator. The average head at the powerhouse is 27m and rated discharge is 7m$^3$/s. The intake structure consists of a gated vertical intake in the reservoir that conveys water past a guard valve to the powerhouse through an 80m long 1.52m diameter steel penstock that passes through the dam. The penstock bifurcates at the powerhouse and supplies the single turbine and a cone valve. Both discharge freely into the spillway channel that runs to the river downstream.

33. The main component will be the refurbishment and re-commissioning of a 1.5MW turbine. The existing unit will be retained in the turbine gallery. The layout for the refurbishment of the turbine hall is subject to detail design but the location will be in the same space in the reinforced concrete structure that it currently occupies at the toe of dam (Figure 3.1). The refurbishment and commissioning will take about six months after detailed design and will be within the existing Sirinumu facility boundaries.

34. The guides for the draft tube gate at the intake structure point will be refurbished. The draft tube gate which is stored in water in the open position should be refurbished to ensure it will seal properly and its hoisting facilities shall also be refurbished. The guard valve will also be replaced. In order to avoid draining the reservoir, this work must take place underwater and will be completed by specialist divers.

35. The condition of the generator is currently being assessed but it is expected that the generator will be examined and refurbished to maintain performance as necessary. Replacement is an option if the generator is in very poor condition. When the generator is removed for inspection it will allow access to the turbine for the refurbishment. In order to refurbish the turbine the generator, which is located above it, must be removed.

36. The turbine equipment at Sirinumu TOD was commissioned in 1975. The existing turbine has a generating capacity of 1.5MW. The bearings in the turbine unit are giving rise to excessive high frequency noise indiciating that major overhaul of the plant is overdue. As a precaution, due to the fragility, the unit is being confined to a maximum generating capacity of 1.1MW. The upgrade and refurbishment of the turbine will involve new items for the turbine runner, guide vanes and wear rings, shaft seal and bearing. The spiral casing, stay-ring and the draft tube will be refurbished. This would involve grit blast and corrosion protection of the spiral casing, draft tube, inlet pipe and stay ring, replacing the head cover,
bottom ring, guide vane operating ring and links, providing new items for the turbine runner, guide vanes and wear rings, shaft seal and bearing.

37. A new digital electro-hydraulic governor will also be installed. The cone valve will be dismantled, removed and replaced. Flow indication of the turbine and the cone valve will also be provided. A new digital electro-hydraulic governor will be provided comprising pressure oil tank and pump set with sump tank and accumulator with bladder type compressed air system, over speed device, emergency shut-down valve and other components as required.

38. A complete modern state of the art alarm, control and protection system to replace the old system will be provided for local and remote operation (via Rouna 2 power station).

39. It is also considered important that an additional isolating butterfly valve be installed in the penstock just upstream of the cone valve. This is to enable isolation and to allow the generating unit to remain operative during maintenance of the cone valve.

40. The existing penstock needs to be inspected and will need to be cleaned and repainted. For purposes of this IEE the penstock will also be refurbished. This would involve grit blast and corrosion protection of the inside surfaces.

41. The subproject can be completed using the existing access which will be upgraded.

C. Alternatives considered

42. Technical alternatives for investment at Sirinumu have been considered during the development of the recommended interventions. The main consideration with environmental consequences was whether or not to refurbish the turbine in the existing powerhouse or install a new machine.

43. There is also potential to add a second generator unit using the water currently being discharged through the cone valve. Concurrently ADB is providing for the Rouna cascade management study and the findings from this may suggest significant alterations to the way Sirinumu operates.

D. Access

44. The Sirinumu yard is located next to the dam and there is access via the Sogeri to Sirinumu access road. The road is designated a ‘national highway’ but in reality is little more than an earth track which is near to impassable during the wet season. To ensure the plant can be safely transported to Sirinumu TOD improvements to the road will be undertaken.

45. During the refurbishment works lorries and other powered mechanical equipment will be required to deliver the equipment and materials to the site. Precautions need to be taken to ensure that when access is required that lorries and other plant coming to and going from the site use a prescribed route and avoid blocking the main Sogeri to Sirinumu access road or other roads in the vicinity. Traffic management measures to be adopted will be spelled out by the contractor in a traffic management plan.

E. Components Requiring Environmental Assessment

46. The components that require environmental assessment are (i) upgrading works for the access road; (ii) refurbishment of the intake structure and replacement of valves; (iii) refurbishment of the generator above the turbine; (iv) refurbishment of the turbine; (v) installation of additional control and alarm equipment for the turbine; (vi) replacement of the cone valve; and, (vii) minor modifications to the Sirinumu substation and re-commissioning of the system.
F. Implementation Schedule

47. The works planned for the TOD will take about six months. The schedule produced during the PPTA intends for the DSC to mobilize and start detailed design works in 2013. Contractors will commence work in 2014. The implementation schedule will be approximately as follows:

i. Detailed design and preliminary works (2013, 6 months approximately).
ii. Tendering process and award (2013, 3 months approximately).
iii. Equipment manufacture and supply (2013/14, 12 months approximately)
iv. Works and installation (2014, 10 months approximately).

48. The likely commencement and duration of construction works will depend to a large extent on the duration of the detailed design phase. Construction and refurbishment is currently planned to be concluded by 2014.
Figure 3.1 - Components to be refurbished at Sirinumu

- Generator above turbine gallery
- Water released via cone valve
- Generator above turbine gallery
- Cone valve (to be replaced)
- Earth dam
- Intake structure
- Approximate line of penstock under water
4. DESCRIPTION OF ENVIRONMENT

A. Physical Environment

1. Topography
49. Sirinumu is on the Sogi Plateau about 35km east of Port Moresby. The Sirinumu reservoir was created by constructing a dam across the Laloki River. Sirinumu is characterized by hills and gullies around the reservoir and valleys and numerous tributaries to the Laloki River further north below the dam. The site is below the Sirinumu Dam. General relief of the area ranges from 20m to 40m while slope is gentle between 10-20°.

2. Meteorology and Climate
50. Papua New Guinea has a tropical climate and the hinterland of Port Moresby has a dry savannah climate with relatively constant temperatures throughout the year. The wet season starts in December and ends in May; the dry season covers the remaining six months.

51. Sirinumu area is in between two climate zones of PNG, the dry savannah climate and the tropical wet climate. The Owen Stanely mountain range influences the climate of Sogi area including Sirinumu Dam area.

3. Temperature and Rainfall
52. Average daily high temperatures range from 25°C to 28°C depending on time of year, while the average low temperature shows very little seasonal variation, hovering around the 26°C mark. It tends to be slightly cooler in the dry season. Colder and windy weather is experienced from around August to October. The nearest meteorological data is from Port Moresby (Table 4.1).

53. Mid November to February is the driest period and March to May is the hottest period with periodic heavy thunderstorms. June to mid September is the most rainy and humid period. Mid September to early November is a transitional period with decreasing rainfall but with frequent thunderstorms but with relatively high temperatures and humidity in which 1500-2000mm of rain is received annually. The inland areas beyond Sirinumu area receives >2000mm of rain annually.

54. Rain mostly falls in the few months of the monsoon; usually about 4500mm. Monsoon rains can be stormy, and downpours of >100mm per day are not uncommon and storms of more than 250mm in a day are occasionally experienced. The rainfall follows the general climate pattern with the highest rainfall in the summer months of May to September and minimum rainfall in the cooler and drier months of November to March.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest °C</td>
<td>37</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>34</td>
<td>33</td>
<td>32</td>
<td>32</td>
<td>34</td>
<td>34</td>
<td>36</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Average high °C</td>
<td>32</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>30</td>
<td>29</td>
<td>28</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>Average low °C</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Lowest °C</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>18</td>
<td>21</td>
<td>18</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>Precipitation mm</td>
<td>178</td>
<td>193</td>
<td>170</td>
<td>107</td>
<td>64</td>
<td>33</td>
<td>28</td>
<td>18</td>
<td>25</td>
<td>36</td>
<td>48</td>
<td>112</td>
<td>1,012</td>
</tr>
</tbody>
</table>

Source www.bbc.co.uk/weather
4. Climate Change in Papua New Guinea

Climate change may cause shifts in current weather patterns and increase the severity and possibly the frequency of major storms. A recent climate change vulnerability assessment for PNG\(^3\) has concluded that climate change is predicted to affect several climate attributes in PNG. By reference to the Fourth Assessment Report of the International Panel on Climate Change (IPCC)\(^4\) it is projected that for the Pacific region, anthropogenic climate change will cause:

- Sea levels and sea water temperature to rise, contributing to greater incidence of coastal flooding;
- Increased cyclone intensity, with Category 4 and 5 cyclones more common, although with lower frequency.

The Pacific Climate Futures project has also projected minimum temperature increases of 1.1°C by mid-century for PNG.\(^5\) The assessment also reviews national level studies that indicate PNG’s climate is changing, for example:

- Annual and seasonal ocean and land surface temperatures have increased by 0.6 to 1.0°C since 1910.
- Since the 1970s, average temperature has increased by 0.3 to 0.5°C per decade and.
- Significant increases have been observed in the annual number of hot days and warm nights, with significant decreases in the annual number of cool days and cold nights.

Climate change projections for PNG resulting from this work have been summarized as per Table 4.2.\(^6\)

<table>
<thead>
<tr>
<th>Climatic variable</th>
<th>2030 projections</th>
<th>2055 projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface air temperature (°C)</td>
<td>+0.8°C</td>
<td>+1.45°C</td>
</tr>
<tr>
<td>Total rainfall (%)</td>
<td>+1.2%</td>
<td>+8.8%</td>
</tr>
<tr>
<td>Humidity (%)</td>
<td>+0.1%</td>
<td>+0.15%</td>
</tr>
<tr>
<td>Mean sea level (cm)</td>
<td>+10 (5-14)</td>
<td>+20 (9-30)</td>
</tr>
</tbody>
</table>

Source: Pacific Climate Change Program: Climate Change in the Pacific: Scientific Assessment and New Research, CSIRO (2011)

The function, use and integrity of power systems may be affected by several changing climate attributes that may influence sea levels rise, contributing to greater incidence of coastal flooding and increased cyclone intensity leading to greater rainfall.

---

3 ADB: Papua New Guinea Community Water Transport Sector Project - Climate Change Vulnerability Assessment, TA-6420 (February 2012)
5 Pacific Climate Change Program: Climate Change in the Pacific: Scientific Assessment and New Research, CSIRO (2011)
6 Pacific Climate Futures Program, Climate Futures Exploration Tool. Ensemble mean data for 2030 and 2055 projections for A1B (medium emissions scenario). The ensemble mean of 10 GCMs (of a total of 18 models) is presented in this analysis. Data derived from the Pacific Futures tool (February 2012).
5. Geomorphology

The Sogeri Plateau is part of the astrolabe agglomerate unit and is comprised of pyroclastic rocks, lavas, marine and terrestrial clastic sedimentary rocks. The unit is then underlain by older Metamorphic rocks to the north-east. Rocks in the Sirinumu area are characterized of gabbro, diorite and layered gabbro. There are a range of underlying rocks of the Port Moresby area including limestone, chert, marine clastic sedimentary rocks, lalva and agglomerates as summarized in Figure 4.1. The main Laloki River has hard bedrock overlain by irregular to rounded boulders.

6. Seismic activity

The PNG region experiences relatively high seismicity but Port Moresby is in the lowest seismic zone; situated on the northern India-Australian Plate and in a region of relatively low seismicity. However, the Papuan Peninsula has a history of tremors generated by distant earthquakes in the New Britain Arc and Trench (subduction zone). No significant earthquake has occurred within 200 km of Port Moresby but there have been several within 200 km -300 km from Port Moresby. Magnitude 6+ earthquakes have occurred within 100 km of Port Moresby and several magnitude 6+ earthquakes occurred within 200 km of Port Moresby since 1900. The closest distance to a subduction system from Port Moresby is about 300 km. The nearest fault lines are presented in Figure 4.2.

7. Surface waters and drainage pattern

The Sirinumu Reservoir was created by damming the headwaters of the Laloki River. The Laloki River provides the major drainage system for the area. The river below the dam follows a meandering course approximately south to north from Sirinumu eventually reaching the Rouna hydropower cascade and draining into the sea to the west. The Laloki River receives flows from several tributaries in the area notable the Sogeri River. The confluence is 4-5 km upstream from Sirinumu at Sogeri Government Station. Large volumes of sediment move through neighboring tributaries and the Laloki River. Very heavy rainstorms cause floods and debris torrents in the mountain catchments. Combination of the Laloki River and storm waters from tributary drains transports large volumes of sediments to the rivers running through fan deltas on the coast. Water flow from tributaries is seasonal.

The existing hydropower plant at Sirinumu is located below a rock-fill dam across Laloki River and consists of a powerhouse located at the TOD with turbine, generator and substation. In PNG water quality is regulated under the Environment Act and to protect aquatic life surface waters should meet the criteria in the Environmental (Water Quality Criteria) Regulations 2002 promulgated by DEC.

There are also numerous smaller natural rivers and man-made channels running into the Laloki River from the surrounding area. Sirinumu Dam has a vast catchment area. Water overflows to the river or runs through the Sirinumu toe of dam facilities. The average head of water at the powerhouse is 27m and rated discharge is 7m³/s which runs into the Laloki River. The waters meander downstream for about 6km to the Rouna 2 dam and into the Rouna 2 hydropower facility, out flowing back into the Laloki River downstream through a tunnel. Water is then taken into aqueducts just below Rouna 2 outfall to be diverted in a channel and a pipe to the Sirinumu header pond (Figure 3.1).

The water at Rouna 3 wier and the outfall from Rouna 3/Sirinumu is collected in the tailrace and into another aqueduct and then a tunnel through the hill to Rouna 4 header pond and into the hydropower generating facilities at Rouna 4. Some water is also diverted to the Port Moresby water treatment works from Sirinumu and Rouna 4 header ponds.
8. Groundwater

Port Moresby is serviced by Eda Ranu Sewerage & Water Company Ltd whereby treated water is supplied through pipes and reticulation system from the Mount Eriama water supply works which is located to the north east. There is no use of ground water in the project area. Water supply for the area around Sirinumu is taken from a nearby tributary of the Laloki River and rainwater is also harvested.

9. Air Quality

Vegetation burning for animal hunting and to clear land for gardening is the main source of air pollution in Sirinumu area. Motor vehicles are usually present but in small numbers and are not a major source of air pollution in the area. Generally the air is very clean.

In the Sirinumu area the main source of air pollution is fumes arising from the frequent accidental and deliberate burning of the hillsides. Dust also arises from ground or soil disturbance from passing vehicles on unsealed sections of roads and tracks. Dust concentrations will be higher, if only intermittently, on surrounding roads, when dust rises from the damaged surfaces and shoulders. When vehicles pass, dust levels are high enough to obscure vision significantly for a short while, based on field observations. Wood and other solid fuel burning for cooking are also likely to be contributing to air pollution.

10. Noise

The human population is limited mainly to PPL workers and their families. Noise is very minimal or absent in the Sirinumu hydropower area. Occasional noise from passing vehicles is the only noisy feature of the areas, otherwise the area is quiet. There is no specific criterion for noise in PNG and therefore the World Bank criteria will be applicable. The World Bank\(^8\) criterion for residential, school and hospital sensitive receivers is Leq 55dB(A) or background +3dB (A) where background exceeds the criterion. The World Bank criterion of background +3dB (A) will be applied in the assessment. It is noted that there is a general presumption that there will be no night time working except in exceptional circumstances.

B. Biological Environment

The land around the Sirinumu facility was cleared and developed in the late 1950s to prepare for the first stages of the Sirinumu hydropower project. Whereas the project and human impact removed some of the trees, much of the natural vegetation in the areas around Sirinumu was retained or has subsequently grown back. Vegetation is routinely cut back around the header pond and the penstock and the area around the turbine hall. Some gardens have also been planted.

1. Vegetation

There are four habitat features of the area, open savannah woodland, gulley forests, garden plants and secondary re-growth in burned areas (Figure 1.2). Savannah woodland vegetation comprises of fire tolerant wire/blady grasses (mostly *Thermeda australis* and *Imperata cylindrica*), ferns, shrubs, and various species of eucalypt trees (mostly *Eucalyptus confertiflora*, *Eucalyptus papuana* and *Eucalyptus alba*).
71. This vegetation type stretches in all directions from the site including the Varirata National Park (which is 8 km from the site). Within the open savannah there are numerous gulley forests which host many species of snakes, birds and animals. Secondary regrowth vegetation is mostly found in pockets within the savannah and gulley forest vegetation mainly resulting from gardening and burning for hunting. Gardens are mostly found along the gullies where soil moisture content and fertility is higher. Gardens are mainly dominated by banana, sugarcane, pawpaw and pineapple.

72. No vegetation habitat will be disturbed by the proposed development. The immediate surrounding areas of project site are of no conservation value because of the heavy anthropogenic activities in the area.

2. Agriculture
73. There is no intensive agriculture in the area. There are some gardens and subsistence farming. The areas in the hinterland about 100m to 200m away from the site are used for residences and gardens for the PPL residential work force and their families. To the north there is forest and scarp across the Laloki River. There are no other residential villages near the site.

3. Forestry
74. There are numerous naturally seeded trees and others planted for garden beautification in the PPL compound. In the hinterland areas near the project the removal of natural vegetation is almost total due to clearance for gardens. A few of the areas near the Project area still have remnant patches of larger trees. There are a few isolated small trees that have re-grown on the Project area are in some places.

4. Fauna and Flora
75. The project area is remote and there are no recorded rare, threatened or endangered species of terrestrial or aquatic flora and fauna in the impact zone of the project. The Varirata National Park is located about 8 km north-west from the subproject area at Sirinumu (and more than 12 km by road) (Figure 4.3). No habitat will be disturbed by the subproject.

76. The Sirinumu area and the neighboring Sogeri and Varirata National Park areas host a good selection of lowland forest species, plus a few "hill" birds. Birds recorded for the area include but are not limited to the following: White-faced Robin, Goldenface Dwarf Whistler, Chestnut-backed Jewel-babbler, Raggiana Bird of Paradise, Growling Riflebird, Cuckoo-shrike species, Zoe and Pinon Imperial Pigeons, Hooded Pitohui, Marbled Frogmouth, Papuan King, Eclectus Parrots, Chestnut-bellied Fantail, Fairy Gerygone, Barred Owlet-nightjar, Russet Paradise-kingfisher, Wompoo Fruit-dove, Yellow-breasted Boatbill, Pygmy Drongo, Long-billed Honeyeater, Black-billed Brush-turkey, Hooded Butcherbird, White-throated Honeyeater, Forest Kingfisher, White-bellied Whistler, Leaden Flycatcher and Black-capped Lory.

77. Animal species typical of the area are few as many species are hunted for bush meat. Animals known to occur in the area are, wallaby (Thyglyages bruijinii) bandicoot (Enchimpera spp.) rats, gohana lizard, python, deer bats and amphibians (including introduced cane toads).

78. Catfish, trout, eel, tilapia, mosquito fish (Gambusia affinis) and Goldie River rainbow fish (Melanotaenia goldiei) are native fishes found in Sirinumu Reservoir, small gulley creeks and Laloki River. PPL and the National Fisheries Authority introduced Barramundi species into Sirinumu Reservoir some years ago to control the build up of dam sediment. Prawns (Macorbrachium rosenbegii) also occur in small creeks.
C. Social and Cultural Environment

1. Human Issues and Life Quality

79. The project area has a remote rural setting environment and most basic social services are absent. Like all other rural areas in PNG the main issues in the area are lack of social services and deterioration of existing road and bridge infrastructure. Services that are available to locals are the Sirinumu road from Sogeri and the power supply connecting most of the villages in Sirinumu.

80. The lives of locals in the project area revolve around rural activities, mainly crop farming, fishing, hunting and making houses. Surplus garden produce, fish catches and feral animal harvests are taken to Sogeri and Port Moresby markets for sale for cash. Sirinumu people are one of the significant suppliers of garden crops to Port Moresby city residents.

81. Sirinumu links with the Sogeri Road which is the only road linking to Port Moresby city. There was another road that links the Sirinumu area and Port Moresby via Mt. Diamond area but it is no longer in use due to lack of maintenance. The Sogeri link is categorized as a national road. This road was constructed as part of the Sirinumu Dam development project in early 1960s. However, the unsealed Sirinumu Road is not accessible during wet season. Vehicles can get bogged down for about 80% of the road length due to the clayey type of soil of the area. Thais road is planned for upgrading by the provincial authorities.

2. Cultural and historical sites, schools and housing

82. There are no and historical sites in the area. There are schools at Sogeri. Houses are present in the villages 100m to 200m from Sirinumu Dam.

3. Power supply

83. The power distribution network runs from Sirinumu to the substation and than along the transmission lines to Port Moresby. There is also a local supply to the homes of the villagers and their families at Sirinumu.

4. Water supply

84. The Eda Ranu company is responsible for the provision of water and sewerage service to National Capital District but there is no supply to the areas around the site. The exiting intake to Sirinumu at the header pond will be modified to supply to the refurbishment penstock. The existing intake and penstock will be retained to supply a continuous 1 m\textsuperscript{3}/s to the Eda Ranu water treatment plant at Mt Eriama.

85. The water treatment and supply works at Mount Eriama receives raw water from both Sirinumu and Rouna 4 header ponds. The supply from Sirinumu to Mount Eriama will be retained after the works at Sirinumu.

86. The Koiai locals in the rural Sogeri areas around the area do not get treated water supplies. The locals use raw creek water for daily use. Iron roof houses with water tanks collect rain water.

5. Sewerage System

87. The sewerage system in Port Moresby city is the responsibility of Eda Ranu which controls the sewerage treatment systems that caters for about 90% of the city sewerage wastes. Some sea front city areas discharge sewage directly into the sea without treatment through Eda Ranu’s short outfall sewerage pipes. Eda Ranu is improving the system to treat all sewerage wastes before discharge.

88. Most of Port Moresby city is connected with sewerage system network except for some squatter settlements and all urban villages which use pit latrines for sewage control.
Urban fringe villages on the sea shore discharge sewage directly into the sea, which is a major concern of NCDC and the city residents who use the sea front for fishing and other recreational activities. The project area is not covered by the above two public utility services.

6. **Solid Waste Disposal**

89. National Capital District Council (NCDC) collects all domestic and commercial wastes by installing waste bins and providing pick up dump trucks. The wastes are taken to Baruni municipal waste dump where they are dumped, picked over and some are burned. Industries in the city have their own waste storage, collection but the end point for all solid waste is the dump at Baruni.

90. The settlements and urban villages are not serviced by municipal wastes collection service system of NCDC. The majority of solid domestic waste from settlements and urban villages on land are burned or disposed of into main storm water drains which washed away by storm water during heavy rains. For settlements on the sea shore domestic wastes are disposed of directly into the sea. Open disposal or fly tipping around the urban fringes is also typical for solid waste disposal.

7. **Telecommunications**

91. PNG Telikom Ltd, Be-mobile and Digicel provide telecommunication services in Port Moresby. Telecommunications cables running near most of the Project area except the Sirinumu site. Telecommunication cables run only as far as Sogeri District Government Station. Sirinumu area does not have line telephones. However, Digicel covers the area with its mobile communication network.
Figure 4.1 - Underlying Geology of Port Moresby Area

Legend:

- **Qa** = Alluvium, beach deposits, colluvium and scree
- **Tp** = Pyroclastics, marine and terrestrial clastic sedimentary rocks
- **Tmm-p** = Pyroclastics, lavas, marine and terrestrial clastic sedimentary rocks
- **Tou** = Lavas, pyroclastics, marine clastic sedimentary rocks
- **Tos** (pink colour) = Gabbro, diorite and layered Gabbro
- **Te** = Limestone, chert and marine clastic sedimentary rocks, lavas and agglomerate
- **Ku** = Basalt, low grade metamorphics and globigerinal limestone
- **JK** = Low grade metamorphics with some high grade, folded and cleaved marine clastic sedimentary rocks, phyllites and limestone
Figure 4.2 - Central Province Forest Map

Central Province Forest Map

LEGEND

- Vegetation type (Merchantable)
- Vegetation type (Non-merchantable)
- Land use as at 1975
- Land use since 1975
- Logged over
- Logged over converted to land use
- Extreme physical limitations to logging (Inundation)
- Serious physical limitations to logging (Inundation)
- Extreme physical limitations to logging (Slope)
- Serious physical limitations to logging (Slope/Relief)
- Extreme physical limitations to logging (Altitude)
- Extreme physical limitations to logging (Polygonal karst)
- Extreme physical limitations to logging (*mangroves)
- Coastline
- Province boundary
- Concession boundary
- Proposed Concession boundary
- Protected Area
- Urban area
- Lakes & rivers
- Road (TPC 1:500 000)
- Rivers & creeks (TPC 1:500 000)
Figure 4.3 – Location of Varirata National Park

LEGEND

Varirata National Park

3km

Port Moresby Power Grid Development Project ADB TA 7783 PNG
Initial Environmental Examination

Fig. 4.3 Varirata National Park Locality Plan

Source: DEC Conservation Division
5. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Environmental Impacts Associated with the Project

92. This section discusses the potential environmental impacts of the works to be undertaken and identifies mitigation measures to minimize the impacts in the pre-construction and construction phases. Environmental analysis has covered potential direct, indirect, cumulative, and induced impacts but primarily focuses on the physical impacts within the area during the pre-construction and construction phases. With the exception of improved environmental management will not have any expected impacts in the operational phases.

93. A DDR has been undertaken to identify if existing operations and facilities that are linked with the Project comply with the SPS. Through due diligence, review, and supervision ADB ensures that borrowers comply with the SPS requirements during project preparation and implementation. The process outlined in the SPS notes that, over time, safeguards may require the updating of existing operations to enhance environmental effectiveness, respond to changing needs, and reflect evolving best practices. The DDR report is included in Appendix D and the findings are included in this section while required actions are integrated into the EMP presented in Section 8.

94. **Physical Impacts.** The main physical issues relate to impacts such as the upgrading of the access road, and waste disposal. The road improvement works and installations at the TOD will create some unavoidable but temporary traffic management, dust, noise, run-off, spoil and waste disposal impacts.

95. **Management Issues.** The main management issues relate to impacts such as, transportation of materials to site, materials supply, controlling noise and dust, management of waste disposal, and managing workers and public safety. Traffic management issues will be addressed through the traffic management plan to be prepared during detailed design.

96. **Biological Impacts.** The subproject is within PPL facilities and next to an existing road. Biological impacts are not expected to occur. There no other biological issues that relate to the project.

97. There is no issue of interference with sites protected for their biodiversity. There will be no interference with protected forests as the subproject will be within the designated PPL facilities. There will be no change to the surrounding drainage.

98. The environmental flow regime will not be altered as a result of the subproject.

99. **Social Impacts.** The social impacts are temporary disturbance for purposes of installation of the improvements and potential health and safety issues. The social and human impacts to residential villages and impacts to social infrastructure are mitigated through implementation of the social development work-stream. A Poverty and Social Assessment has been prepared and the EMP also addresses potential impacts on the social environment.

B. Cumulative, Indirect and Induced Environmental Impacts

100. **Cumulative impacts.** Other infrastructure improvement projects planned for the Sirinumnu area are routine road maintenance and local infrastructure projects but there are no significant or cumulative direct impacts. There will be further expansion of the PPL grid in years to come, but this is still in the planning stages. At this stage there are no readily
identifiable indirect or induced direct cumulative impacts. The direct cumulative impacts of the Project are insignificant.

101. The minor additional impacts are likely to be mainly construction related, relatively short lived and can be mitigated by implementing mitigation measures and a suite of management arrangements and other mitigation measures similar to those identified in the EMP.

102. **Indirect impacts.** There may be some adverse and beneficial environmental impacts which cannot be immediately traced to the project activities but can be causally linked. For example, a project’s pollution may directly impact air quality. Overall the improvements shifting of future PPL power generation from diesel fuel to liquid natural gas (LNG) and the use of more fuel efficient generation equipment will improve the system overall and reduce some of the pollution arising and therefore have some indirect benefits on the respiratory health of some of those living near to projects. However it is not possible to quantify these impacts.

103. **Induced impacts.** The subproject will be carried out in a remote rural area and there will be no additional adverse impacts in the operational stage. As the Project systems develop the overall status of the environment may remain much the same as at present in but overall the improvements to the Project facilities should make electrical power delivery more efficient.

104. The statutory provisions under the laws of PNG cover pollution control. These laws are established but institutional strengthening is required and improvements in resources are needed to achieve better enforcement to support strategic management of pollution control in the long term. The proposed environmental controls on the Project facilities will provide a good example of clean and efficient operation of PPL facilities. Therefore overall there would appear to be some opportunity for beneficial induced impacts although it is difficult to foresee unplanned developments caused by the project that may occur later or at different locations, that would bring about any negative impacts, caveat there will be better planning for strategic power management overall.

105. The potential environmental impacts of the subproject in the pre-construction, construction and operational phases are assessed below. Where impacts exceed accepted environmental standards, mitigation measures are proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The criteria for assessment are in line with SPS. The national standards of the government are in development. Where PNG has no set of standard or guideline, the standards given in *World Bank's Environmental Health and Safety Guidelines (2007)* are used. The EMP (Chapter 8) provides a matrix of mitigation and monitoring measures to prevent or minimize the impacts. For purposes of this assessment the PPL will establish a PMU and engage a DSC to manage and supervise any in-house works and the Contractors detailed designs and construction.

C. **Pre-Construction Phase – Detailed Design**

106. The project involves design, construction and operation of the refurbished intake structure, valves, penstock and turbine and replacement of the cone valve. Preliminary designs have been completed but detailed design will be completed by the DSC and contractors. The IEE has identified some potential impacts that will need to be mitigated in the pre-construction as well as construction phases. There are a number of mitigation measures and good environmental management practices that will need to be implemented in order to avoid construction impacts. The DSC will support the PMU set up specifically for the Project.
107. In line with ADB policy on environmentally responsible procurement, opportunities to provide environmental enhancements will also be identified in the detailed design in addition to routine matters such as trimming trees professionally, avoiding unnecessary removal of trees and compensatory and enhancement planting.

1. Design Measures and Project Disclosure

108. The DSC as part of the PMU will supervise the preparation of the detailed designs and detailed management plans to address the requirements below and all items in the EMP as set out in Table 8.2, including, but not necessarily limited to, the following requirements:

i) Consultations undertaken as per the C&PP.

ii) Land acquisition, resettlement and environmental impacts will be avoided or minimized by basing the detailed designs within the Project subproject area as proposed in the preliminary designs.

iii) Arrangements will be made to facilitate the timely supply of materials for refurbishment and to avoid impacts by stockpiling within or near the area.

iv) Drainage impacts during construction will be minimized by including in the detailed design by making sure of collection and diversion of incoming surface runoff from surrounding hills, drains and ditches, culverts and other infrastructure around the subproject area.

v) Disruption to current facilities for water supply will be avoided and as far as is practicable facilities will be retained or re-provisioned before construction works commence; provisions will be made to preserve the operation of current facilities for water supply in sufficient quantity in agreement with the local community.

vi) Disruption to current power supply will be avoided and movement of power lines will be planned well in advance. Temporary power distribution circuitry will be re-provisioned before construction as far as practicable works commence; provisions will be made to preserve the operation of current facilities for power supply in sufficient quantity in agreement with the local power supply company.

vii) Plans to minimize disturbance of vehicular transport and pedestrians during construction will be included in the detailed designs. Plans will be discussed and agreed with the police authorities and other local authorities around the project area. Phasing and programming for construction will retain a passing lane along the road used for access during construction and avoid community interference.

109. Temporary facilities will utilize the planned PPL area for a contractor’s yard. If additional areas are required, acquisition of land will be minimized by selecting locations for additional lay down areas or construction yards on barren or marginal land and agree terms with local community.

110. The final detailed designs will be disclosed to DEC under the requirements of the Environment Act 2000 and EPAR as well as to the wider public under ADB’s Public Communications Policy (2011). A check will be made at the detailed design stage that project design has been designed as planned to avoid and mitigate impacts in line with the disclosure and any application for EP required by DEC. The IEE and EMP shall be updated by the PMU and submitted to ADB for approval incorporating the results of this IEE and any recommendations and requirements from the DEC. Further, if during detailed design there are any unexpected changes to subproject design (such as change in layout or footprint or alignment) that would result in environmental impacts or risks that are not within the scope of this IEE and EMP, the PMU assisted by DSC shall further update the EMP or prepare a new environmental assessment report for submission to ADB. Prior to preparation of the updated or new environmental assessment report, the proposed change(s) shall be screened by PMU and confirmed by ADB for potential environmental impacts and risks to determine the
appropriate extent and type of environmental assessment to be undertaken. PMU will also establish the GRM before site works commence.

2. Environmental Capacity Development of PMU

111. PPL will make sure that a PMU is set up, trained and prepared by DSC to ensure that contractors are trained as required to provide compliance with EMP and other management plans. PPL has indicated that there are few staff in PPL who have any post-graduate qualifications in environmental management and that the one existing Environment Officer (EO) is currently not designated to project work but is fully committed on environmental management for existing installations. The Country Safeguard System review was recently completed and this provides a detailed assessment of PPL capacity and record of implementation of environmental safeguards on previous projects. As PPL does not have existing resources to undertake the required environmental management for the Project, sufficient resources will be provided through the PMU. The DSC will engage an international environment specialist (IES) and PPL will provide a national environment specialist (NES), most likely through external recruitment, to be attached to the PMU.

112. In conjunction with ongoing dialogue with PPL, the IES will also develop a strengthening plan for environmental management and provide training to the EO and senior management to increase awareness of environmental management and safeguards issues. Details of the proposed environmental capacity building are provided in Chapter 8 (Environmental Management Plan).

3. Preparation of Contractor’s Site-specific EMP

113. The PMU will include the EMP and relevant provisions from the IEE in the bidding documentation and provide training on environmental management to contractors as to ensure the contractors are ready to implement the necessary environmental management measures. This is required to ensure compliance with the national law and environmental management measures in the SPS. Prior to signing of contracts, the DSC will produce a series of method statement or site-specific environmental management plans (draft CEMPs) to be approved by PMU for inclusion in the contract. The contractor(s) will subsequently update the method statements (assisted by the DSC) for approval by PMU. The broad content of the draft CEMPs is included in the construction mitigation section of this IEE.

114. The CEMPs will demonstrate the manner (location, responsibilities, schedule, timeframe, budget, etc.) in which the contractor will implement the mitigation measures specified in the EMP and other management plans.

115. Based on the EMP, the following method statements shall be drafted by the DSC in the pre-construction/detailed design stage for updating by the contractor (assisted by DSC) before construction commences:

a. Waste Management (WMP) for handling, storage, treatment, transport and disposal of solid and liquid wastes, hazardous materials, hazardous wastes and excavation of spoil from the access road and powerhouse and substations earthworks;

b. Noise and Dust Control Plan (NDCP) to minimize impacts to sensitive receptors (educational establishments, hospitals, residential areas, etc.) due to earth works, other construction works, sourcing and transport of construction materials, and other project-related activities;

c. Drainage Management Plan (DMP) to ensure that works will not cause blockages to existing drainage or ponding/flooding within the subproject areas.

---

(including along the access road during upgrading), or the residential and commercial areas adjacent to the subproject areas;

d. Health and Public Safety Plan (HSP) to identify interfaces between the works and public and ensure worker and public safety, prevent accidents due to the construction works, and process required to report all accidents due to the Project activities.

4. Environmentally Responsible Procurement

116. PPL will establish a PMU that will be supported by a DSC and include an IES and NES. The IES will provide training to NES, existing EO and other PPL staff as required to implement CEMP and other plans and start to build capacity within PPL. All the above plans will be agreed in advance by PMU and will be included in contract documentation. The requirements in the contract will include full implementation of the EMP including all the above plans to ensure contractors are fully aware in advance of their environmental responsibilities and obligations.

117. The PMU shall require the contractor to engage capable and trained site agents to take responsibility for the environmental management at the working level and to audit the effectiveness of the contractor’s CEMP and review mitigation measures as the project proceeds. Effective implementation of the CEMP will be audited as part of the loan conditions and the executing agency (IPBC) will be prepared for this. The IES and NES will train the EO and other PPL staff as required to implement CEMP and guide the contractors on the environmental aspects of subproject construction. This process will be initiated during this Project and Town Electrification Improvement Program (TEIP) and can start to embed methods, knowledge and experience that can then be carried forward in other projects.

118. Any recent recommendations and initiatives from DEC or other provincial authorities will be incorporated into updated EMP and audited as necessary as the Project is rolled out.

5. Ambient Environmental Baseline Data

a. Noise and Dust

119. To control measures to be applied to works for upgrading the road, dust and noise from construction of foundation pads and earthworks at the TOD site will be managed through the noise and dust control plan.

120. Noise impacts will be of short duration, although they can be very intrusive if not controlled properly. If complaints arise, noise measurement can be taken to establish if the World Bank criterion of Leq 55dB(A)-hour is exceeded at measurement points at the nearest residential sensitive receivers. The World Bank criterion of background +3dB(A) will be applied.

b. Water Quality

121. The site is adjacent to the head of the Laloki River and the access road passes by creeks and tributaries of which the water quality must be protected. Collection of baseline data for water quality will be taken on at least five occasions in the month before construction starts.

122. Sampling requirements, including parameters, will be assessed during the detailed design. If required, baseline data on surface water quality shall be collected by PMU assisted by the DSC. Any sampling and analytical methodology shall be consistent with best international practice, ASTM or national regulations for surface water quality and in line with the Environmental (Water Quality Criteria) Regulations 2002.
### Table 5.1 – Maximum allowable concentration of example pollutants in surface water

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Permissible freshwater limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>No alteration in natural pH (i.e. same as upstream)</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen (DO)</td>
<td>mg/l</td>
<td>≥ 5</td>
</tr>
<tr>
<td>Turbidity</td>
<td>N.T.U</td>
<td>&lt;25</td>
</tr>
<tr>
<td>Oil &amp; grease</td>
<td>mg/l</td>
<td>None</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/l</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Hexavalent Chromium</td>
<td>MPN/100ml</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Fecal coliform</td>
<td>MPN/100ml</td>
<td>&lt;25</td>
</tr>
</tbody>
</table>

Source: DEC: Environmental (Water Quality Criteria) Regulations 2002

Notes: N.T.U - Nephelometric Turbidity Unit

6. **Climate Change Adaptation**

123. Severe tropical storms can have a debilitating impact on energy infrastructure and climate change has been predicted to affect several climate attributes that may influence the integrity of the power systems such as by the intensity of more common cyclones increasing or sea level rise. However climate change is not considered to present any material risk to this subproject and it is not foreseen that a predicted rise in seal level or precipitation would present the need to adapt design significantly to account for climate change.

124. The energy assets can be protected from these impacts both by protecting the facility or relocating it to safer areas. Sea level rise is clearly not an issue. The location of Sirinunu hydropower toe of dam facilities is fixed but the landform means that is on higher ground by about 5m than the nearby Laloki River. The site is self draining as the landform falls towards the river.

125. Lightning strikes are unlikely due to the location low down in the valley. Instabilities that would be brought about by increased intensity of more common cyclones are very unlikely and severe tropical storms will be mitigated by the design measures planned to mitigate the instabilities that already occur in the system. The impacts from increased rainfall will be mitigated by the attention to maintaining the existing drainage. Therefore to a large extent the designs can be regarded as self protecting designs with regards to climate change and no further adaptation measures are required.

7. **Enhancements**

126. Environmental enhancements have not been a major consideration in the assessment. Whereas it is noted that it has been common practice in many paces to plant trees along PPL Moresby streets and highways to provide visual interest in line with best international practice there will be few opportunity sites for tree planting in the vicinity of the project. Other opportunities for enhancements can be assessed prior to construction.

8. **Due Diligence Review**

127. Due diligence has been undertaken through a review of the available documentation, interviews with staff of PPL and site visits during July and August 2012 in order to explore with the facility operator/owner whether the facility (be it existing and proposed) is in compliance and/or can be brought into compliance with SPS, and if so to agree on required corrective actions and a time-line for their implementation as a part of international good practice.

128. In preparing the DDR the consultants have exercised due diligence and studied where PPL’s current practices meet ADB SPS requirements and where there are gaps that need to be filled. This section summarizes the results set out in Appendix D and identifies
how any gaps can be addressed so that the loan procedures can proceed with confidence that the requirements of SPS will be complied with.

129. **Current status of compliance.** The Sirinumu hydropower plant was commissioned in 1975 and was operating up to 2008 with a Water Use Permit for the abstraction of water issued under the Water Resources Act. The permit was issued to PNG Electricity Commission (ELCOM) the agency preceding PPL.

130. The Water Resources Act was repealed by the Environment Act in 2000, and while all permits approved under Water Resources Act stayed in force, the permits for Sirinimu scheme expired in 2008. While it is known that PPL has issued a letter requesting new permits under the Environment Act, in effect the system is currently operating without permits.

131. **Actions required for compliance.** There are several immediate recommended actions for PPL in order to achieve environmental compliance and bring the project in line with SPS. The recommended course of action is for PPL to:

   i. Request clarification from DEC, as the environmental authority, about current state of affairs regarding environmental compliance in PPL with regards to Sirinumu TOD.

   ii. Disclose the scope of the improvements for Sirinumu TOD and seek guidance from DEC on the procedures required and the actions needed to establish regularization of environmental compliance of Sirinumu TOD.

D. **Construction Phase**

132. The source of the construction impacts– for both road upgrading works and refurbishment works at the TOD site - will include (i) spoil and waste disposal; (ii) managing of supply for construction materials including stockpiles of materials; (iii) delivery and installation of the equipment; (iv) canteens and toilets and various worker activities in and around the sites; (v) erosion, run-off, and siltation issues; and (vi) traffic management, access and transportation issues. For purposes of this assessment it is assumed that the DSC will cover implementation and the TOD system and access road upgrading design. Detailed design of the small engineering works such as foundations will be completed by the contractor.

1. **Activate CEMP and Obtain Permits and Licenses**

   133. The DSC will provide awareness training, induct and supervise the contractors to carry forward the environmental mitigation measures and enhancements identified in the detailed designs. On behalf of PMU the DSC will assist contractors to prepare updates of the management plans/CEMPs prepared by DSC at the pre-construction stage. Separate CEMP (and other management plans as required) will be completed for (i) access road upgrading and (ii) TOD refurbishment works as these will likely be tendered as two separate contract packages.

   134. The benchmark for monitoring and reporting on the contractor’s environmental performance are the updated CEMP, all the mitigation measure in the EMP (Table 8.2) and any additional mitigation measures that may be included in the EMP during detailed design stage either by DSC or conditions of EPs received from DEC. Prior to commencement of construction, the updated CEMP/management plans shall be approved by the PMU. PMU shall ensure that contractor(s) and their suppliers comply with all statutory requirements for permits from DEC with regard to use of mechanical equipment, establishment and operation of construction plant such as concrete batching plant. PMU shall ensure that (if necessary) contractor(s) and their suppliers use sources of rock based materials that comply with all statutory permits and DEC requirements for environmental permits.
2. Orientation of Contractor

135. The IES and NES of the PMU shall orient the contractor(s) on implementation of construction mitigation measures and all other construction phase mitigation measures included in the subproject EMP (i.e. EMP included in this IEE) and any additional mitigation measures that may be included by the DSC during detailed design stage.

136. The DSC will monitor the implementation of mitigation measures by the contractor(s) and if the required mitigation measures are not installed, payments will be withheld as per the bidding documents. This will include implementation of HIV/AIDS awareness program in line with social plans to be implemented under the Project. These requirements including the EMP table on mitigation measures (Table 8.2) will be included in the Particular Specification for the contract.

3. General Construction Waste Management

137. Uncontrolled waste disposal operations can cause significant impacts. Mitigation measures for the waste arising from the subproject will seek to reduce, recycle and reuse waste as far as practicable. The DSC will be responsible to monitor the contractor’s progress of updating the waste management plans (WMP) and to include the implementation of mitigation measures, to minimize impacts.

138. The General Waste section of the WMP will include consideration of all matters related to solid and liquid waste disposal including the following:

- Expected types of waste and quantities of waste arising
- Waste reduction, reuse and recycling methods to be employed
- Agreed reuse and recycling options and locations for disposal / endorsement from DEC
- Methods for treatment and disposal of all solid and liquid wastes.
- Establishment of regular disposal schedule and constraints for hazardous waste.
- Program for disposal of general waste / chain of custody for hazardous waste.
- Discussion of the PMU/DSC inspection/monitoring role.
- Establishment of complaints management system for duration of the works
- Agreement on publicity/public consultation requirements (advance signing etc.).

139. The contractor’s mitigation measures in the WMP will include but not necessarily be limited to the measures listed below. The contractor shall ensure implementation of these measures.

- Update the draft WMP (in CEMP, assisted by DSC) to cover all aspects of waste storage, disposal and accidental spills, all to be approved in writing by the DSC one month prior to starting works.
- Areas for disposal to be agreed with local authorities and checked and recorded and monitored by the PMU.
- Segregation of wastes shall be observed. NO BURNING is allowed on site.
- Recyclables shall be recovered and sold to recyclers.
- Residual waste shall be disposed of in disposal sites approved by local authorities and not located within 500m of rivers or streams.
- Construction/workers’ sites and camps shall be provided with garbage bins.
- Burning of construction and domestic wastes shall be prohibited.
- Disposal of solid wastes into drainage ditches, rivers, other watercourses, agricultural fields and public areas shall be prohibited.
- There will be no site-specific landfills established by the contractors. All solid waste will be collected and removed from the work camps and disposed in local waste disposal sites.
• Waste disposal areas approved by local authorities shall be operated in line with the DEC environmental code of practice for Sanitary Landfill Sites and rehabilitated, monitored, catalogued, and marked before the project is completed.


140. Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Mitigation measures will seek to control access to and the use of hazardous substances such as oils and lubricants and control waste disposal. The DSC will be responsible to monitor the contractor’s progress of updating the WMP to include implementation of mitigation measures, to minimize impacts from hazardous substances such as oils and lubricants.

141. The contractors mitigation measures in the Hazardous Materials section of the WMP of the CEMP will include but not necessarily be limited to the following measures. The contractors shall ensure implementation of such measures.

• Ensure that safe storage of fuel, other hazardous substances and bulk materials are agreed by PMU and follow the DEC environmental code of practice for Vehicle / Machinery Workshops and Petroleum Storage / Resale / Usage sites and local authorities.

• Hydrocarbon and toxic material (and explosives if necessary) will be stored in adequately protected sites consistent with national and local regulations to prevent soil and water contamination.

• Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.

• The contractor shall identify named personnel in the WMP/CEMP in-charge of these sites and ensure they are properly trained to control access to these areas and entry will be allowed only under authorization.

• Fuel and other hazardous substances shall be stored in areas provided with roof, impervious flooring and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.

• Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with national and local regulations.

• Ensure all storage containers are in good condition with proper labeling.

• Regularly check containers for leakage and undertake necessary repair or refurbishment.

• Store hazardous materials above possible flood level.

• Discharge of oil contaminated water shall be prohibited.

• Used oil and other toxic and hazardous materials shall be disposed of in an authorized facility off-site.

• Adequate precautions will be taken to prevent oil/lubricant/ hydrocarbon contamination of drainage channel beds.

• Ensure availability of spill clean up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored.

• Spillage, if any, will be immediately cleared with utmost caution to leave no traces.

• Spillage waste will be disposed at disposal sites approved by local authorities and approved by DSC.

• All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying
with all the applicable statutory stipulations and the environmental codes of practice.

5. **Materials Extraction and Management of Quarry and Borrow Areas**

142. Materials in the form of base-course and suitable aggregate for access road upgrading works and grit sand for sand blasting, paints and other supplies and equipment and materials will be required for TOD refurbishment works. The timely supply of construction materials is a consideration in planning and managing the construction works. The DSC will produce draft materials management plans (MMP) in the detailed design phase for confirmation by the contractors in the pre-construction phase. The MMPs will be updated as necessary in the construction phase by the contractor to minimize the use of non-renewable resources.

143. The access road upgrading is the component of this subproject which will require the larger volumes of material. Removal of river gravel for construction materials has the potential to interfere with aquatic ecology and hydrological conditions. However, the streams and rivers within the subproject area are subject to frequent flooding and naturally high disturbance regimes. This means that the ecosystems they contain have had to adapt to variable and high water flows, channel changes and high turbidity and are likely to be resilient to the disturbances associated with moderate gravel extraction.

144. Depending on the size of the stream or river, volume of material to be extracted, and where the material is to be obtained from, removal of gravels could have an effect on the river bed and/or channel morphology, including river widening and increased flow speeds, causing bank instability or erosion.

145. Sources of material (gravel, aggregate etc) and quarry sites for the road upgrading will be identified during detailed design. In order to reduce impacts associated with informal quarry activities and borrow pits, if already existing quarries cannot be used, contract documents will specify that (i) sites must be identified in consultation with NCDC, local land owners and communities; (ii) the contractors will be responsible for setting up dedicated crusher plants at sites approved by NCDC and PMU; (iii) appropriate existing sites will be used in preference to establishing new extraction sites wherever possible; and (iv) for all sites, the contractor will ensure that appropriate environmental permits from DEC have been obtained before sourcing the material.

146. The contractor will be required to identify sources and prepare a sustainable extraction plan, for all sources of material and spoil that will be used in road upgrading works. The aggregate extraction will be detailed as a separate section in the MMP (as part of the updated CEMP) and will be submitted to PMU, which will approve and then monitor implementation. The MMP will therefore be drafted during the detailed design process by the DSC and updated by the contractor (when quantities and type of materials etc are known with more certainty).

147. The MMPs will include, as a minimum, consideration of the following:
- Required materials, potential sources (by type), estimated quantities available and method statements for extraction
  - Impacts to identified sources and availability
  - Endorsement from DEC and local landowners for use of sources
  - Methods of transportation to minimize interference with normal traffic
  - Constraints of regular delivery schedule to reduce stockpiling on site
  - Discussion of the PMUs inspection and monitoring role
  - Agreement on publicity/public consultation requirements

148. For sourcing of materials for access road upgrading, to mitigate the impacts from stream or river extraction, as well as from land-based borrow pits, it is recommended that in
addition to the preparation of the site-specific MMP (including extraction section) by the contractor, that bid and contract documents specify that:

- The contractor is to submit the site-specific and updated MMP to PMU/DSC (and DOE if required) for review and approval;

- Limits to volume of material extracted from any one source will be set in light of the ability of the source to regenerate and likely environmental impact as a result of the extraction. As with any extraction, there are limits after which localized or more extensive environmental impacts may occur. This might be due to facilitation of erosion or sedimentation which could alter the immediate environment or impact directly upon flora and fauna;

- Access to extraction sites will be negotiated with land owners and users, in the event that an access is purpose built, should the owner not want to keep the access, the contractor will be responsible for reinstating the land to its pre-project condition;

- Any rivers or streams identified as comprising part of the intertidal zone, comprising swamp or wetland, or including mangroves, will not be permitted to be used as sources of material;

- Any rivers or streams that are used as a fresh water source for villages should not be used as a materials source as gravel extraction will cause increased sedimentation and turbidity. In cases where such rivers or streams must be used, alternative water sources, such as drilled or dug wells, upstream of extraction sites and works, must be provided for the villages;

- Use of approved machinery for gravel extraction from rivers such as excavator or backhoe. Dredging or similar operations for the winning of construction material will not be permitted;

- A number of sites for extraction are preferred over a large volume being taken from one location;

- In respect of maximum volumes to be removed from any one source, any river gravel removal for road upgrading works will be managed in accordance with the draft MMP prepared by the DSC and any conditions attached to environmental permits;

- Gravel or material should not be extracted from river bends, and if required, river training be undertaken;

- Gravels will not be extracted from any coastal or shoreline areas;

- Any extraction sites and borrow areas close to the existing access road will be located at least 15 m outside the right-of-way of the road, extraction from the sides of the access road (or other roads in the area) in such a way that could undermine them will not be permitted;

- Site and pit restoration will follow the completion of works in full compliance with all applicable standards and specifications;

- Any topsoil excavated from the top of sites and borrow pit areas will be saved and reused in re-vegetating the sites and pits to the satisfaction of the PMU;

- Additional extraction sites and/or borrow pits will not be opened without the restoration of those areas no longer in use; and

- The excavation and restoration of sites and borrow areas, as well as their immediate surroundings, will be undertaken in an environmentally sound manner to the satisfaction of the PMU. Sign-off to this effect by PMU will be
required before final acceptance and payment under the terms of the contract.

149. In the detailed design stage the DSC will produce a chart for the equipment and materials needed for the construction works. The chart will also be updated and modified as necessary by the contractor(s) as part of the CEMP before construction commences to produce a MMP to specify (i) the methods to be employed prior to and during transportation of materials for construction and (ii) all other measures to be employed to mitigate nuisances to local residents, contractual clauses will be included to require the contractor(s) to update the draft MMP regularly and report monthly to monitor the production and use of materials. The contractors will be responsible for the updates to the draft MMPs.

6. Noise and Dust

150. The construction and installation works will require some powered mechanical equipment such as generators, drills, and perhaps a concrete-mixer and these will generate some noise and vibration. Modern machines that are acoustically designed to generate low noise levels are available in PNG and the works will not take place so close to residential accommodation and settlements to create significant impacts. The cumulative effects from several machines is unlikely to cause significant nuisances because there is at least 100m buffer distance between the work area and the sensitive receptors.

151. To minimize impacts the contractors should be required by the PMU to (i) maintain and service all equipment to minimize noise levels; (ii) locate equipment to minimize nuisances; and, (iii) install acoustic insulation or use portable noise barriers where practicable to limit noise at sensitive receivers. Insulation should be provided to minimize noise impacts such that the measured noise at the edge of the works nearest residential areas will be less than and 70 dB(A) Leq during the day (7am to 9pm).

152. Although construction noise and dust were recognized as nuisances by the local population they were also considered acceptable nuisances in view of the potential benefits and future improved electricity supply conditions.

- If the works surfaces are dry water will be sprinkled on the road and exposed surfaces when work is carried out within 50m of residences or roadside food stalls.
- No work will be carried out within during the night (2100hrs to 0700hrs) except in special circumstances permitted by the PMU.
- If works have given rise to complaints over dust, the contractor shall investigate the cause, report it to the PMU.
- Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project.
- Vehicles equipment or cement and sand and other construction materials will be covered with tarpaulin sheets to avoid impact from dust.

7. Drainage

153. Along the access road and Sirinumu TOD site there may be some interfaces with existing drainage ditches and culverts that will require advance planning. The construction activities may affect local drainage systems on surrounding lands and precautions will be needed to avoid natural streams and man made channels (Figure 4.2) that drain into the subproject area. If not the adjacent drainage pathways may become silted with materials (earth) in the runoff from the construction work areas.

154. The contractors will be required to implement the provisions of the drainage management plan (DMP) to prevent flooding around the works and provide drainage facilities to avoid ponding / flooding during construction of areas used for project-related activities and adjacent areas. The DMP will address:
i. Prevention of flooding and ponding on land around the work sites and adjacent channels;
ii. Protection of work crews from hazards associated with heavy rainfall draining towards the site;
iii. Maintenance of access to adjoining properties; and
iv. Addressing issues that may delay the subproject works.

155. The contractors will incorporate the following design features into the CEMP after review of the detailed design to minimize alterations to and impacts on surface drainage patterns in the areas around subproject areas as far as possible:

- Contractors will review the detailed designs for drainage structures provided with the tender and assess and agree with PMU if redesign is required or if new or additional structures or channels will be constructed or existing ones will be repaired.
- The contractor shall review the local weather and rainfall patterns and install and maintain as necessary all temporary drainage facilities to ensure the works, the adjacent land and existing facilities are adequately drained during the course of the works.
- Contractors (assisted by DSC) will update the DMP in a timely manner as required.
- In areas close to the residential sensitive receivers, the existing drains would be protected so that the outfalls of the surface run-off from the subproject are diverted away from the sensitive receivers.
- Measures will also be taken during the construction phase to ensure that storm drains and highway drainage systems on the access road are regularly cleared to maintain storm water flow.

8. Occupational Health and Safety

156. Worker occupational health and safety is generally governed by the PNG Employment Act 1978. A health and safety plan (HSP) will be submitted by the contractor in the CEMP to establish routine safety measures to cover the main Project area and any other associated quarry sites or construction yards. The HSP will meet the requirements of good engineering practice the Employment Act 1978 and World Bank Environmental, Health, and Safety General Guidelines as well as to provide first aid facilities.

157. Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows:

- At least one month before construction commences the contractor will demonstrate to PMU that the safety plan will be properly resourced and a qualified safety officer will be identified by the contractor as shown in their bid and the safety plan will be approved by PMU and DSC before construction commences.
- Before construction commences the contractor will conduct of training for all workers on environmental, safety and environmental hygiene. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice and provide first aid facilities.
- The contractor will instruct and induct all workers in health and safety matters (induction course) before they start work and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting on site will include environment, safety and environmental hygiene.
- Workers shall be provided (before they start work) with of appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection at no cost to the
workers. Site agents/foremen will follow up to see that the safety equipment is used and not sold on.
- Fencing shall be installed on all areas of excavation greater than 1m deep and at sides of temporary works.
- Audible reversing signals shall be installed on all construction vehicles.

158. The contractor will include provisions in the Worker Safety section of the HSP in the CEMP for:
- Instruction of all workers in health and safety matters.
- Provision of potable water supply in all work locations.
- Establishment of safety measures as required by law and by good engineering practice and provision of first aid facilities.
- Providing to all workers appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear plugs, gloves, etc.
- Scheduling of regular (e.g., weekly tool box talks) to orient the workers on health and safety issues related to their activities as well as on proper use of PPE.
- Where worker exposure to transport cannot be completely eliminated, protective barriers shall be provided to shield workers from transport vehicles. Alternatively another measure is to install channeling devices (e.g., transport cones and barrels) to delineate the work zone.
- Fencing on all excavation, borrow pits and sides of temporary bridges
- The main construction yard shall be provided with toilets/sanitation facilities in accordance with local regulations to prevent any hazard to public health or contamination of land, surface or groundwater. These facilities shall be cleaned daily and well maintained to allow effective operation.

159. Facilities for workers and public safety, construction site offices and canteen will also be regulated in line with the PNG Employment Act 1978. Complaints will be monitored and investigated and mitigation measures will be revised and the CEMP will be updated as necessary if unexpected impacts occur. All measures related to workers’ safety and health protection shall be free of charge to workers. The worker occupational health and safety plan to be submitted by the contractor before construction commences and in tandem can be extended to cover public safety and approved by PMU.

9. Community Health and Safety

160. Public safety, particularly of pedestrians and children can be threatened by works in public areas. The requirement for excavation of the trenches for side drain construction will be subject to detailed design. Fencing will be installed prior to excavation work commencing on all sides of temporary and permanent excavations.

161. The existing footpaths will be retained or reprovisioned and safety barriers will be installed at the edge of the pavement to discourage pedestrians and children from walking into the works areas. The plans will also include provisions for site security and guards, trench barriers and covers to other holes and any other safety measures as necessary.

162. The contractor will provide warning signs at the periphery of the site warning the public not to enter and define this in the CEMP. The contractor will restrict the speed of project vehicles gaining access to the sites and also control traffic on the access road by contra-flow and provide flag men and warning signs at either side/end of the works areas if existing traveling lanes need to be temporarily reduced to facilitate the works. The safety measures for the public in the HSP will include:
• Barriers (e.g. fence) and signboards shall be installed around the construction areas to deter pedestrian access to the site.
• Pedestrian footpath and barrier on the north side of Konedobu substation to deter pedestrian access to the works except at designated crossing points.
• The general public/local residents shall not be allowed in the sites which is a high-risk area, e.g., installation sites and areas where heavy equipment is in operation and all access points to the sites will have a watchman at the entrance to keep public out as far as is reasonably practicable.
• Provide warning signs at the periphery of the site and the substation yard warning the public not to enter, beware of heavy machinery and define this in the CEMP.
• Provisions for site security, trench barriers and covers to other holes and any other safety measures as necessary.
• Speed restrictions shall be imposed on Project vehicles and equipment traveling within 50m of sensitive receivers (e.g. residential etc.).
• Strict imposition of speed limits along access through residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located.
• Educate drivers on safe driving practices to minimize accidents and to prevent spill of load and other construction materials during transport.
• Communication to the public through local officials, radio and mass media and notice boards regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions.

163. The contractor will provide information boards near the work sites to inform and instruct the public on how to conduct themselves and to be aware of their surroundings if they must approach the works. The notice board will provide contact numbers. The Public Safety section of the HSP will include but not necessarily be limited to the following:

• Statement of contractor’s safety policy for workers and public.
• Legal requirements.
• Works safety issues and public safety issues.
• Training the workforce and informing the public on works safety issues.
• Establishment and monitoring of acceptable working practices to protect safety.
• Overlap with traffic and road safety (e.g. traffic flow/delay requirements).
• Discussion of the DSC/PMU inspection/monitoring role.
• Establishment of complaints management system for duration of the works
• Agreement on publicity/public consultation requirements.
• Reporting of accidents.
• Complaints management

10. **Sanitation and Disease Vectors**

164. Potential sanitation and impacts from disease will need to be controlled by maintaining hygienic conditions in the construction yard and other worker camps and the construction site, implementing the social and health programs for the Project. The contractor will ensure that:
Measures to prevent malaria shall be implemented (e.g., provision of insecticide treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.).

Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes.

Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.

Moveable lavatories shall be installed around the site and open defecation shall be prohibited and use of lavatories encouraged by cleaning lavatories daily and by keeping lavatory facilities clean at all times.

HIV/AIDS awareness and HIV/AIDS education and prevention program shall be implemented in line with social plans under the Poverty and Social Assessment.

11. Construction camps and canteen facilities

165. The contractor’s construction camp and maintenance yards will be located within the site boundary. This location is acceptable to all the residents who made comments at public consultations (August 2012) and they foresee opportunities for employment and setting up small businesses to supply food and sundries to workers. The location of the main contractor’s yard in will be near the dam (as shown previously on Figure 3.1).

166. Other worker overnight accommodation will be at local motels and hotels and not in construction camps to minimize the interface of workers with the local population.

167. Contractors will adopt good management practices to ensure that fuels and chemicals, raw sewage, wastewater effluent, and construction debris/scarified material is disposed of in line with the requirements of the environmental permit for solid and liquid waste management. Waste will be disposed of under controlled conditions to reduce the risk of contamination. The proposed measures include:

- Worker camp location and facilities located to be agreed with local community with facilities approved by DSC and PMU and camps managed to minimize impacts.
- Construction camp will not be used but accommodation will be used at local motels and hotels
- Potable water, clean water for showers, hygienic sanitation facilities/toilets with sufficient water supply, worker canteen/rest area and first aid facilities will be provided onsite. Separate toilets shall be provided for male and female workers.
- As many local workers as possible will be hired and trained.
- Adequate areas will be provided at the site to establish clean canteen/eating and cooking areas.
- Flushing lavatories shall be installed and open defecation shall be prohibited and use of lavatories encouraged by cleaning lavatories daily and by keeping lavatory facilities clean at all times.
- Wastewater effluent from contractors’ workshops and equipment washingyards will be passed through gravel/sand beds and all oil/grease contaminants will be removed before discharging it into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed WMP.
- Predictable wastewater effluent discharges from construction works shall have the necessary permits from DEC before the works commence.
• The contractor’s yard area will be cleaned up to the satisfaction of PMU and local community after use.
• All waste materials shall be removed and disposed to disposal sites approved by local authorities

12. River and Stream Protection

168. The streams and Laloki River supports casual fisheries by local residents for subsistence in the area downstream of the works. At this stage there is no expectation that the river beds will need to be modified or used for river sources of rock based construction materials.

169. There will not be any change in the abstraction and re-release of water and there should be no impact on the fisheries die to the works. However careless use and lack of control of construction materials can cause pollution and blockage to rivers. It is therefore prudent to put in place mitigation measures to protect the river during the works. Therefore in the work areas near the yard at Sirinumu the following will be carried out:
• The MMP will be established to minimize the impacts to the river beds and only approved extraction sites may be used.
• Works will be kept away from 5m away from river banks in all locations (except cone valve replacement).
• Accidentally dislodged boulders and stones will be promptly removed so that they do not block the river, resulting in adverse impact on the flow regime.
• In the cone valve replacement rocks and boulders may be removed in a controlled manner according to the MMP to create a safe working place.
• Waste materials will not be disposed of at rivers.
• River banks will be protected and if accidentally damaged they will be reinstated before the contractor leaves the site.

170. With these mitigation measures in place there will be no effect on subsistence fisheries in the area that will need to be protected during the works. The flow regime of the river appears to replenish silty materials from debris flows upstream. Careless use and lack of control of construction materials that can cause pollution and blockage to rivers will not be permitted. As the project does not propose any change in the water abstraction regime at the TOD site, there will not be long-term impacts.

13. Water Quality

171. In order to prevent water contamination the following precautionary measures will be undertaken by the contractors:
   i) Lubricants will be stored in dedicated enclosures with a sealed floor >20m from water bodies.
   ii) Solid waste from construction activities will not be thrown in rivers and shall be disposed of as per the WMP and there will be NO BURNING of waste.
   iii) Construction storage/stockpiles shall be provided with bunds to prevent silted run-off.
   iv) Stockpiled materials will be covered to reduce run-off.
   v) If complaints occur there will be monitor and investigation of water quality.
   vi) Work in rivers will be scheduled during dry season and work duration shall be as short as possible.
   vii) Bare slopes shall be stabilized immediately after works completed.
   viii) Stockpile areas and storage areas for hazardous substances shall be located >20m away from water bodies.
   ix) Washing of machinery and vehicles in surface waters shall be prohibited.
172. If complaints are received, the incidents and possible sources of water supply disruption will be investigated by the PMU (assisted by the DSC) and where the complaint can be substantiated; water samples will be taken and analyzed based on the baseline monitoring results.

173. In response to complaints to either the contractor or the local authorities the DSC and the PMU will be immediately informed so that water quality measurements will be taken 50m before (upstream) and 50m after (downstream) of the works giving rise to complaint in line with the methodology used in for baseline sampling.

174. Samples will be taken as soon after the complaint as possible and analyzed immediately and again two weeks after the complaint to determine if water quality has been restored. Impacts will be determined by reference to the baseline results from the preconstruction stage. The criteria will be based on the Environment (Water Quality Criteria) Regulations 2002.

14. **Erosion Control and Runoff**

175. Engineering controls for erosion protection measures will be required for the road upgrading works. The potential impacts on soil, or from erosion, during construction are from (i) sediment contamination of streams and rivers (including turbidity impacts); (ii) extraction of materials from streams or rivers and/or borrow pits; (iii) conversion of the existing land uses such as agriculture and grassland for stockpiles of materials; (iv) soil erosion and loss of protective vegetation in areas of slopes or uncompacted embankments; and (vi) soil contamination from fuel, chemicals and/or construction material spillage.

176. Earth embankments and material stockpiles will be susceptible to erosion, creating sediment laden run-off, particularly during rains and re-suspension of dust during the dry season.

177. Works in rivers and streams will be required to limit losses of sediment into the rivers through the use of silt fences, progressive re-planting and siting works area areas well back from river bank areas.

178. There will be little loss of soil of agricultural or productive value as the project does not cross any lands currently being used for gardens or plantations. The works will be largely confined to the existing road and immediate right-of-way. Excavation for materials or location of material stockpiles is not permitted on agricultural or potentially productive land (including land identified as garden land).

179. Potential impacts will be mitigated by:

- All required materials will be sourced in strict accordance with government guidelines, Project provisions including the extraction guidelines section of the MMP (in the updated CEMP);
- In the event that the contractor causes damage to agricultural land, productive land or gardens, the contractor is solely responsible for repairing the damage and/or paying compensation;
- Re-use of excavated material wherever possible;
- Material stock-piles, borrow pits and construction camps will only be located on unused land or non-agricultural land following consultation with NCDC, land owners and village chiefs. All land will be rehabilitated to its original or better condition upon completion of the project works;
- Embankments and in-stream/river activities will be monitored during construction for signs of erosion. Stones and rocks should be kept on hand for work in location of stream and river which can be used in the event that there is bank or channel erosion;
• Gabion baskets, rip-rap or bio-engineering methods will be used to both strengthen the road and to prevent erosion where the road passes through hilly areas. This will also need to be undertaken in consultation with villagers to ensure that accessibility to local resources is maintained;

• Re-vegetation of riverbanks with fast growing species, or other plants in consultation with the land owners and village chiefs, as quickly as possible after work in the slope areas has been completed;

• Random and uncontrolled tipping of spoil, or any material, will not be permitted. Suitable tip sites will be designated in consultation with land owners and village chiefs. Tip sites will not be permitted close to rivers, streams or other watercourses or on garden land or in areas used for livelihood production by villagers; and

• Acquisition of all necessary permits or approvals for location of material extraction sites and sources of construction materials as per the MMP and government agencies (such as NCDC and DEC) prior to any extraction of material.

180. It should be noted that a number of the mitigation measures (compacting, terracing, drainage and re-vegetation) will provide long-term environmental benefits by reducing soil erosion and sedimentation of surface waters while replacing damaged culverts and providing well constructed drainage will reduce localized flooding.

15. Spoil and Spoil Disposal

181. Soil and spoil will not arise from the TPD refurbishment but will be an issue associated with the road upgrading works. During the improvement activities it will be necessary to carry out excavation of some existing road pavement materials and for culverts and drainage undertake works in the vicinity of rivers/streams.

182. Spoil and stockpiled materials, if located within a floodplain, may be eroded and dispersed and patterns of water movements during ‘normal’ and flood flows affected. Movements of machinery and other activities can be expected to impact riverine fauna and flora, however because the rivers in the area are high-disturbance ecosystems, regularly subjected to flooding and channel shifts, impacts on these are likely to be minimal.

183. Potential impacts on the structure of river habitats, including their channels, banks and floodplains will be mitigated by:

• Material stock-piles will not be located within riverbeds or the islands in the centre of rivers. Similarly, they will not be located within the current area of floodplain in areas subject to regular flooding (i.e. once per year or more). All land will be rehabilitated to its original or better condition upon completion of the works;

• Scour protection will be used as temporary measures, as needed, to ensure temporary structures do not damage river configuration;

• Movements of vehicles and machinery, and hence disturbance, within the riverine habitats will be minimised at all times;

• In the event that the contractor causes damage to the river bank or other structural parts of a river, the contractor is solely responsible for repairing the damage and/or paying compensation;

• Embankments and in-stream/river activities will be monitored during construction for signs of erosion;

• Re-vegetation with local fast growing species, or other plants in consultation with the land owners and village chiefs, will be carried out incrementally and
as quickly as possible after work within any river habitat has been completed; and

- Spoils, rubbish or any material will not be disposed of within any river system including riverbed, banks or floodplain areas. Suitable tip sites will be designated in consultation with land owners and village chiefs.

16. Transport Management

184. The access road upgrading will cause temporary negative impacts through presence of vehicles and equipment, including inconvenience, minor disruptions to traffic using the road, and on local access to and from the villages along the subproject road during the construction period. Mitigation of impacts on access and traffic will include:

- The contractor, as part of the CEMP, will prepare, and submit to PCU, a traffic management plan detailing diversions and management measures;
- Signs and other appropriate safety features will be used to indicate construction works are being undertaken;
- Contract clause specifying that care must be taken during the construction period to ensure that disruptions to access and traffic are minimized and that access to villages along the subproject road is maintained at all times;
- NCDC and village officials will be consulted in the event that access to a village has to be disrupted for any time and temporary access arrangements made;
- Construction vehicles will use local access roads, or negotiate access with land owners, rather than drive across vegetation or agricultural land, to obtain access to material extraction sites. Where local roads are used, they will be reinstated to their original condition after the completion of work.
- The road will kept free of debris, spoil, and any other material at all times;
- Disposal sites and haul routes will be identified and coordinated with local officials; and
- Provision of adequate protection to the general public in the vicinity of the work site, including advance notice of commencement of works, installing safety barriers if required by villagers, and signage or marking of the work areas; and
- Provision of safe access across the works site to people whose villages and access are temporarily affected during road upgrading activities.

185. During TOD refurbishment works, activities are not likely to have a major affect on the roads around the area as almost all activities will take place within the site. However there will be a routine requirement to transport construction materials to the site although this should only amount to a few truck loads per week over several months. Therefore traffic flow in the surrounding areas is unlikely to be interrupted.

186. Temporary traffic management measures will be necessary for this subproject. The contractor will address the issues in a traffic management statement contained in the CEMP.

17. Concrete Supply

187. Construction and refurbishment will not require much concrete for foundations. This can be delivered by mixer lorry or smaller amounts can be carefully hand mixed on site without creating conditions unacceptable to the local population or significant impact on the residential sensitive receivers in the nearest villages.
18. Water Resources

188. Moderate amounts of water for washing and cleaning will be needed and ample water should be available from the water supply to the site. If the water quality measures described earlier are fully implemented, no impacts local water resources are expected.

19. Enhancements

189. Environmental enhancements such as tree planting will be explored in the detailed designs. Enhancements shall be re-assessed prior to construction and proposed enhancements should be discussed with the contractor.

E. Operational Phase

190. There will be no adverse operational impacts from the project. The subproject will install new equipment which will improve the performance of the grid. Matters of existing operations identified during the DDR will be incorporated into the EMP and undertaken as corrective actions. The road upgrading is supported by the communities in the area\(^\text{10}\) and will provide benefits in terms of improved access to social infrastructure (schools, health clinics and church), employment opportunities, and provide for enhanced communication.

\(^\text{10}\) During consultations improvements to the access road were actually requested by the communities to be part of the Project. These communities consider they have suffered for a long time from very poor access and the many promises made by the government to upgrade the road have not been kept.
6. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

191. Information disclosure and public consultation was conducted during August 2012 to inform stakeholders about project components and discuss the main environmental impacts expected from project implementation. The results of the public consultation are that there is general support. However some participants expressed opinions that some activities of the existing PPL have caused environmental damage or interference with smooth operation of traffic over the past years. Stakeholders suggested that they should be more involved in some environmental issues related to PPL development and operation.

192. The objectives of the stakeholder consultation process was to disseminate information on the Project for the Project and the expected impact, long-term as well as short-term, among primary and secondary stakeholders and to gather information on relevant issues so that the feedback received could be used to address these issues at early stages of project design. Another important objective was to determine the extent of the concerns amongst the community, to address these in the project implementation and to suggest appropriate mitigation measures. For the purposes of this IEE the main group interviewed was the community around the subproject in the NCDC area and the local officials in the administration. A formal consultation session was also held with Sirinumu land owners (Appendix B). The feedback received has been used to address these issues at early stages of project design.

A. Identification of Stakeholders

193. The stakeholders consulted for the Project included local affected persons and other groups with an interest in where the Project subprojects will be implemented. Individuals representing most of the family groups living in the wards where the Project subprojects will be implemented were informed about the Project for the Project and invited to comment on their environmental concerns in six areas round NCDC Sirinum land owners. These stakeholders were considered to be representative of the community living in the area the main beneficiaries, the road users, the business associated with the access road and the locally elected representatives. Consultations took place on several days in August 2012. The dates and locations of consultations are presented in Appendix B. Government departments were also consulted to identify any local or national requirements prior to commissioning the subprojects.

B. Consultations with Stakeholders

194. The summaries of results of the public consultations are recorded in Appendix B. Many local affected people near the access road were pleased to respond but one refused to comment and requested anonymity. There were no residents in the location of the Runs 1 and Sirinum but consultation has already been completed with the clan groups in the area. The main environmental and other concerns can be summarized as follows.

195. Interest in the survey. All the residents interviewed indicated they had some comments to make on the Project. None said the Project would affect their working and home lives.

196. Support for Project. Respondents were in favour of the project and indicated their support for the Project. Some remarked that the PPL should make other improvements associated with power supply such as better street lighting and traffic signals.

197. Overall environmental impact. When questioned on the overall environmental impact of the project none of the respondents had any specific ideas to share. Most
respondents identified potential benefits in terms of better power supply better life standard and quality of environment.

198. Most identified some dis-benefits in terms of temporary impacts, increases potential for accidents if near roads and some said that although some impacts would be inevitable the overall impacts would only be temporary disturbances. Compensation of owners was a concern to all. The impression given was that overall the impacts should be tolerable given the potential improvement of power supply.

199. **Controlling environmental impacts.** Concerning how to control the overall environmental impact of the project many respondents said that they were concerned about traffic jams and accidents if the works are near the roads. Most said the project was welcome and should be completed as soon as possible.

200. Increased dust, noise and controlling the interface with project workers and sanitation during construction were also general concerns. Another general concern was the water supply. Affected people were concerned about social issues such as security. Many commented on compensation for land acquisition and that payments should be completed.

201. No significant operational phase impacts were identified and the community near the subprojects generally indicated they would fully support the Project for the Project as and saw the Project as beneficial overall.

202. The affected persons also fully expect that the necessary arrangements to compensate loss of any property that may result from the installation of the Project subprojects are addressed before construction commences. Results from the consultation in NCD area served by the project are summarized broadly in Table 6.1. Further information from consultation with people from Roua is provided in Appendix B.

C. **Concerns Addressed**

203. The main issues raised are addressed in the environmental management plan, as far as is reasonably practicable at this stage. Concerns with respect to safety, keeping the works areas clean, have been passed to the PPL Team. Concerns with respect to temporary increased pollution, increases in traffic congestion, accidents, environmental awareness of the implementing agency and planning environmental controls have been addressed in the EMP.

204. The access road alignment is assumed to be as at present and drainage design and the disturbance to property and business, private property and community disturbance have been brought to the attention of the project proponent. The relevant parties are well aware of the potential for local disturbance that can result from poorly controlled contractors and mitigation measures are presented in the EMP to restrict accommodation to local hotels and motels.

<table>
<thead>
<tr>
<th>Concerns Expressed*</th>
<th>How concerns are addressed in IEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreement with to Project</td>
<td>Noted and summarised in the IEE</td>
</tr>
<tr>
<td>Removal of domesticated and garden plants</td>
<td>EMP provides for controls on tree and garden plant removal during implementation.</td>
</tr>
<tr>
<td>The project works and location will not affect us</td>
<td>Noted and summarised in the IEE</td>
</tr>
<tr>
<td>Project will contribute significantly to the city in terms of business and other development</td>
<td>Noted and summarised in the IEE</td>
</tr>
<tr>
<td>Need improved power supply in National Capital</td>
<td>Noted and summarised in the IEE</td>
</tr>
<tr>
<td>Concerns Expressed*</td>
<td>How concerns are addressed in IEE</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>District (NCD). Project is beneficial for Port Moresby communities</td>
<td></td>
</tr>
<tr>
<td>Removal of gardens or cultivated areas</td>
<td>EMP provides for controls on tree and garden plant removal during implementation.</td>
</tr>
<tr>
<td>Must have in place traffic jam control and mitigation measures</td>
<td>EMP provides for temporary traffic controls for areas roads affected by works during implementation.</td>
</tr>
<tr>
<td>Street lights needed for safety at nights</td>
<td>Noted and summarized in the IEE. EMP safety provisions provides for temporary safety lighting of works during implementation.</td>
</tr>
<tr>
<td>Compensate owners of domesticated plants / gardens</td>
<td>EMP provides for controls on tree and garden plant removal during implementation. PPL policy will provide for compensation as specified in the social work-stream.</td>
</tr>
<tr>
<td>PPL Make proper land lease/purchase arrangement with customary landowners.</td>
<td>EMP provides for controls on tree and garden plant removal during implementation. PPL policy will provide for compensation as specified in the social work-stream.</td>
</tr>
<tr>
<td>PMV Bus service will be affected</td>
<td>EMP provides for temporary traffic controls for areas roads affected by works during implementation.</td>
</tr>
<tr>
<td>Clearing of natural vegetation on customary land</td>
<td>EMP provides for controls on tree and garden plant removal during implementation.</td>
</tr>
<tr>
<td>Power poles in settlements need to be replaced and trees along TL need to be cleared</td>
<td>Subproject 3 will replace many damaged and dilapidated poles. EMP safety provisions provides for temporary safety arrangements and tree trimming during implementation.</td>
</tr>
<tr>
<td>Want increase capacity of power supply to city communities</td>
<td>Noted and summarized in the IEE. This is an objective of the Project.</td>
</tr>
<tr>
<td>Existing power poles are old or rotten, risky for people and needs replacement</td>
<td>Another component of the Project - SP3 - will replace many damaged and dilapidated poles. EMP safety provisions provides for temporary safety arrangements and tree trimming during implementation.</td>
</tr>
<tr>
<td>Consult domesticated plants’ owner before removal</td>
<td>EMP provides for controls on tree and garden plant removal during implementation.</td>
</tr>
<tr>
<td>Make early awareness of project to project site communities before construction</td>
<td>EMP provides for public information campaign as well as consultation.</td>
</tr>
<tr>
<td>Consult Eda Ranu and identify their water and sewerage pipelines or pump stations – Must not interrupt water and sewerage systems</td>
<td>EMP provides for early consultation with Eda Ranu to identify infrastructure affected by works during implementation.</td>
</tr>
<tr>
<td>Will project create jobs for local?</td>
<td>Noted and summarised in the IEE. Some limited local labour will be required as summarised in the social workstream.</td>
</tr>
<tr>
<td>Will PPL project pay compensation to customary landowners</td>
<td>PPL policy will provide for compensation as specified in the social workstream.</td>
</tr>
<tr>
<td>Alienation of customary land</td>
<td>PPL policy will provide for compensation as specified in the social workstream.</td>
</tr>
<tr>
<td>Restrict removal of plants to within TL and substation sites. Avoid unnecessary clearing</td>
<td>EMP provides for controls on noise and dust during implementation.</td>
</tr>
<tr>
<td>Our right to access to power as residents of NCD. But fee of electricity is so high. Government and PPL must reduce power charge rate so many people will use power</td>
<td>Noted and summarised in the IEE.</td>
</tr>
<tr>
<td>Local people might be rushing to get temporary jobs during construction period</td>
<td>Noted and summarised in the IEE. Some limited local labour will be required as summarised in the social workstream.</td>
</tr>
</tbody>
</table>

* based on door to door surveys in NCD districts served by Sirinumu

### D. Information Disclosure and Participation

205. The public and affected persons are generally in support of the project although some concerns have been expressed the local affected people are more concerned about
effects on their property and gardens. The PPL has disclosed the Project construction works in advance and it will be necessary also to disclose the complaints monitoring and GRM (Chapter 7) which will provide further opportunities for consultation and can assist in public participation. Providing information through local authority and ward offices will also provide a conduit for the improvement of the project implementation to better serve the stakeholders. Public consultation can also assist in:

i) harnessing cooperation from informed people to help local authorities reconfirm the extent of local permits and licenses that will be required at a later stage;
ii) obtaining cooperation from informed residents and groups which to avoid cost and time in dealing with complaints;
iii) identifying local infrastructure projects or other local initiatives that will interface with the Project areas with assistance from informed local authorities; and
iv) the collection of anecdotal information on the current condition of the local environment.

206. The environmental assessment process under the SPS requires the disclosure of the IEE in an accessible place and language to the public during the completion of the IEE, also in line with ADB’s Public Communications Policy 2011 which requires full disclosure of all project documents. This IEE will be updated at a later stage if necessary and PPL will provide summary of the IEE in local language (Tok Pisin) at public places i.e. for display at the district and ward headquarters and in PPL premises during the period when the IEE is disclosed on the ADB website.

207. The C&PP prepared for the Project will guide PPL and PMU in ongoing consultations.
7. GRIEVANCE REDRESS MECHANISM

208. A project grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the environmental and social performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

209. It is important that the safeguard cell to be established within the PMU is alert on environmental and social impacts during project preparation and implementation. It is therefore envisaged that an environmental safeguards will be implemented the PMU that will be supported by a DSC and include an IES and NES. The IES will provide training to NES and to existing PPL environment officer and other PPL staff as required to implement CEMP and other plans and start to build capacity within PPL (see also implementation arrangements in Chapter 8).

210. Existing informal arrangements for redress of land-related grievances for affected persons are through complaints to the Paramount Chief and/or clan leader. If the problem is not resolved at that level, the latter is taken up at Land Court for redress. Any other disputes are first taken to the clan leader and problems are resolved via Ward Councilor, and ward committees up to the sub-provincial level and then through the provincial DEC and back to the agency that implements a project (in this case IPBC/PPL). This indirect route will remain available in place to preserve the usual administrative remedies.

211. There will be a need to deal with complaints and grievances during construction for this project. Therefore another more direct mechanism will be available to affected persons whereby complaints can also be made direct to the PMU (with the usual parties PPL and DEC being kept informed). The informal arrangements to resolve complaints via the involvement of Paramount Chief / clan leader will also remain available during project implementation. The local leaders will be briefed by the staff of PMU adequately on this matter including reporting via PMU.

212. The GRM will be established in the preconstruction phase and well before construction commences. The PMU and PPL will maintain an open door policy to accept complaints at all levels concerning the environmental and social aspects of the project. The GRM will provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. The CEMP submitted by the contractor will clearly show how the GRM will be implemented.

213. PPL shall instruct the PMU to make the public aware of the GRM through public awareness campaigns and a project information brochure. The PMU will also raise the level of awareness of local leaders with regard to the GRM and different ways available for aggrieved parties to resolve their disputes. The contact phone number of the PMU will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside the PMU offices and at the construction sites and project sites at site entrances and at the entrance to the contractor's maintenance yard(s).

214. The project information brochure will include information on the GRM and shall be widely disseminated to the stakeholders in the areas surrounding the Project subproject areas by the safeguards officers in the PMU. Grievances can be submitted verbally to leaders, in writing or by phone with any member of the PMU or PPL, construction sites and other key public offices, all of which will maintain an open door policy to accept complaints.
1. **Preliminary Action.** It is customary for grievances to be brought to the Paramount Chief or other clan leaders and it is likely that this will remain as a preliminary step for grievances in many instances. This will be an important inclusion bearing in mind the traditional clan hierarchy in PNG. At this level, the leaders will try to resolve grievances reported to them informally and with the assistance of the PMU a record will be made for submission to the PMU.

2. First tier of GRM. The PMU is the first tier of GRM which offers the fastest and most accessible formal mechanism for resolution of grievances. The social and land officer and NES of the PMU shall be designated as the key officers for grievance redress. They may be approached direct or via the clan leader. Resolution of complaints will be within seven working (7) days.

3. The safeguards unit within the PMU will provide the support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, local police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:
   i. Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
   ii. Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);
   iii. Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

4. The updated register of grievances and complaints will be available to the public at the PMU office, construction sites and other key public offices around the project area (offices of the ward and sub-province authority). Should the grievance remain unresolved it will be escalated to the second tier. A grievance redress committee (GRC – see below) shall be established by PPL/PMU before commencement of site works, shall be chaired by Project Manager PMU and shall have members from ward committees and sub-province or municipal authority committees, relevant government departments, a local NGO, and a women's organization. The contractor(s) will have observer status on the committee.

5. **Second Tier of GRM.** The second tier of GRM will be activated by referral of the unresolved issue (with written documentation) to the Project Manager PMU who will pass unresolved complaints upward to the GRC. The GRC shall be established by PMU/PPL before commencement of site works. The GRC will consist of persons representing the following groups:
   (i) Project Manager (PPL/PMU);
   (ii) Community Development Manager Lands and Community Services (PPL/PMU)
   (iii) National Capital District Commission administration – Community Services (for subproject 1, 2, 3 & 4, if necessary)
   (iv) National Capital District Commission administration – Regulatory Services (for subproject 1, 2, 3 & 4, if necessary)
   (v) Central Province administration – (subprojects 5 and 6 if necessary)
   (vi) Central Province land administration - (subprojects 5 and 6 if necessary).
   (vii) Port Moresby Police
   (viii) Sub-province and Ward;
   (ix) Representative of the affected person(s); and representative of the local women's group / NGO (e.g. Marie Stopes, Soroptomist International).
6. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within thirty (30) working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant’s access to the judicial or administrative remedies.

7. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

8. The PMU will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

9. Third tier of GRM. In the event that a grievance cannot be resolved directly by the above means, the affected person can seek alternative redress through the Ward or Sub-provincial committees under the existing arrangements for redress of grievances for affected persons. The PMU or GRC will be kept informed by the district, municipal or national authority. The GRM procedure is depicted in Figure 7.1 below.

10. The monitoring reports of the EMP and resettlement plan (RP) implementation shall include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending).
Figure 7.1 - Grievance Redress Mechanism

- **First Level Grievance**
  - PMU / DSC
  - 7 days
  - Grievance redressed

- **Second Level Grievance**
  - Inform
  - PPL IPBC

- **Third Level Grievance**
  - GRC
  - 30 days
  - Grievance redressed

- **Higher Authority / Court of Law**
  - Legal ruling

Port Moresby Power Grid Development Project
Initial Environmental Examination

Figure 7.1 Grievance Redress Mechanism

GRC = Grievance Redress Committee, DSC = Design and Supervision Consultants, National Environmental Specialist in PMU. PMU = Project Management Unit, IPBC = Independent Public Business Corporation. PPL = PNG Power Limited.
8. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangements

11. The EMP and the reporting requirements (Figure 8.1) will generally be applied to all subprojects in the Project. In the interests of sound environmental management the EMP and mitigation measures are also generally applicable to many other aspects of PPL operations. However the scope of the subprojects in Project varies significantly in scale, complexity and subprojects are at different locations. Also the subprojects are all linked as part of the overall planning for improvements in PPL systems and operations. Therefore all mitigation measures will need to be applied as appropriate to each subproject. However for purposes of presentation of the environmental assessments the IEEs for the Project subprojects are assessed separately. The assessment presented in Chapter 5 and the matrix of environmental mitigation measures (Table 8.2) is specific to this subproject. However the responsibilities for environmental management apply generally to all subprojects. In principle the EMP and mitigation measures will also provide a way forward for PPL to provide more thorough environmental management in future.

1. DEC Approval Requirements

12. In PNG the environmental regulations are derived from the Environment Act and EPAR (as previously discussed in Section 2) and subsequent rules and regulations.

13. The subprojects are generally extensions of or improvements to existing facilities under section 43 of the Environment Act 2000 and the existing activities of PPL include some Level 2 and Level 3 activities under EPAR (Table 2.2). DEC will require notification of the scope of the subprojects to determine whether or not EPs will be required. In order that PPL can complete its obligations under the Environment Act in a timely manner, notification of the scope of the subprojects to DEC should take place as soon as practicable.

14. Some elements of the Project are extensions of, or improvements to, Level 2 or Level 3 activities and therefore the DEC must decide on what environmental permits (if any) are required. As a first step PPL has approached DEC to clarify the requirements for environmental permits for PPL existing facilities under the Environment Act and this situation is currently under review with DEC. Water abstraction and discharge of solid waste are Level 2 activities. The permits from DEC may be issued subject to such conditions the Director considers are necessary or desirable.

15. The Environment Act also requires that if it is proposed to carry out preparatory work, prior to the issue of the environmental permit for a Level 2 or Level 3 activity, the intention must be registered with DEC at least one month prior to commencing the preparatory work. The definition of preparatory work is limited but includes carrying out other studies relevant to environmental issues. It is an offence not to register preparatory work and fines can be levied for non-registration of preparatory work.

16. It is also required that an application for an environment permit shall be made by the body that is responsible for the proposed activities carried out at the site mentioned in the application. Where the applicant is a corporation, the natural person signing on behalf of the corporation must be a senior person with overall supervision and management of the activities conducted at the site mentioned in the application. Therefore clarification should be sought from DEC that PPL should be the applicant named for the environmental registration in due course.

17. During the PPTA it has not been possible during to clarify DEC requirements under the Environment Act, therefore as a minimum PPL will be required to disclose the scale and scope of the Project works in a timely manner.
18. DEC can then decide on the further procedures that need to be completed under the environmental laws so as not to delay unnecessarily the issue of EPs (if required) and implementation of the project. Therefore the PMU (assisted by the DSC) on behalf of PPL/IPBC will submit the notifications to disclose the full scale and scope of the subprojects in due course and include an application for the EP (if required) so that the necessary review and public disclosure of the EIS can take place. PMU (assisted by the DSC) can then complete the environmental assessment process to obtain approval and clearance certification and the EP can be issued in due course.

2. Existing Arrangements in PPL

19. PPL has one officer in charge of environmental matters. The EO has responsibility to bring environmental issues to the notice of senior management. The EO is involved in regular operational duties for PPL and the capacity to check environmental assessments prepared by consultants or the adequacy of the EMPs has been the subject of review as part of the recently implemented Country Safeguard Systems TA.

3. Arrangements Proposed for this Project

20. It is proposed that the PMU established for the Project will be supported by a DSC and include an IES and NES. The IES will provide training to EO and other PPL staff as required to monitor the implementation of the CEMP and other management plans. The IES will also provide training to the EO and other PPL staff as required to address environmental management issues in existing operations and to start to build capacity within PPL.

21. The DSC will be recruited to support the PPL and the PMU management during project implementation including supervision of the detailed designs and supervision of construction. The TOR for the DSC will include capacity building. The PMU will engage the contractors for construction. The contractors will have an environmental engineer delegated in their health and safety management division to cover the implementation of environmental mitigation measures.

22. Pollution standards for the protection of the environment are still in development. Therefore the World Bank criteria\(^{11}\) will be applied.

23. The PMU will be responsible for ensuring compliance with all the statutory environmental and SPS requirements for the Project. The PMU will be trained on the job by all safeguard specialists but for practical purposes the IES will have to lead the environmental workstream at the beginning. Due to the scale and scope of the environmental tasks to be completed it is recommended that the IES provides a 2-month input in years one and two to accompany the NES who should provide 4-months in year one and full-time (12 months) in year two, followed by 1-month and 0.5 month by IES and 5-months and 1 month by NES in year three and four. These inputs will allow sufficient resources to support environmental compliance, training for the PMU, induction and awareness training for the contractor and setting up the environmental monitoring mechanisms as well as other support to the PPL on environmental matters, as necessary. Table 8.1 presents the responsibilities of the various parties as identified during the environmental assessment of the Project that will apply to all aspects of the project implementation including the Project and the associated activities such as waste disposal and water abstraction.

### Table 8.1 - Responsibilities for EMP Implementation

<table>
<thead>
<tr>
<th>Agency</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Independent public Business Corporation (IPBC) | - Executing agency with oversight for project construction and operation  
- Ensure that sufficient funds are available to PPL properly to implement the EMP  
- For project duration ensure that the PPL commit and retain dedicated staff environment and safety managers to oversee EMP implementation.  
- Provide sufficient resources to PPL to support proper and timely staffing and monitoring and report of required mitigation measures in the EMP. |
| PNG Power Limited (PPL) | - Implementing agency with overall responsibility for project construction and operation  
- Ensure that sufficient funds are allocated to properly implement the EMP  
- Ensure that Project, regardless of financing source, complies with the provisions of the EMP and SPS  
- Ensure that Project implementation complies with Government environmental policies and regulations.  
- Ensure that the PPL provide and retain sufficient resources to support EMP related implementation issues.  
- For project duration ensure that the PMU commit and retain dedicated environment and safety staff.  
- Provide sufficient resources to PMU and segregate these amounts, specifically to support PMU for proper and timely staffing and monitoring and reporting of required mitigation measures in the EMP and CEMP. |
| Project Management Unit (PMU) | - Ensure that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs.  
- Obtain necessary environmental clearances certification under Environment Act from DEC as necessary prior to award of civil works contracts.  
- Ensure that Project implementation complies with SPS principles and requirements.  
- For project duration, commit and retain dedicated staff within the PMU to oversee EMP implementation (assisted by DSC)  
- Confirm that bidding contract documents include the IEE and EMP.  
- Check that necessary environmental clearances and approval(s) are obtained from DEC prior to award of civil works contracts  
- Establish and implement an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples’ concerns, complaints, and grievances about the Project environmental performance.  
- Ensure contractor’s bidding and contract documents include the IEE and updated EMP.  
- Include the IEE for Project subprojects and EMP and specify in the employers requirements of the contract for preparation and implementation of method statement and Contractor’s site-specific EMP (CEMP) as described in the IEE/EMP and that the CEMP includes all mitigation measure specified in the updated EMP.  
- Prior to Contract being signed seek clarification from the Contractor on the Contractors proposed detailed design and method statements are as proposed in the tender submitted.  
- Ensure that the Contractor has provided sufficient funding and human resources for proper and timely implementation of required mitigation measures in the CEMP and that these sums are segregated in the contract documents.  
- Ensure that updated EMP provisions are strictly implemented during various project phases (design/pre-construction, construction and operation) to mitigate environmental impacts to acceptable levels.  
- Check that environmental protection and mitigation measures in the updated EMP and CEMP are incorporated in the detailed designs and carried out by the Contractor.  
- Participate in an environmental grievance redress mechanism, as described in the IEE and updated in the IEE, to receive and facilitate resolution of affected peoples’ concerns, complaints, and grievances about the Project's environmental performance  
- Undertake monitoring of the implementation of the EMP (mitigation and monitoring measures) with assistance from DSC.  
- Report to ADB on all aspects of environmental management and monitoring at six month intervals, based on the results of EMP monitoring.  
- Submit monthly progress reports implementation to IPBC / PPL and ADB as necessary.  
- Prepare and submit summary semi-annual monitoring reports on EMP implementation to ADB with support from DSC.  
- Based on the results of EMP monitoring, identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB. |
<table>
<thead>
<tr>
<th>Agency</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Design and Supervision Consultant (DSC) | • Engage at IES to ensure proper implementation of EMP provisions. Through IES the DSC shall: (i) ensure proper and timely implementation of DSC’s tasks specified in the EMP, (ii) conduct environmental training for PPL and PMU as specified in the IEE & EMP, (iii) conduct Contractor workers’ orientation, awareness training and induction on EMP provisions, (iv) undertake regular monitoring of the Contractor’s environmental performance, as scheduled in the EMP (v) conduct field measurements for sediment, water quality, dust and noise as required in the updated EIA and EMP, and (vi) assist PMU to prepare environmental baseline report and environmental semi-annual environmental monitoring reports, as specified in the EMP, for submission to ADB.  
• Prior to Contractor’s contract being signed assist PMU to seek clarification from the Contractor on the Contractors proposed detailed design and method statements in the tender submitted.  
• Update the IEE and EMP and the Contractors proposed detailed design and method statements.  
• During the pre-construction phase when the Contractor produces detailed designs ensure that the detailed designs of the Contractor incorporate all the environmental protection and mitigation measures identified in the updated EMP.  
• Assist PMU/PMU to ensure that all environmental requirements and mitigation measures from the IEE, updated EIA and EMP are incorporated in the contract documents.  
• During detailed design phase, prepare draft method statement/CEMPs including WMP, MMP, ERCP, NDCP, DMP, TMP and HSP.  
• Prior to construction, review and approve in writing the updated CEMP/method statements prepared in consultation with Contractor as per Employers Requirements.  
• Implement all mitigation and monitoring measures for various project phases specified as DSC’s tasks in the EMP.  
• Work within PMU to execute any additional environmental assessment prior to project construction as required in the EMP (e.g., preparation of new or supplementary environmental assessment, inception report and environmental impact statement, to support environmental permit) and include any changes to the Project and proposals that will result to adverse environmental impacts that are not within the scope of the in this IEE prepared during loan processing or subsequently, etc.).  
• On behalf of PMU prepare and submit any submissions required by DEC under the Environmental Act 2000 and obtain environmental clearance (EP) prior to project construction as required in the EMP (Also preparation of new or supplementary environmental assessment in case of change in project proposals that will result to adverse environmental impacts that are not within the scope of the IEE prepared during loan processing or subsequently, etc.)  
• Assist PMU in obtaining environmental approvals and permits from DEC prior to award of civil works contracts.  
• Assist PMU in obtaining approvals for preparatory works from DEC if required prior to award of civil works contracts  
• Assist PMU to ensure that the contractor has provided sufficient funding and human resources for proper and timely implementation of required mitigation measures in the CEMP and that these sums are segregated in the contract documents.  
• Undertake environmental management capacity building activities for PPL, PMU and PMU and awareness training and induction for Contractor’s staff as described in the IEE and EMP  
• Monitor compliance with CEMP and other plans.  
• Establish monitoring and reporting/recording systems within PMU.  
• Provide inputs to Quarterly Progress Reports (QPR) to IPBC and ADB |
| Contractor | • Recruit qualified environmental and safety agents (environmental specialists and / or environmental engineers (ESA) to ensure compliance with environmental statutory and contractual obligations and preparation and thorough implementation of the CEMP.  
• Prior construction, update EMP and compile draft CEMP based on method statements to include WMP, MMP, ERCP, NDCP, DMP, TMP and HSP for approval by DSC.  
• Implement WMP, MMP, ERCP, NDCP, DMP, TMP and HSP and other management plans in cooperation with PMU and in close coordination with other relevant authorities.  
• Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and CEMP and segregate these sums |

55
<table>
<thead>
<tr>
<th>Agency</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Agency | sums in the contract documents  
• Implement additional environmental mitigation measures for unexpected impacts, as necessary and as required by the PMU/DSC.  
• Monitor environmental effect as required by DEC environmental permit and ADB approved updated EIA and EMP. |
| PPL as operator | • Responsible for operation and maintenance of subproject.  
• Implement any additional monitoring if required in updated IEE and EMP for operations.  
• Provide additional resources to PMU if agreed with IPBC to support EO and PMU for proper and timely implementation of operational monitoring if required and mitigation measures in the EMP. |
| Department of Environment and Conservation | • Determine notice to proceed/EP requirements for each subproject.  
• Review and approve environmental assessment reports required by the Government.  
• Undertake monitoring of the project’s environmental performance based on the DEC mandate and environmental assessment. |

24. To facilitate EMP implementation, during construction the contractors must be prepared during the detailed design / pre-contract and pre-construction phase to cooperate with PMU, PMU, DSC and the local population in the mitigation of impacts. However, experience suggests that contractors may have little impetus or interest in dealing with environmental problems in the absence of performance-related criteria. Therefore, as mentioned in Chapter 5 of this IEE, the contractor will be required (under employer’s requirements of the contract and with the assistance of the DSC) to compile a CEMP based on their method statements and the updated IEE and EMP prepared by the DSC during the detailed design phase. Clearances for payments will include certification from the DSC as to the effective implementation of the CEMP and all other mitigation measures specified in the IEE and updated EMP. The completion of implementation of mitigation measures will therefore be linked to payment milestones.

B. Environmental Mitigation

25. The anticipated environmental impacts and mitigation measures for the Project subproject discussed in the previous section is presented in Table 8.2. The table also shows responsibilities and timeframe/schedule for implementation of mitigation measures and monitoring.

26. Table 8.2 shows that most mitigation activities during pre-construction are to be implemented by the DSC while during construction, measures shall be primarily implemented by the Contractor. No operational monitoring is required for this subproject based on the IEE but in the event that the scope of the subproject changes PPL shall during the operation stage, undertake any environmental mitigation and monitoring requirements that are specified later by DEC. To ensure implementation of mitigation measures during construction, the IEE and EMP will be included in the tender and contract documents for civil works. Contractors’ conformity with environmental contract procedures and specifications shall be regularly monitored by PMU with assistance from DSC and results shall be reported to ADB through the Quarterly Progress Reports (QPR).
<table>
<thead>
<tr>
<th>Environmental Concern</th>
<th>Objective</th>
<th>Impact mitigation</th>
<th>Performance and impact monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Design update and project disclosure</td>
<td>Incorporate detailed design measures in the project design to minimize environmental impacts. Compliance with PNG statutory environmental assessment process. Establishment of Grievance Redress Mechanism (GRM)</td>
<td>1. Secure the services of the Design and Supervision Consultant (DSC) to update designs to address design requirements. 2. Update IEE and EMP based on detailed designs for Project subproject &amp; submit to ADB for review and approval. 3. Ensure updated EMP is included in and contract documents. 4. Notify Project to DEC and identify and obtain environmental permits / certificates under statutory environmental assessment process. 5. Implement plan for Grievance Redress Mechanism as described in the IEE and inform local authorities. 6. Based on the Project EMP (included in the IEE), prepare the following draft method statements/site-specific EMPs (CEMPs) for updating by the contractor before construction commences; such CEMP shall not be in conflict with any provisions of the EMP: (i) Waste Management Plan, (ii) Materials Management Plan, (iii) Drainage Management Plan, (iv) Noise and Dust Control Plan, and (v) Workers and Public Safety Plan. These CEMP will demonstrate the manner (location, responsibilities, schedule/ timeframe, budget, etc.) in which the contractor will implement the mitigation measures specified in the Project EMP, and other measures identified during detailed design. Further details that should be included in the above CEMP are provided in the subsequent sections of this table and in Chapter 5 of the IEE. 7. Incorporate/undertake the following measures in the project design: i. Land acquisition, resettlement and environmental impacts will be avoided or</td>
<td>1 to 5: PMU 6 (i to vii): Design and Supervision Consultant (DSC)/PMU 1 to 3: Immediate. Start of preconstruction &amp; detailed design. 4: Before start of civil works 5 &amp; 6 (i to vii): preconstruction &amp; detailed design phase</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>minimized by basing the detailed designs within the Project area as proposed in the concept designs. Continue to implement RP and provide all compensation and entitlements prior to displacement. ii. Arrangements will be made to facilitate the timely supply of cement materials for construction and to minimize impacts due to unnecessary stockpiling outside the to Project subproject areas. iii. Extensions and improvements of drainage culverts with interface to Project subprojects and drainage to the adjacent surrounding land will be designed to account for increased rain due to a once in 100 year return storm event. iv. Hydrological and drainage impacts during construction will be minimized by including in the Drainage Management Plan the early phasing of replacement of side drains, culverts and other infrastructure. v. Aim to provide enhancements under ADB policy on environmentally responsible procurement and avoid negative impacts due to unnecessary removal of trees. vi. Waste materials will be disposed of at Baruni dump to avoid fly-tipping and approved by the DSC and by PMU and the local community before contracts are signed.</td>
<td>1: PMU/ESO 2&amp;3: DSC</td>
</tr>
</tbody>
</table>

2. Environmental capacity development

Develop environmental management capacity of PMU to ensure proper EMP implementation and promote environmental awareness among PMU to commit and retain dedicated staff (ESO) for project duration to oversee EMP implementation. DSC to train PMU/ESO to build their capacity on EMP implementation, monitoring and reporting using workshops and on-the-job training techniques and case studies. Conduct Contractor / workers’ orientation on EMP provisions. Such orientation is expected to be carried out during detailed design phase and continue throughout project construction. |

<p>| 1 | PMU/ESO 2&amp;3: DSC | Initiate during detailed design phase and continue throughout project construction | Cost included in PMU and DSC cost | Require in DSC contract. Check at Preconstruction. Complete training and check before and | Prior to start of site works and throughout construction phase. | PMU/PMU | Cost met by PMU/PMU project staffing |</p>
<table>
<thead>
<tr>
<th>Environmental Concern</th>
<th>Objective</th>
<th>Impact mitigation</th>
<th>Performance and Impact monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractors and workers.</td>
<td>orientation shall be periodically conducted by the DSC as every new contractor is engaged.</td>
<td>DSC updated by contractor in preconstruction.</td>
<td>DSC contract. Check at Preconstruction. Complete check of items 1 to 5</td>
</tr>
<tr>
<td><strong>3a. Plan Waste Disposal</strong></td>
<td>Comply with legal requirements for EP and minimize waste; avoid fly-tipping and pollution from liquid waste.</td>
<td>Detailed design phase (before bidding).</td>
<td>Once, detailed design phase</td>
</tr>
<tr>
<td>1. Re-use of waste materials &amp; spoil disposal locations included in contract documents.</td>
<td>Cost included in DSC fees.</td>
<td>PMU/PMU</td>
<td></td>
</tr>
<tr>
<td>2. Prepare a draft WASTE MANAGEMENT PLAN (to be updated by contractor later). The plan shall cover handling, storage, treatment, transport and disposal of solid and liquid wastes, hazardous materials, and sand for reuse.</td>
<td>Cost met by PMU/PMU project staffing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 3. The General Waste section of the draft WASTE MANAGEMENT PLAN will include consideration of all matters related to solid an liquid waste disposal including the following: | | |}
| i) Expected types of waste and quantities of waste arising. | | |}
| ii) Waste reduction, reuse and recycling methods to be employed | | |}
| iii) Agreed reuse and recycling options and locations for disposal / endorsement from DEC and local groups. | | |}
| iv) Methods for treatment and disposal of all solid and liquid wastes. | | |}
| v) Methods of transportation to minimize interference with normal traffic. | | |}
| vi) Establishment of regular disposal schedule and constraints for hazardous waste. | | |}
| vii) Program for disposal of general waste / chain of custody for hazardous waste. | | |}
| viii) Discussion of the PMU/DSC inspection/monitoring role. | | |}
| ix) Establishment of complaints management system for duration of the works | | |}
| x) Agreement on publicity/public consultation requirements (advance signing etc.). | | |}
| 4. The draft Waste Management Plan shall include a section on Hazardous | | |}
<p>| | | |
| | | |</p>
<table>
<thead>
<tr>
<th>Environmental Concern</th>
<th>Objective</th>
<th>Impact mitigation</th>
<th>Performance and Impact monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td>Materials and Waste section. This will detail the mitigation measures, organizational arrangements, resources, facilities, etc. to avoid environmental as well as health and safety impacts due to use and disposal of hazardous materials/substances.</td>
<td>DSC (updated by contractor in preconstruction).</td>
<td>Detailed design phase (before bidding)</td>
<td>Cost included in DSC fees.</td>
</tr>
<tr>
<td>3b. Plan construction materials management</td>
<td>Avoid interruptions to supply of materials and plan stockpiling of rock based materials and avoid runoff.</td>
<td>1. Designs to minimize excavation where possible. 2. Prepare a draft MATERIALS MANAGEMENT PLAN (to be updated by contractor later). The plan shall detail the arrangements to be made to facilitate the timely production and supply of construction materials to avoid impacts due to unnecessary stockpiling outside the Project site. As a minimum, the plan shall consider the following: (i) Required materials, identify potential sources and estimated quantities available, supply chain, competitors. (ii) Impacts to identified sources and availability, (iii) Constraints of regular delivery schedule to reduce stockpiling on site. (iv) Discussion of the PMU/DSC inspection/monitoring role.</td>
<td>DSC (updated by contractor in preconstruction).</td>
</tr>
<tr>
<td>3c. Noise and dust management</td>
<td>Minimize noise and dust</td>
<td>1. Reconfirm noise and dust sensitive receivers likely to be affected by construction works. 2. Contact local residents for awareness of works. 3. Prepare a draft NOISE and DUST CONTROL PLAN (to be updated later by contractor) to minimize impacts to sensitive receptors (residential areas,) due to construction works and other project-related activities.</td>
<td>DSC (updated by contractor in preconstruction).</td>
</tr>
<tr>
<td>3d Drainage and Hydrological Impacts, (Control of Flooding)</td>
<td>To minimize hydrological impacts flooding and runoff from area surrounding Project and work areas associated with project.</td>
<td>1. Designs for drainage and culverts sufficient to control flooding with appropriate drainage structures to cater for worst case flow and rainfall from 100 year return storm. 2. Prepare draft DRAINAGE MANAGEMENT PLAN (to be updated by contractor later). The plan shall detail</td>
<td>DSC</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td>3e. Workers and public safety</td>
<td>Avoid accidents due to construction works</td>
<td>Prepare a draft WORKERS and PUBLIC SAFETY PLAN (to be updated later by contractor) to identify interfaces between the works and the public, formulate measures to ensure safety of workers and the public, and prevent accidents due to the construction works.</td>
<td>DSC (updated by contractor in preconstruction.)</td>
</tr>
<tr>
<td>4. Environmentally responsible procurement</td>
<td>EMP provisions are properly implemented by selected contractor.</td>
<td>1. EMP is included in bidding and contract documents to ensure that mitigation measures are budgeted and to prepare the contractor for environmental responsibilities. 2. Specify in bid document that Contractor shall engage capable and trained staff or site agent(s) to take responsibility for the environmental management and safety issues at the working level and to monitor the effectiveness and review mitigation measures as the project proceeds. 3. Contractors (assisted by DSC) submit updated specific environmental management plans or CEMPs for approval by DSC (i.e., materials, management plans such as drainage, materials, waste traffic, noise and dust management plans, etc.). 4. Contractors recruit qualified and experienced staff to oversee implementation of environmental and safety measures specified in the EMP.</td>
<td>1 &amp; 2: DSC for PMUs 3: Preparation of CEMPs – Contractor, Approval of CEMPs-DSC 4: Contractor</td>
</tr>
<tr>
<td>5. Grievance Redress Mechanism procurement</td>
<td>Receive / facilitate resolution of affected persons concerns and grievances about environmental performance of the subproject.</td>
<td>Establishment and implementation of GRM confirmed by PPL/PMU.</td>
<td>PPL/PMU</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Activate management plans and obtain permits / licenses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoid impacts from unplanned activities.</td>
<td>1. Update and activate management plans/CEMPs for waste disposal, materials management, drainage, traffic, noise and dust control and workers and public safety. The CEMPs shall not be in conflict with any provisions of the EMP. 2. Contractor(s) and their suppliers comply with all statutory requirements for permits from DEC and codes of practice with regard to use of mechanical equipment, establishment and operation of construction plant and water abstraction etc.</td>
<td>1: Contractor to prepare updated CEMPs, DSC to assist and approve 2: Contractor</td>
<td>1. One month before start of site works 2. Before start of site works.</td>
</tr>
<tr>
<td>2. Orientation for Contractor, Workers on environmental and social management.</td>
<td>Contractor &amp; workers trained to implement mitigation measures and better implementation of EMP.</td>
<td>1: Contractor 2: DSC 3: Contractor</td>
<td>1: Before start of site works 2: Within one week of start of site works 3: Upon deployment of workers to project site</td>
</tr>
<tr>
<td>3. General Construction Waste Disposal</td>
<td>Reduce, reuse and recycle waste and contamination due to poor waste disposal practices.</td>
<td>1: Contractor to update WMP, DSC to assist and approve 2 to 10: Contractor</td>
<td>1: One month before start of site works 2 to 10: Throughout construction phase</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Mitigation Measures</th>
<th>Responsible to Implement</th>
<th>Timing to Implement</th>
<th>Cost</th>
<th>Parameter to monitor</th>
<th>Frequency &amp; Verification</th>
<th>Responsible to Monitor</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter to monitor</th>
<th>Frequency &amp; Verification</th>
<th>Responsible to Monitor</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Parameter to monitor</th>
<th>Frequency &amp; Verification</th>
<th>Responsible to Monitor</th>
<th>Monitoring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring Cost</th>
<th>DSC &amp; PMU/PMU Project staffing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring Cost</th>
<th>DSC &amp; PMU/PMU Project staffing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

62
<table>
<thead>
<tr>
<th>Environmental Concern</th>
<th>Objective</th>
<th>Impact mitigation</th>
<th>Performance and Impact monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>monitored, catalogued, and marked.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Segregation of wastes shall be observed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Recyclables shall be recovered and sold to recyclers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Residual and hazardous wastes shall be disposed of in PPL temporary stockpile at Hohola maintenance depot.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Burning of construction and domestic wastes shall be prohibited.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Disposal of solid wastes into drainage ditches and public areas shall be prohibited.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. There will be no site-specific landfills established by the contractors. All general solid waste will be collected and removed from the work areas and disposed in Baruni waste disposal site.</td>
<td></td>
</tr>
<tr>
<td>4. Use of hazardous substances and hazardous waste disposal</td>
<td>Minimize contamination due to use and storage of hazardous substances</td>
<td>1. Update Hazardous Waste section of WASTE MANAGEMENT and PLAN prepared by the DEC, one month before construction. Updated plan to be approved in writing by DSC one month prior to starting works. Contractor to implement WMP provisions.</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Hydrocarbon, toxic material and explosives will be stored in adequately protected sites consistent with DEC code of practice to prevent soil and water contamination.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Equipment commissioning will be confined to areas in substation sites designed to contain spilled lubricants and fuels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with DEC code of practice.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Ensure all storage containers are in good condition with proper labeling.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Regularly check containers for leakage and undertake necessary repair or replacement.</td>
<td></td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>7. Discharge of oil contaminated water shall be prohibited.</td>
<td>Minimize impacts from materials extraction, transPPLation and storage.</td>
<td>1. Update draft MATERIALS MANAGEMENT PLAN or MMP (which will also include a mass haul chart) prepared by DSC during detailed design phase. Updated plan to be approved in writing by DSC one month prior to starting works. Contractor to agree &amp; implement MMP provisions.</td>
<td>Contractor to update MMP, DSC to approve 2 to 15: Contractor</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>must be arranged for rivers currently used by communities for water supply; 8. Sources from rivers and borrow pits to be identified during detailed design; 9. Preparation and implementation of extraction plan (with limits to volumes extracted from any one source) in accordance with guidelines; 10. Extraction from rivers will be identified by consultation with MID, Chiefs and communities; 11. Approved machinery only to be used (dredges not permitted) 12. Materials not extracted from river bends or other sensitive areas 13. Permits obtained from DEC 14. All extraction sites to be rehabilitated after use 15. Topsoil is preserved and replaced during rehabilitation</td>
<td>1: Contractor to update NDCP, DSC to approve 2 to 6: Contractor</td>
</tr>
</tbody>
</table>

6. Noise and dust nuisances

To minimize noise and air impacts effectively and avoid complaints due to noise and airborne dust.

1. Before construction starts, update the draft NOISE and DUST CONTROL PLAN (NDCP) prepared by the DSC. Include requirements for controlling noise and dusty materials at source. Updated plan to be approved in writing by DSC one month prior to starting works. Contractor to implement NDCP provisions.
2. Restrict works to daylight hours.
3. Construction equipment and vehicles will be maintained to a good standard and shall be provided with muffler silencers. Machinery causing excessive pollution will be banned from substation site.
4. Monitor and investigate complaints; propose alternative mitigation measures.
5. Machinery shall be turned off when not in use.
6. Impose speed limits on construction vehicles to minimize dust emission along roads providing site access where sensitive receptors are located (houses, schools, etc.).
<table>
<thead>
<tr>
<th>Environmental Concern</th>
<th>Objective</th>
<th>Impact mitigation</th>
<th>Performance and Impact monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7. Drainage Impacts</strong></td>
<td>To minimize hydrological impacts flooding and runoff of river banks.</td>
<td><strong>Proposed Mitigation Measures</strong>&lt;br&gt;1. Review detailed designs drainage and side-drainage structures, assess and agree with PMU/DSC if redesign is required or if new structures would be constructed or existing ones would be repaired.&lt;br&gt;2. Before start of site works, update draft DRAINAGE MANAGEMENT PLAN (DMP) prepared by DSC during detailed design phase. Updated plan to be approved in writing by DSC one month prior to starting works. Contractor to implement provisions of DMP.&lt;br&gt;3. Implement agreed designs for drainage ditches sufficient to control flooding as designed and to dissipate energy of flow to reduce runoff.&lt;br&gt;4. Divert lead-in streams that may run into Project site and prevent becoming silted by construction runoff, workshops or equipment washing-yards.&lt;br&gt;5. Make necessary alterations in the project area’s surface drainage patterns to prevent flooding and as much as possible:&lt;br&gt;6. Drains to be constructed so that the outfalls of the surface run-off from the Project site are diverted away from the SRs.&lt;br&gt;7. Ensure that adjacent drains and drainage systems are periodically cleared to maintain storm water flow during construction.</td>
<td><strong>Responsible to Implement</strong>&lt;br&gt;1: Contractor&lt;br&gt;2: Contractor to update DMP, DSC to assist and approve.&lt;br&gt;3 to 7: Contractor&lt;br&gt;<strong>Timing to Implement</strong>&lt;br&gt;1 &amp; 2: One month before start of site works&lt;br&gt;3 to 7: Throughout construction phase&lt;br&gt;<strong>Cost</strong>&lt;br&gt;Cost included in design&lt;br&gt;<strong>Parameter to monitor</strong>&lt;br&gt;Check implementation of items 1-7 and DMP provisions&lt;br&gt;<strong>Frequency &amp; Verification</strong>&lt;br&gt;1 &amp; 2: Before start of site works&lt;br&gt;3 to 7: Monthly&lt;br&gt;<strong>Responsible to Monitor</strong>&lt;br&gt;DSC, PMU/ESO&lt;br&gt;<strong>Monitoring Cost</strong>&lt;br&gt;Check implementation of WPSP provisions: Monthly&lt;br&gt;<strong>Cost met by</strong>&lt;br&gt;DSC, PMU/ESO project staffing</td>
</tr>
<tr>
<td><strong>8. Safety Precautions for the Workers</strong></td>
<td>Ensure worker safety.</td>
<td><strong>Proposed Mitigation Measures</strong>&lt;br&gt;1. Contractor to update draft WORKER AND PUBLIC SAFETY PLAN (WPSP) prepared by DSC and instructs workers in health and safety matters. Updated plan to be approved in writing by DSC one month prior to starting works. Contractor to implement WPSP provisions.&lt;br&gt;2. Establish safety measures as required by law and by good engineering practice and provide first aid facilities that are readily accessible by workers.</td>
<td><strong>Responsible to Implement</strong>&lt;br&gt;1: Contractor&lt;br&gt;2: Contractor to update WPSP, DSC to assist and approve.&lt;br&gt;2 to 10: Contractor&lt;br&gt;<strong>Timing to Implement</strong>&lt;br&gt;1: One month before start of site works&lt;br&gt;2 to 10: Throughout construction phase&lt;br&gt;<strong>Cost</strong>&lt;br&gt;Cost included in contracts&lt;br&gt;<strong>Parameter to monitor</strong>&lt;br&gt;Check implementation of items 1-10 and WPSP provisions&lt;br&gt;<strong>Frequency &amp; Verification</strong>&lt;br&gt;Check compliance to Papua New Guinea Employ-&lt;br&gt;1: Before construction &amp; 10: Monthly&lt;br&gt;Implementaton of WPSP provisions: Monthly&lt;br&gt;<strong>Responsible to Monitor</strong>&lt;br&gt;DSC, PMU/PMU&lt;br&gt;<strong>Monitoring Cost</strong>&lt;br&gt;Cost met by DSC and PMU/PMU project staffing</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Scheduling of regular (e.g., weekly tool box talks) to orient the workers on health and safety issues related to their activities as well as on proper use of PPE.</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Fencing on all excavation, and sides of temporary excavation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear plugs, gloves, etc. at no cost to the employee.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Workers shall be provided with reliable supply of potable water.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Ensure reversing signals are installed on all construction vehicles.</td>
<td></td>
</tr>
<tr>
<td>9. Community and Public safety</td>
<td>Prevent accident with public in local community</td>
<td>1. Include in WPSP for barriers (e.g., temporary fence), shall be installed at construction areas to deter pedestrian access to the substation works except at designated crossing points.</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation and such sites have a watchman to keep public out.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Speed restrictions shall be imposed on Project vehicles and equipment when traveling within 50m of sensitive receptors (e.g. residential, schools, temples, etc.).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Upon completion of construction works outside the substation, borrow areas will be backfilled or fenced.</td>
<td></td>
</tr>
<tr>
<td>10. Sanitation and Diseases</td>
<td>Control of infectious diseases.</td>
<td>1. Standing water will not be allowed to accumulate in the temporary drainage facilities or around the substation to prevent proliferation of mosquitoes.</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. HIV/AIDS awareness program shall</td>
<td></td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>11. Operation of contractor camps</td>
<td>Worker facilities not to cause nuisance or exploit forest of wildlife resources.</td>
<td>1. Contractor yard facilities located within PPL property 2. Construction camps will be established in areas with adequate natural drainage channels in order to facilitate flow of the treated effluents. 3. Hire and train as many local workers as possible. 4. Provide adequate accommodation for all workers at the local motels and hotels and establish clean canteen/eating and cooking areas on site. 5. Portable lavatories (or at least pit latrines in remote areas) shall be installed and open defecation shall be prohibited and prevented by cleaning lavatories daily and by keeping lavatory facilities clean at all times. 6. Provide separate hygienic sanitation facilities/toilets with sufficient water supply for male and female workers. 7. Wastewater effluents from contractors’ workshops and equipment washing-yards will be passed through gravel/sand beds and all oil/grease contaminants will be removed and not discharging into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed Waste Management Plan and consistent with national and local regulations. 8. Predictable wastewater effluent discharges from construction works shall have the necessary permits from DEC before the works commence. 9. As much as possible, food shall be provided from farms nearby and bush meat supplies will be banned to discourage poaching. 10 Ban use of guns and hunting equipment by workers and dismiss workers taking or using green timber or hunting or in possession of wildlife.</td>
<td>Contractors</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11. Contractor site will be cleaned up to the satisfaction of and local community after use.</td>
<td>Contractors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. Solid and liquid waste will be managed in line with Waste Management Plan.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13. All waste materials shall be removed and disposed to disposal sites approved by local authorities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>14. Land used for contractor sites shall be restored to the original condition as far as practicable and the area shall be cleaned.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. Stream &amp; river protection</td>
<td>Protect rivers and maintain river flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Rocks and stones will be disposed not to block rivers and streams.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No rock based construction materials will be obtained from the rivers and guidelines under the MMP will be established to minimize the impacts to the river beds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Works will be kept away from 5m away from river banks in all locations (except cone valve replacement).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Accidentally dislodged boulders and stones will be promptly removed so that they do not block the river, resulting in adverse impact on the flow regime.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. In the cone valve replacement rocks and boulders may be removed in a controlled manner according to the MMP to create a safe working place.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Waste materials will not be disposed of at rivers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. River banks will be protected and if accidentally damaged they will be reinstated before the contractor leaves the site.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Other erosion control measures above and covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction.</td>
<td></td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>13. Water quality</td>
<td>Prevent water quality impacts due to negligence and ensure unavoidable impacts managed effectively.</td>
<td>1. Store lubricants, fuels in dedicated enclosures at least 50 m from water bodies. 2. Solid waste from construction activities will not be thrown in rivers and other water courses (drainage, irrigation, etc.) 3. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off. 4. Stockpiled materials will be covered to reduce silted run-off. 5. No stockpiling within 100m of water body. 6. Immediate stabilization of bare slopes shall be undertaken. 7. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off. 8. Stockpile areas and storage areas for hazardous substances shall be located 100m away from water bodies. 9. Washing of machinery and vehicles in surface waters shall be prohibited. 10. Stockpile areas and storage areas for hazardous substances shall be located 100m away from water bodies.</td>
<td>Contractors</td>
</tr>
<tr>
<td>14. Erosion control/run-off</td>
<td>Protect established works.</td>
<td>1. Implement erosion control measures before construction starts and implement and maintain slope stabilization measures during construction to protect the works. 2. Establish vegetation and erosion protection immediately after completion of works. 3. Check weather forecasts and minimize work in wet weather. 4. Stockpile topsoil for immediate replanting after cutting. 5. Minimize damage and cutting of surrounding vegetation during slope formation. 6. Protect the cut slope with planted vegetation, bioengineering or conventional civil engineering structures as soon as practicable after cutting. 7. Include and implement appropriate measures for slope protection, i.e.</td>
<td>Contractors</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetation cover and stone pitching, as required in the construction drawings. 8. Prevent erosion and protect the cut slope with temporary or permanent drainage as soon as practicable after cutting. 9. If new erosion occurs accidentally, back fill immediately to restore original contours. 10 Protect low embankments from erosion by seeding and planting indigenous grasses that can flourish under local conditions. 11. High embankments, i.e. 2m high and above, will be considered for protection by constructing stone pitching or a riprap across the embankment immediately after the works are completed. This practice will also be applied along cross-drainage structures. 12. Payments linked to the completion of the works as indicated by the installation of erosion control measures to protect the works to the satisfaction of PMU.</td>
<td>Contractors</td>
</tr>
<tr>
<td>15. Spoil Disposal</td>
<td>Control spoil and construction waste disposal, oily and hazardous wastes.</td>
<td>1. Implement corresponding provisions of WASTE MANAGEMENT PLAN (WMP) prepared by the DSC and ensure that wastes (construction wastes, garbage/trash) will not be disposed within Laloki River. 2. Areas for disposal to be agreed with land owner and DECONRE checked and recorded by the DSC, PPL/PMU and monitored 3. Spoil disposal areas to be rehabilitated monitored, catalogued, and marked. 4. Spoil will not be disposed of in rivers and streams or other natural drainage path. 5. Spoil will not be disposed of on fragile slopes, flood ways, wetland, farmland, forest, religious or other culturally sensitive areas or areas where a livelihood is derived.</td>
<td>Contractors</td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Performance and Impact monitoring</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>Responsible to Implement</td>
<td>Timing to Implement</td>
</tr>
<tr>
<td>6. Surplus spoil will be used where practicable for local repair works to fill eroded gullies and depression areas and degraded land in consultation with local community.</td>
<td>Contractor 1-9</td>
<td>Throughout construction phase</td>
<td>Cost included in contracts</td>
</tr>
<tr>
<td>7. Disposed spoil will be spread in 15cm layers and compacted to optimum moisture content, covered with topsoil, landscaped and provided with drainage and vegetation to prevent erosion in line with best practice.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Spoil disposal shall not cause sedimentation and obstruction of flow of watercourses, damage to agricultural land and densely vegetated areas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Under no circumstances will spoils be dumped into watercourses (rivers, streams, drainage, irrigation canals, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The spoils disposal site shall be located at least 50 m from surface water courses and shall be protected from erosion by avoiding formation of steep slopes and grassing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Traffic management plan</td>
<td>To minimize traffic and access issues during construction works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Concern</td>
<td>Objective</td>
<td>Impact mitigation</td>
<td>Proposed Mitigation Measures</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed Mitigation Measures</td>
<td>access roads, or negotiate access with land owners, rather than drive across vegetation or agricultural land, to obtain access to material extraction sites. Where local roads are used, they will be reinstated to their original condition after the completion of work. 6. The road will kept free of debris, spoil, and any other material at all times; 7. Disposal sites and haul routes will be identified and coordinated with local officials; and 8. Provision of adequate protection to the general public in the vicinity of the work site, including advance notice of commencement of works, installing safety barriers if required by villagers, and signage or marking of the work areas; and 9. Provision of safe access across the works site to people whose villages and access are temporarily affected during road upgrading activities.</td>
</tr>
</tbody>
</table>
C. Environmental Monitoring

1. Compliance Monitoring

27. Table 8.2 above also shows the program for monitoring the compliance on various provisions of the EMP during pre-construction and construction phases. DSC needs to implement a number of measures during the pre-construction (e.g., incorporation of environmental design measures into the detailed design, preparation of draft method statements/CEMP, etc.) and this will be confirmed by DSC/PMU to ADB. During construction, most of the mitigation measures shall be implemented by the contractor and their environmental performance, in terms of implementation of such measures, shall be monitored by DSC. The timing or frequency of monitoring is also specified in Table 8.2.

   i) Pre-construction – Detailed Design Stage

28. The IES and NES should be mobilized prior to the commencement of the tendering for the detailed design activities in order to work full time with DSC to ensure the inclusion of environmental requirements into contractual documents. PMU will ensure that contract documents for DSC consultants will also include the this IEE and EMP. PMU assisted by the DSC shall ensure that updated EMP measures for the pre-construction stage are incorporated in the detailed designs by the DSC and the Contractor in the pre construction stage. The effective incorporation of the EMP in the civil works contracts shall also be ensured by PMU with assistance from DSC and this, along with implementation of updated EMP provisions shall be audited by ADB as part of the loan conditions.

29. Prior to implementation of the subproject the IEE and EMP will be updated and amended by DSC, to include any modifications to the scope and scale of the subproject assessed in this IEE as necessary, after the detailed designs are complete and contracting arrangements are known. Such updating shall be based on reconfirmation and any additional information on the assumptions made at the pre-construction / detailed design stage on location scale and expected conditions of the subproject. Although no major additional impacts would be anticipated based on the information provided to date, the performance and evaluation schedules to be implemented during project construction can be reviewed, updated, and costs estimates can be revised if necessary.

   ii) Pre-construction Stage

30. Implementation of the Project will need to comply with any EPs that need to be obtained from DEC. DEC will decide if any construction activities of the subproject will require an EP application. DSC shall also check that contractor(s) have included for fine tuning of the updated EMP all the necessary valid licenses and permits for use of electrical power and powered mechanical equipment if necessary.

   iii) Construction Stage

31. The updated CEMP / method statement prepared by contractor will be reviewed and approved by PMU with assistance from the DSC, before any construction activity is initiated to take account of any subsequent changes and fine tuning of the updated EMP prepared by DSC. The PMU, and EO and other PPL staff for training purposes, shall undertake regular monitoring of the contractor’s implementation of mitigation measures specified in the CEMP.

   iv) Operational Stage

32. Operational stage monitoring of environmental impacts is not required based on the subproject as currently described however PPL shall implement operational stage mitigation and monitoring requirements as required by DEC as the result of any EPs issued in due course and to rectify non-compliance matters identified in the DDR.
2. Environmental Monitoring

33. Environmental monitoring by the PMU shall take the form of checking that the mitigation measure (Table 8.2) and CEMP are being implemented by the contractor. The DSC will report the findings to the PMU on a monthly basis. Monitoring for noise and dust will not be required for this subproject. Supplementary sampling shall be carried out on occasions and parameters shall be analyzed (as necessary) to validate complaints and/or investigate pollution events caused by the project.

34. The contractor will issue Monthly Reports to the PMU reporting on general progress on the contract, these will address environmental management issues including any non-compliance issues cited or corrective actions required.

3. Reporting

35. The following environmental monitoring reports will be prepared and submitted to IPBC and ADB.

36. **Baseline Monitoring Report.** The results of baseline data collection carried out on behalf of the PMU for water quality (as specified in the EMP) shall be reviewed and validated by the DSC and shall be submitted by PMU to ADB prior to commencement of civil works.

37. **Environmental Monitoring Reports.** Environmental monitoring reports shall cover the status of EMP implementation in terms of environmental compliance and permitting, required mitigation measures for different project phases, results of environmental effects monitoring (noise and vibration, water quality and sediment quality), necessary remedial actions to effectively address negative environmental impacts due to project implementation, status of environmental capacity building activities as well as documentation of complaints received and corresponding action/resolution. The reports will consolidate the findings of the Monthly Reports submitted by the contractor in addition to issues and findings of PMU. The environmental monitoring reports will be submitted to ADB as part of the QPR submitted by PMU to ADB.

38. **Environmental Costs.** As part of good engineering practices in the subproject, there have been several measures as materials management, waste and spoil management, safety, signage, dust prevention, noise mitigation, etc. the costs for which will be included in the design costs of the subproject. The IEE costs include monitoring costs during construction and capacity building costs on environmental management of which are absorbed into DSC or contractors works packages. The costs for training proposed include the costs incurred towards the site visits, travel to the training program by the participants, printing of training materials and other logistic arrangements are also included in the DSC consulting package. The costs involved towards preparation of training material and imparting of training are covered in the DSC fees. The budget for the cost of environmental management is not a significant addition to the overall subproject or Project cost.

D. Capacity Building

39. The existing arrangements and capacity of PPL in respect of environmental management has been described elsewhere in this IEE. As PPL do not currently have the capacity to complete the environmental responsibilities for the Project the PMU supported by the DSC will undertake these responsibilities on behalf of PPL.

40. The IES will lead the environmental work-stream and assist and support the NES and PPL’s EO. Both the IES and the NES will work closely with the DSC within PMU.
The IES and NES will support the PMU and be responsible for the day to day environmental monitoring work, giving PMU on the job training, and reporting environmental management coordination for the whole Project. Benefits are available to PPL if training sessions are broadened out to include PMU and other PPL staff, including management, as necessary.

41. The ability of the EO to undertake the environmental responsibilities of PPL will increase gradually as on-the-job training and experience progresses through implementation of the Project and TEIP. The EO can initially fall back on assistance available through the PMU as they develop experience. As noted the environmental responsibilities for the Project are sufficient to warrant dedicated staff (IES and NES) and in future this approach can be broadened and continued by the PMU. After completion of the Project it is suggested that PPL could adopt the core safeguards unit from this Project and TEIP and strengthen it into a more robust safeguards management unit for all other PPL projects and facilities by increasing the number of permanent and dedicated staff trained in environmental engineering and environmental management. Over time this will reduce the requirements for project-specific staff and projects will contribute to building PPL’s in-house resources which will be developed to improve overall environmental management.

42. Through this and other projects PPL will have the opportunity to support increased environmental capability and awareness by providing human resources and also ensuring that the necessary actions to comply with environmental requirements for the operational phase are included in the Project.

43. Considering the number of agencies that need to be involved in implementing the EMP, training workshops should be conducted by the PMU/DSC two weeks before works commence and refresher courses should be set up every month for the first three months as the Project construction gears up. Training workshops should be conducted periodically by the DSC as every new contractor is engaged in the first year and every six months or twice each year, for the second and third year, to share experience in the implementation of the works and the monitoring report on the implementation of the EMP, to share lessons learned in the implementation and to decide on remedial actions, if unexpected environmental impacts occur. The EO in PPL and PMU officers can take over this role as they develop capacity.

44. The table below shows the indicative terms of reference for the environmental management capacity building activity to be conducted by DSC for PMU staff tasked to oversee EMP implementation.
<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Participants</th>
<th>Form of Training</th>
<th>Duration</th>
<th>Trainer / Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and sensitization to environment issues</td>
<td>Sensitization on environmental concerns Environmental impacts of Project. Environmental regulations of the Government ADB environmental regulations Coordination between departments for implementation of environmental issues</td>
<td>PMU &amp; EO in PPL, PMU engineers / management team, officials responsible for implementing project, and other PMU / DSC staff as interested.</td>
<td>Workshop</td>
<td>One day workshops Pre-construction</td>
<td>DSC-IES</td>
</tr>
<tr>
<td>Pre-project training on hazards, health, safety and environmental issues pertaining to the project</td>
<td>Sensitization and training for engineering and management professionals, to be involved in on-site execution and operation of the proposed facilities.</td>
<td>PMU &amp; EO in PPL, PMU engineers / management team, officials responsible for implementing project, and other PMU / DSC staff as interested.</td>
<td>Workshops, site visits</td>
<td>Three days, pre-construction</td>
<td>Tailor made training programs by Industrial safety board of Papua New Guinea (ISBB), Engineering Staff college etc.</td>
</tr>
<tr>
<td>EMP implementation</td>
<td>Implementation of environment EMP Identification of environment impacts Monitoring and reporting for EMP Public interactions and consultations Coordination for consents and with various departments Monitoring formats filling and review of impacts</td>
<td>PMU &amp; EO in PPL, PMU engineers / management team, officials responsible for implementing project, and other PMU / DSC staff as interested.</td>
<td>Lectures and field visit</td>
<td>Two-day session Construction stage</td>
<td>DSC Environmental Specialist</td>
</tr>
<tr>
<td>Training on environmental management, OHS systems, emergency and risk response systems</td>
<td>Guidance for conformance to environmental management systems</td>
<td>PMU technicians, PMU engineers / management team, officials responsible for implementing project, and other PMU/DSC staff as interested.</td>
<td>Lectures</td>
<td>Four day program, lectures, site visits</td>
<td>Tailor made training programs by departments at board of Papua New Guinea University of Technology (PNG Unitech), engineering college etc.</td>
</tr>
</tbody>
</table>
Figure 8.1 – Responsibilities for Environmental Management Plan

Abbreviations: EMP = Environmental Management Plan, PMU = Project Management Unit in PPL, DEC = Department of Environment and Conservation, PPL = PNG Power Limited, EO = Environmental Officer in PPL, DSC = Design and Supervision Consultants including International Environmental Specialist (IES) and National Environmental Specialist (NES) in PMU, CEMP = Contractors Environmental Management Plan (for construction phase).
9. CONCLUSIONS AND RECOMMENDATIONS

45. This IEE concludes that the environmental impacts from the project will be manageable if the mitigation measures set out in the EMP are implemented thoroughly. The EMP is based on the type, extent and duration of the identified environmental impacts. The EMP has been prepared by close reference to best practices and in line with the SPS.

46. This IEE study has been carried out after preliminary design but before any detailed design has been completed. Essentially secondary data were used to assess the environmental impacts in a comprehensive manner. Public consultation and site reconnaissance were carried out in order complete the environmental assessments and recommend suitable mitigation measures. The potential environmental impacts were assessed in a comprehensive manner. It is required by SPS that in the event that any design details for the locations or scope of the project are changed, the environmental assessments and EMP shall be reviewed and revised accordingly and submitted to ADB for acceptance. The IEE will first be reviewed by the DSC as soon as they are engaged and the EMP (and any updates thereof) included in contract documents before the detailed design requirements of the contractor are confirmed.

47. The Project offers robust options for the enhancement of the Port Moresby power grid for PPL to serve future requirements. Several actions are required before signing the contract and during the pre-construction stage to minimize impacts to acceptable levels. The negative environmental impacts will take place during the construction stage and the IEE provides suitable mitigations that can be integrated in the CEMP by the contractor in due course. The impacts from refurbishment should be very predictable and manageable and with appropriate mitigation few residual impacts are likely. Additional human and financial resources will be required to improve environmental capability and to notify DEC and progress and achieve necessary statutory compliance for the Project and any associated activities that also require environmental assessment and environmental permits under the environmental laws of PNG.

48. The responsibilities for the implementation of mitigation measures and the parities responsible will be clearly defined in contracts and agreements and the implementation by various parties will be monitored by PMU with assistance from DSC.

49. Whereas the anticipated environmental impacts will take place during the construction phase, there are no significant cumulative adverse impacts during operation that have been identified at this stage. The implementation of the environmental mitigation measures during the construction period shall be the responsibility of the contractors and these requirements will be included in contracts and shall be closely monitored by the PMU assisted by DSC.

50. The implementation of the environmental mitigation measures during the construction period will be assigned to the contractors but experience suggests that contractors may have little impetus or interest to deal with environmental problems in the absence of performance linked criteria. The required EMP will be included at the bidding stage and in the contract documents and environmental performance and the completion of mitigation will be linked to payment milestones in the contracts. The required environmental mitigation and EMP must be clearly described in the contract documents to ensure that all recent developments and environmental performance requirements are clearly understood by the contractor and linked to payment milestones in the contracts.

51. The EMP prepared for the Project (Chapter 8) will be reviewed by the DSC and approved by ADB and used as a basis for an environmental compliance program in a regular program of environmental monitoring and auditing. In addition, any conditions included as part of the environmental permits from DEC will also be included as a basis for the environmental monitoring and compliance program.
52. Therefore monitoring of (i) the implementation of mitigation measures (ii) the implementation of the conditions of environmental compliance will be carried out regularly as scheduled in the EMP and results will be reported semi-annually to ADB. The operational performance specifications for the Project will be set in future by the PPL that will in future be responsible for all PPL activities in PNG.

53. Environmental impact and compliance monitoring activities will focus on compliance with conditions of environmental permits from DEC and EMP provisions, recording implementation of mitigation measures, recording environmental parameters, reviewing contractor environmental performance and proposing remedial actions to address unexpected impacts and complaints. The DDR (Appendix D) has also identified actions that need to be implemented by PPL to ensure compliance of existing operations.

54. The DSC will train PMU to develop environmental awareness at all levels in PPL and this can also be broadened to raise environmental awareness and assist contractor in complying with environmental responsibilities. It will require sustained effort over several months to achieve proactive management of environmental responsibilities in the PMU and PPL. The Project seeks to consolidate environmental capability and over time environmental improvements can accrue in line with good sustainable practice and ADB guidelines. The PMU will be supported by the DSC who will be able to liaise with PMU and decide how to better to utilize the available staff resources to support environmental management. This capability can be used to extend environmental awareness for PPL staff and the contractors. In the medium to long term PMU and PPL can be strengthened to support their developing environmental management responsibilities and dovetail their efforts with the environmental initiatives and requirements from DEC and other agencies. At the completion of the Project, the staff of PMU and NES could be retained in the PPL and the ongoing environmental obligations of the Project could be more easily taken up by these more experienced staff. This would embed capacity within PPL for when it wishes to undertake more ambitious projects in future.

55. Environmental permits are required under the Environment Act for waste disposal and water abstraction for PPL as a whole. The environmental permit requirements to be negotiated with DEC. At the implementation stage during the preconstruction phase, PMU assisted by DSC will make arrangements to ensure that the environmental permits for the main project and for waste disposal and water abstraction are secured in a timely manner. This can be accomplished in a comprehensive notification to DEC for all the Project subproject activities. This can be prepared earlier by PPL or as a last resort must be prepared by the DSC environmental specialists starting as soon as the DSC is appointed.

56. The DSC must be made aware of the scale and complexity of the environmental permit application task before signing their contract so that the appropriate resources can be readied for mobilization in advance. The design assumptions and all mitigation measure can be combined in a comprehensive notification to DEC of all Project on-site and associated off-site activities in order to facilitate smooth interchange with DEC and avoid unnecessary delay notifying DEC in case environmental permits are required.

57. The PMU assisted by DSC will monitor the schedules of mitigation measures and conduct of environmental effects monitoring for all activities specified in the updated IEE and EMP.

58. With these measures in place, environmental impacts should be manageable and will not result in any residual impacts which are above accepted environmental standards. No further or additional impact assessment is considered necessary at this stage.
Appendix A: Selected Photographs

Photograph 1
Sirinumu Dam and hydro power station

Photograph 2
Sirinumu hydro power turbine water discharge point. PPL workers inspecting turbine.

Photograph 3
Environment Downstream (50-100m) of Sirinumu hydro power generation station

Photograph 4
Sirinumu hydro power facility. Switchroom and entrance to turbine gallery

Photograph 5
Sirinumu cone valve discharge affects area. Approx. 30m radius impact area

Photograph 6
Sirinumu facility cone valve and turbine discharge point
Appendix B: Results of Public Consultation

Issue / Question Raised

Mr. Philip Kamilus
- Support and agree to project
- Many houses in the 12 villages do not have access to power
- All houses need full power supply
- Demanding for the National Government, IPBC and the National Roads Authority to seal the roar to Sirinumu Dam before any project goes ahead on the Sirinumu site.

Mr. Watson Nason
- Support and agree to project
- Need improved power supply in National Capital District (NCD). Project is beneficial for Port Moresby communities
- The Sirinumu Road is a national road, its responsibility of the Government to seal it. It’s a national issue
- The issue with the Road has been made to the Government several times before
- Existing power supply in Sirinumu and other villages are in the
- New supply to villages is another issue with John Tangit

Mr. Maeawa Osida
- Submitted many petitions to the government for social services and compensation but no response from the Government
- This Project will not go on until the Sirinumu Road is sealed, not minor upgrading
- Outstanding payments is another issue, need to be paid to us

Mr. Steven Jones (SIDCO Chairman)
- National Government must meet their conditions
- Local machines and Labour must be use in the projects
- Seal the Sirinumu Road
- Concerned that the project might affect the environment, Carbon Trade, Logging and fish farming on the dam
- The existing Sirinumu Dam and Hydro Power facilities were constructed in the 1960s without any proper consultation with us the landowners

Mr. Jack Oga (SIDCO Director)
- Project will contribute significantly to the city in terms of business and other development
- The land the dam is on has huge damage cost
- Little development done in the village and surrounding areas.
- Not enough compensation paid us for land by the Government
- Will the refurbishment program affect the other people downstream?
- Concerned with Environmental and social issues
- How we the landowners will participate or benefit from the project? We land landowners must participate in some ways.
Appendix B: Results of Public Consultation

Kalip Salo & Dr Velepat
Refurbishment project will not involve resettlement, it is just upgrading of existing facilities

Dr. Brown
- We the government understand the importance of landowner participation in all resource development projects in PNG. For these Port Moresby Power Grid Project we need your understanding and support so that we all can help PPL in implementing project which is very important for National Capital District development as a whole.
- Land owners need to organise themselves to reap benefits from such projects and long term operation of the infrastructure facility.

Parkop Kurua
- Thanks Kalip for organizing the meeting
- Explains the role of the government and State Owned Enterprises
- Economic boom, putting pmUre on PPL to supply power
- Government approved the policy on Land Owner Participation
- Private Sector Participation to relieve the Government

Others
- Need improved power supply in National Capital District. Project is beneficial for Port Moresby communities.
- Project location is within existing PPL’s hydro power facility so will not affect us
- We heard the dam depth is reducing due to sediment and silt building up. The project might involve releasing this sediments/silts which might affect our river system and fish.
- We have been long neglected by the government and PPL in terms of monetary compensation
- We landowners have machines and labor. We must be given first priority in construction contracts by the project
- PPL does not have good relationship with landowners

SMEC Team
- No new land will be taken up by the project
- No significant environmental impact to be caused by the project
- All works will be within existing PPL’s Sirinumu hydropower facility area
### Appendix B: Results of Public Consultation

#### Representation from Project Management Unit, PPL, ADB and Government

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Designation</th>
<th>Contact Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Angela Braun</td>
<td>Dept. Prime Minister and NEC</td>
<td>Director</td>
<td>327 76701</td>
</tr>
<tr>
<td>Shazel Siaguru</td>
<td>Dept. Prime Minister and NEC</td>
<td>Research Officer</td>
<td>3266605</td>
</tr>
<tr>
<td>Dr. David Green</td>
<td>SMEC/ADB</td>
<td>Environmental Consultant</td>
<td></td>
</tr>
<tr>
<td>Dr. Anura Widana</td>
<td>SMEC</td>
<td>Social Specialist</td>
<td>71702917</td>
</tr>
<tr>
<td>Dr. Velepat Tuaru</td>
<td>SMEC</td>
<td>Gender/Social Specialist</td>
<td>3267369</td>
</tr>
<tr>
<td>Gabriel Waken</td>
<td>SMEC</td>
<td>Power Sector Specialist</td>
<td>71960129</td>
</tr>
<tr>
<td>Francis Iwainde</td>
<td>SMEC</td>
<td>Environmental Specialist</td>
<td>72400417</td>
</tr>
<tr>
<td>Martin Giyomatala</td>
<td>CPA</td>
<td>Advisor</td>
<td>3214599</td>
</tr>
<tr>
<td>Titus Romano Hatagen</td>
<td>CPA</td>
<td>Dept. Prov. Administrator</td>
<td>3214141</td>
</tr>
<tr>
<td>Waten Naso</td>
<td>PNG Power</td>
<td>Regional Manager/Operations</td>
<td>71905051</td>
</tr>
<tr>
<td>Kailp Salo</td>
<td>PNG Power</td>
<td>Manager Lands and Community Services</td>
<td>324 3547</td>
</tr>
<tr>
<td>Parkop Kurua</td>
<td>IPBC</td>
<td>Portfolio Manager/PPL &amp; Air Niugini</td>
<td></td>
</tr>
</tbody>
</table>

#### Representation from Sirinumu Landowners

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Designation/CLAN</th>
<th>Contact Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philip Camilus</td>
<td>SIDCO</td>
<td>Director</td>
<td>327 3227</td>
</tr>
<tr>
<td>Ian Bali</td>
<td>SIDCO</td>
<td>local Clan Rep</td>
<td>72590992</td>
</tr>
<tr>
<td>Bobogi And</td>
<td>SIDCO</td>
<td>Admin Officer</td>
<td>72208341</td>
</tr>
<tr>
<td>Moses Seni</td>
<td>SIDCO</td>
<td>Ward II Councill</td>
<td></td>
</tr>
<tr>
<td>Jonah Bobogi</td>
<td>SIDCO</td>
<td>Clan Rep</td>
<td>71518325</td>
</tr>
<tr>
<td>Jack Oga</td>
<td>SIDCO</td>
<td>Clan Rep</td>
<td>76960800</td>
</tr>
<tr>
<td>Andy Talu</td>
<td>DSPS</td>
<td>Director/Custumary land</td>
<td>72247887</td>
</tr>
<tr>
<td>Steven John</td>
<td>SIDCO</td>
<td>Chairman</td>
<td>72888208</td>
</tr>
<tr>
<td>Taha Masia</td>
<td>SIDCO</td>
<td>Maneu Kruoui Clan</td>
<td>72535566</td>
</tr>
<tr>
<td>Yohia Mavia</td>
<td>SIDCO</td>
<td>Nidom clan</td>
<td></td>
</tr>
<tr>
<td>Inara Biai</td>
<td>SIDCO</td>
<td>Maneu Kruoui Clan</td>
<td></td>
</tr>
<tr>
<td>Karimu Rehuni</td>
<td>SIDCO</td>
<td>Maneu Kruoui Clan</td>
<td></td>
</tr>
<tr>
<td>Marks Okki</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lewi Gelta</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airoma Ano</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lvana Korahi</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Toina</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ubene Yohia</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Womae Karioyu</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yuri Yuben</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manea Sarua</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alex A Kaia</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maeawa.O</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jonah Maeana</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Designation/CLAN</td>
<td>Contact Number</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------</td>
<td>---------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Osiva M Aeana</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korgi Vagi</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walanuga</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saruna Yor</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dera.W</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tom Woroqu</td>
<td>SIDCO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. Nvara</td>
<td></td>
<td>Dueoteu Clam</td>
<td></td>
</tr>
<tr>
<td>Worea Oppy</td>
<td></td>
<td>Magibri Clan</td>
<td></td>
</tr>
<tr>
<td>James Bobugi</td>
<td></td>
<td>Wanovan Clan</td>
<td></td>
</tr>
<tr>
<td>Kidu Baradea</td>
<td></td>
<td>Magibri Clan</td>
<td></td>
</tr>
<tr>
<td>Nuana Avana</td>
<td></td>
<td>Magibri Clan</td>
<td></td>
</tr>
<tr>
<td>Taha Inara</td>
<td></td>
<td>Tuia Clan</td>
<td></td>
</tr>
<tr>
<td>Fisherman Nari</td>
<td></td>
<td>Togo Korohi Clan</td>
<td></td>
</tr>
<tr>
<td>Kevani Umui</td>
<td></td>
<td>Manere Korohi</td>
<td></td>
</tr>
<tr>
<td>Avea Maruka</td>
<td></td>
<td>Wanovan Clan</td>
<td></td>
</tr>
<tr>
<td>John Tom</td>
<td></td>
<td>Tuia Clan</td>
<td></td>
</tr>
<tr>
<td>Billy Marks</td>
<td></td>
<td>Magibri Clan</td>
<td></td>
</tr>
<tr>
<td>Kisira Biai</td>
<td></td>
<td>Manere Korohi (Female)</td>
<td></td>
</tr>
<tr>
<td>Manea Osiva</td>
<td></td>
<td>Nidori Clan (Female)</td>
<td></td>
</tr>
<tr>
<td>Geno Nins</td>
<td></td>
<td>Orari Clan</td>
<td></td>
</tr>
<tr>
<td>Usa Tom</td>
<td></td>
<td>Tuia Clan</td>
<td></td>
</tr>
<tr>
<td>Oga Inara</td>
<td></td>
<td>Manere Korohi Clan</td>
<td></td>
</tr>
<tr>
<td>Mageta Osiva</td>
<td></td>
<td>Tubiru Clan</td>
<td></td>
</tr>
<tr>
<td>Niada</td>
<td></td>
<td>Wanovan Clan</td>
<td></td>
</tr>
<tr>
<td>Kidu Toina</td>
<td></td>
<td>Wanowari Clan</td>
<td></td>
</tr>
<tr>
<td>Willie Kidu</td>
<td></td>
<td>Magibri Clan</td>
<td></td>
</tr>
<tr>
<td>Willie Edema</td>
<td></td>
<td>Tuia Clan</td>
<td></td>
</tr>
<tr>
<td>Alfred Kasins</td>
<td></td>
<td>Tubiru Clan</td>
<td></td>
</tr>
<tr>
<td>Ainna Fori</td>
<td></td>
<td>Wanowari Clan</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Results of Public Consultation

Questions posed to affected persons, authorities Port Moresby, utilities, provincial and public officials (August 2012)

<table>
<thead>
<tr>
<th>Ref.</th>
<th>PNG</th>
<th>Information Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ENG</td>
<td>As consultants for the ADB Project Port Moresby Power Grid Development Project we are collecting information from interested parties.</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Mipela ol wokman bilong ADB Projek Port Mosbi Pawa Lain Developmen Projek i raun long kisim sampela tink tink long ol man meri</td>
</tr>
<tr>
<td>2</td>
<td>ENG</td>
<td>The main part of the project is the improvement and upgrading of power transmission and distribution network in Port Moresby, including substations. Have you heard about the Project Project? Let me clarify</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Yu bin harim sampela toktok long Project bipo or nogat? Bai mi kilarim tink tink blong yu gut long projek.</td>
</tr>
<tr>
<td>3</td>
<td>ENG</td>
<td>The project will involve several components involving improvement of the existing facilities in the network for power transmission and distribution in Port Moresby, including substations.</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Projek ya em long stremit gut olgeta pesilitis blong PNG Pawa Ltd nau istap insait long Mosbi, na bai ol I wokim wanpela nupela sabsteisen tu.</td>
</tr>
<tr>
<td>4</td>
<td>ENG</td>
<td>There will be 6 (six) component subprojects in the PGDP project. Five (5) of the subprojects will involve replacements or improvements to existing facilities. Subproject number 1 (one) will require construction of a new transmission line from 6-mile to Kila Kila (via Taurama). This subproject will also require construction of a new substation at either Kila Kila or Kaugere. Subproject number 1 will also involve upgrading parts of the existing TL from Kila Kila to Badili and to Konedubu.</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Bai gat 6 pela pat long projek na wanpela blong ol em long wokim nupela pawa lain long 6 mile ikam long Taurama valley ikam ol geta long Kila kila. Long Kila Kila em bai joinim pawa lain nau stap long en. Tasol dispela olpela pawa lain post bai ol apgreitim long putim nupela pawa lain igo wantain long seim pawa post.</td>
</tr>
<tr>
<td>5</td>
<td>ENG</td>
<td>The TL line between 6-mile, Kila Kila, Badili and Konedubu will be 66kV power line. The substation at Kila Kila or Kaugere will be about 80m x 80m. The improvements to Konedubu substation will include replacement of capacitors and an additional transformer.</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Pawa Lain bai karim 66kV. PPL bai wokim wanpela nupela pawa sabsteisen long Kila Kila o Kaugere. Konedubu em long putim insait nupela Kapasita masin na sesesim trespoma.</td>
</tr>
<tr>
<td>6</td>
<td>ENG</td>
<td>The TL installation between Kila Kila and Kaugere will be aligned by upgrading the lines on the existing poles mainly along the main Pari Road, and Kila Kila Road and Scratchley Road right of way (RoW).</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Pawa Lain long 6-mile kam long Kila Kila em bai ikam long bus graun we nogat man stap antap long en. Long Kila Kila igo long Badili em bai behain aiwe rot we nau olpela pawa lain igo long en. Pawa lain long Badili igo long Konedubu em bai appgredim olpela lain tasol igo olgeta long Konedubu sabsteisen.</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>The detailed designs for all of the projects will be completed in 2013 and contractors will be also selected in 2013.</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Pul disain plen bia projek ol bai wokim long yia 2013 na ol bai kisim ol konstraksen kampanis long stat wok long 2013 yet.</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Construction will be for several months in each location but is targeted for completion in late 2015</td>
</tr>
<tr>
<td></td>
<td>PNG</td>
<td>Konstraksen wok bai kisim planti mun na igo pinis long yia 2015</td>
</tr>
</tbody>
</table>
## Appendix C: International Environment Conventions to which PNG is a Party

<table>
<thead>
<tr>
<th>Title of Convention</th>
<th>Signed</th>
<th>Accession, Ratification, Entry into Force</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vienna Convention for the Protection of the Ozone Layer</td>
<td>27 Oct 92 (Acc), 27 Jan 93 (F), 02 Aug 93</td>
<td></td>
</tr>
<tr>
<td>Montreal Protocol – substances that deplete Ozone Layer</td>
<td>27 Oct 92 (Acc), 25 Jan 93 (F)</td>
<td></td>
</tr>
<tr>
<td>Amendment to the Montreal Protocol</td>
<td>02 Aug 93</td>
<td></td>
</tr>
<tr>
<td>Framework Convention on Climate Change (UNFCC)</td>
<td>13 Jun 92</td>
<td>16 Mar 93 (Rat), 31 Mar 94 (F)</td>
</tr>
<tr>
<td>Kyoto Protocol to the UNFCC</td>
<td>22 Mar 99</td>
<td>28 Mar 02 (Rat)</td>
</tr>
<tr>
<td><strong>Global Biodiversity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Plant Protection Convention</td>
<td>01 Jun 76 (Acc)</td>
<td></td>
</tr>
<tr>
<td>International Plant Protection Convention (Revised Text)</td>
<td>13 Nov 91 (Acc)</td>
<td></td>
</tr>
<tr>
<td>Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)</td>
<td>12 Dec 75 (Acc), 11 Mar 76 (F)</td>
<td></td>
</tr>
<tr>
<td>Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)</td>
<td>16 Jul 93 (F)</td>
<td></td>
</tr>
<tr>
<td>Protocol to amend the Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR)</td>
<td>16 Mar 93 (F)</td>
<td></td>
</tr>
<tr>
<td>Convention on Biological Diversity (CBD)</td>
<td>13 Jun 92</td>
<td>16 Mar 93 (Rat)</td>
</tr>
<tr>
<td>International Tropical Timber Agreement</td>
<td>28 Aug 95</td>
<td>28 Aug 95</td>
</tr>
<tr>
<td>Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks</td>
<td>04 Dec 95</td>
<td></td>
</tr>
<tr>
<td>Convention Concerning the Protection of the World Cultural and Natural Heritage (WHC)</td>
<td>08 Jul 97 (Acc)</td>
<td></td>
</tr>
<tr>
<td>Convention to Combat Desertification (CCD)</td>
<td>06 Dec 00 (Acc), 01 Mar 01 (F)</td>
<td></td>
</tr>
<tr>
<td><strong>Wastes, Chemicals, Pollution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockholm Convention on Persistent Organic Pollution (POPs)</td>
<td>23 May 01</td>
<td></td>
</tr>
<tr>
<td>Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel)</td>
<td>01 Sep 95 (Acc), 30 Nov 95 (F)</td>
<td></td>
</tr>
<tr>
<td>International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties</td>
<td>12 Mar 80 (Acc), 10 Jun 80 (F)</td>
<td></td>
</tr>
<tr>
<td>International Convention for the Prevention of Pollution from Ships as modified by the Protocol of 1978 (MARPOL)</td>
<td>25 Oct 93 (Acc), 25 Jan 94 (F)</td>
<td></td>
</tr>
<tr>
<td>International Convention on Civil Liability for Oil Pollution Damage (CLC 69)</td>
<td>12 Mar 80 (Acc), 10 Jun 80 (F)</td>
<td></td>
</tr>
<tr>
<td>Protocol of 1992 to amend the International Convention on Civil Liability for Oil Pollution (CLC 69)</td>
<td>23 Jan 01 (Acc), 23 Jun 02 (F)</td>
<td></td>
</tr>
<tr>
<td>Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC)</td>
<td>10 Mar 80 (Acc), 09 Apr 80 (F)</td>
<td></td>
</tr>
<tr>
<td>Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (Noumea)</td>
<td>05 Nov 87</td>
<td>22 Aug 90 (F)</td>
</tr>
<tr>
<td>Protocol for the Prevention of Pollution of the South Pacific Region by Dumping</td>
<td>03 Nov 87</td>
<td>18 Aug 90 (F)</td>
</tr>
<tr>
<td>Protocol Concerning Cooperation in Combating Pollution Emergencies in the South Pacific Region</td>
<td>03 Nov 87</td>
<td>18 Aug 90 (F)</td>
</tr>
<tr>
<td>Plant Protection Agreement for Asia and Pacific Region</td>
<td>01 Jun 76 (Acc)</td>
<td></td>
</tr>
<tr>
<td>Agreement Establishing the South Pacific Commission</td>
<td>16 Sep 75 (Acc)</td>
<td></td>
</tr>
<tr>
<td>South Pacific Forum Fisheries Agency Convention</td>
<td>10 Jul 79</td>
<td>10 Jul 79 (F)</td>
</tr>
<tr>
<td>Conservation of Nature in the South Pacific (Apia)</td>
<td>12 Jun 76</td>
<td></td>
</tr>
<tr>
<td>The South Pacific Nuclear Free Zone Treaty (Rarotonga)</td>
<td>16 Sep 85</td>
<td>15 Sep 89 (F)</td>
</tr>
<tr>
<td>Agreement establishing the South Pacific Regional Environment Programme (SPREP)</td>
<td>16 Jun 93</td>
<td>31 Aug 95 (F)</td>
</tr>
<tr>
<td>Convention to ban the Importation into Forum Island Countries of Hazardous Wastes and Radioactive Wastes and to control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific (Waigani)</td>
<td>16 Sep 95</td>
<td>21 Oct 01 (F)</td>
</tr>
<tr>
<td>Agreement for the Establishment of a Regional Animal Protection and Health Commission for Asia and Pacific</td>
<td>25 Jul 80 (Acc)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Department of Environment:
N.B. #DOE terminology Acc= Accession, F= in Force, Rat=Ratification.
Appendix D: Due Diligence of Existing Operations

A. INTRODUCTION

The project preparatory technical assistance has been undertaken and completed feasibility studies of six subprojects which will eventually be interlinked as part of the Port Moresby grid. The feasibility studies include environmental assessment documents comprising initial environmental examination (IEE) of each subproject and due diligence review (DDR) reports documenting the audit of existing operations. This DDR is associated with works proposed at Sirinimu toe-of-dam (TOD) under the Project. The Project will upgrade PNG Power Ltd (PPL) existing facilities and equipment and rehabilitate and expand existing facilities.

Environmental impacts of the Project have been assessed in the IEEs for each subproject in line with ADB’s Safeguards Policy Statement (SPS). It is recognized that the operations of PPL extend to all parts of the grid including, power generation, transmission and distribution and consumption. However for purposes of this DDR the area of influence does not include potential impacts that might occur independently of the Project or impacts that might occur if the subproject does not take place. The focus is on the environment in the existing facility in which the subproject will operate and if the facility's environmental management is generally consistent with ADB’s safeguard objectives and requirements as defined in SPS. The DDR also identifies any mitigation measures that are needed (corrective actions) to bring the facility's environmental management in to line with ADB’s safeguard objectives and requirements.

Through due diligence, review, and supervision ADB ensures that borrowers comply with the SPS requirements during project preparation and implementation. The process outlined in the SPS notes that, over time, ADB’s safeguards may require updating of existing operations to enhance environmental effectiveness, respond to changing needs, and reflect evolving best practices. Due diligence has been undertaken through a review of the available documentation, interviews with staff of PPL and site visits during July and August 2012 in order to explore with the facility operator/owner whether the facility (be it existing and proposed) is in compliance and/or can be brought into compliance with SPS, and if so to agree on required corrective actions and a time-line for their implementation as a part of international good practice.

In preparing the DDR the consultants have exercised due diligence and studied where PPL’s current practices meet ADB SPS requirements and where there are gaps that need to be filled. This DDR report summarizes the results of that study and identification of how any gaps can be addressed so that the loan procedures can proceed with confidence that the requirements of SPS will be complied with.

B. CURRENT STATUS OF ENVIRONMENTAL COMPLIANCE

The Sirinumu hydropower plant was commissioned in 1975 and was operating up to 2008 with a Water Use Permit the abstraction of water issued under the Water Resources Act in 1983 to PNG Electricity Commission (ELCOM). The Water Resources Act was repealed by the Environment Act with all current permits staying in force. However the relevant permit (Table D.1) expired in 2008. PPL has no knowledge of any subsequent, notifications or applications made under the Environment Act or any notices issued to PPL by DEC in respect of the Sirinumu hydropower dam.

There are no records showing transfer of the permits from ELCOM to PPL or of any other transactions with DEC. Likewise no records have been made available with respect to applications or permits required under the Environment Act to operate any of the components of
Appendix D: Due Diligence of Existing Operations

the Sirinumu hydropower dam and Rouna cascade system. Further clarification is required that PPL operations at Sirinumu and the Rouna cascade system are in compliance with the laws of PNG.

C. ACTIONS REQUIRED FOR RAUNA OPERATIONS TO COMPLY WITH SPS

1. There are several immediate recommended actions for PPL in order to achieve environmental compliance: The recommended course of action is for PPL to:

   - Request clarification from DEC, as the environmental authority, about current state of affairs regarding environmental compliance in PPL with regards to Sirinumu toe of dam.

   - Disclose the scope of the improvements for Sirinumu TOD and seek guidance from DEC on the procedures required and the actions needed to establish regularization of environmental compliance of Sirinumu toe of dam.
## Appendix D: Due Diligence of Existing Operations

### TABLE D.1 - MATTERS REQUIRING CLARIFICATION FROM DEC ON ENVIRONMENTAL COMPLIANCE

<table>
<thead>
<tr>
<th>Notes on environment acts and regulations</th>
<th>Wording in Act and Regulations and other comments</th>
<th>Rouna 1</th>
<th>Sirinumu (&lt; = up to)</th>
<th>Rouna Cascade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment Act 2000</td>
<td></td>
<td>1961 completed</td>
<td>1975 completed</td>
<td>1986 (R4) completed</td>
</tr>
<tr>
<td>Sec 134 repeals Water Resources Act and Environmental Planning Act</td>
<td>Rouna cascade operating under four permits granted to ELCOM (granted under WRA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Use Permits for Sirinumu TOD &amp; R1-R4</td>
<td>All water use permits have expired</td>
<td>Expired 26.08.08</td>
<td>Expired 26.08.08</td>
<td>R4 Expired 29.12.87</td>
</tr>
<tr>
<td>No other permits can be identified by PPL</td>
<td>DEC records are unavailable (files misplaced)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Use Permits granted to ELCOM not PPL</td>
<td>Scanned copies are available</td>
<td># 29/83 granted 25 Aug 1983</td>
<td># 29/81 26 Aug 1983</td>
<td># 29/75 (interim Only) 16 Dec 1982 (R4)</td>
</tr>
<tr>
<td>Water available for use in WRA permit</td>
<td>Cumecs</td>
<td>&lt;17.1 (R1 &amp; R3)</td>
<td>&lt; up to 7.0</td>
<td>19.0 (R4)</td>
</tr>
<tr>
<td>Term of WRA permit</td>
<td>25 Years</td>
<td>25 Years</td>
<td>5 Years</td>
<td></td>
</tr>
</tbody>
</table>

- **Sec 43 defines existing activity at time of enactment of Environment Act**: "Existing activities" means those activities which - (a) were being carried on at the date of coming into operation of the Regulation defining level 1, level 2 and level 3 activities; and (b) since that date, have not changed their nature so as to involve the carrying out of a level 2 or level 3 activity that was not previously being carried out.

- **Sec 44 (1) defines obligation to have an environmental permit**: (1) Subject to this section and Section 135, a person commits an offence where he carries out - (a) a level 2 or level 3 activity; or (b) a change in process, or expansion of works or plant in relation to an existing activity such that a level 2 or level 3 activity is carried out without an environment permit. Does the project constitute an expansion of works?

- **Sec 44 (2) defines obligation to have an environmental permit**: (2) A person is not required to have a permit to carry out an existing activity or a Level 1 activity unless the Director has served a notice under Section 45.

- **Sec. 64 Env. Act 2000 (amended 2002)**: The Regulation may provide for notification, referral and consultation requirements in relation to applications and proposed permits to be dispensed with in such circumstances as prescribed.

- **PPL legal department does not have records of notices under Sec 45**: Legal officers in PPL have no knowledge

- **PPL legal department does not have records of notices of**: Legal officers in PPL have no knowledge
### Appendix D: Due Diligence of Existing Operations

<table>
<thead>
<tr>
<th>Notes on environment acts and regulations</th>
<th>Wording in Act and Regulations and other comments</th>
<th>Rouna 1</th>
<th>Sirinumu (&lt; = up to)</th>
<th>Rouna Cascade</th>
</tr>
</thead>
<tbody>
<tr>
<td>dispensation?</td>
<td>Permitting has been referred to Environmental Officer in PPL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action taken</td>
<td>No written records have been kept of PPL approaching DEC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IF NOT dispensed other Regulations would seem to still apply</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPAR 2002</td>
<td>Defines Level 2 and Level 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule 2</td>
<td>14.1 Activities involving investment of a capital cost of more than K50 million, except where such investment is made in pursuing an activity otherwise dealt with in this Regulation in which case that category of activity will apply to the investment.</td>
<td></td>
<td>Would be borderline Level 3 (25mill US$ = 50mil Kina). But is captured by section 10.1 therefore section 14.1 does not apply.</td>
<td></td>
</tr>
<tr>
<td>Schedule 2</td>
<td>19.1 Construction of major hydropower schemes or water supply reservoirs inundating an area greater than 5 km².</td>
<td>Level 2</td>
<td>Level 2 for reservoir.</td>
<td>Level 3 (as &gt;50million Kina)</td>
</tr>
<tr>
<td>Level 2 and Level 3</td>
<td>Require environmental permit</td>
<td>Yes</td>
<td>No, Not for TOD</td>
<td>Yes (R1, R2, R3 &amp; R4).</td>
</tr>
<tr>
<td>Level 2 activities</td>
<td>10.1 Operation of hydroelectric plants with a capacity of more than 2 Megawatts (MW).</td>
<td>5.5 inc. to 6.0MW (+2.5MW unit 4)</td>
<td>1.5 inc to 1.6 MW No (L2 is &gt;2MW)</td>
<td>R1, R2, R3 &amp; R4.each are Level 2</td>
</tr>
<tr>
<td>Requires clarification from DEC</td>
<td>Is this expansion at R1 under Sec 44(1) b?</td>
<td>Or is it exempt under Sec 44(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes as a result of subprojects</td>
<td>Level 2 activity was always carried out at R1, R2, R3 &amp; R4 but no permits can be found</td>
<td>BUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEC need to be consulted about permits required</td>
<td>Rouna 1 will go up from 5.5MW to 6.0MW or possible 8.5MW if unit 4 is retained.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 44 Obligation to have permit</td>
<td>No current valid permits for the operation of Sirinumu to Rouna 4 cascade can be found;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment (Amendment) Act 2000</td>
<td>For purposes of Schedule 2 – Section 14.1 Activities involving investment &gt;K50 million</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>PPL cannot produce any current valid permits for the operation of Rouna 1 or Sirinumu reservoir or Rouna cascade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation</td>
<td>DEC decision on environmental permitting requirements is required. Therefore notification to DEC should be prioritized to obtain clarification as soon as practicable. Notification has been drafted under the TA by environmental workstream. PPL need to finalize.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D: Due Diligence of Existing Operations

D. OPERATIONAL AND MAINTENANCE IMPACTS

There are occasional small scale impacts arising at Sirinumu from routine operations and maintenance. They include (i) waste disposal, (ii) clearing drainage and access roads near buildings (iii) occasional earthworks for service road maintenance and drainage, (iv) maintenance of header pond, intake and penstock, (v) delivery and installation of spare parts and equipment, (iv) maintaining toilets and washrooms, and (vi) managing safety of various worker activities in and around the site. These impacts are minor in scale and do not constitute non-compliance with SPS.

For purposes of this DDR existing facilities or aspects of operations and control measures that do not meet SPS requirements have been identified.

GENERAL WASTE MANAGEMENT

There is no waste collection from Sirinimu. Small amounts of general refuse are burned periodically in an open hearth built from cement. The mitigation measures for waste will seek to reduce, recycle and reuse waste as far as practicable. The mitigation measures are not repeated here in full but the Waste Management Plan (WMP) included for the EMP will also be sufficient to control other waste from Sirinimu. The key actions for general waste disposal are to:

- Introduce waste reduction, reuse and recycling methods
- Segregation wastes at source
- Prohibit burning of operational and general wastes.
- Establish regular disposal schedule for general waste
- Organic (biodegradable - such as tree trimmings) shall be collected, stockpiled and given to the local community (NO BURNING is allowed on site)
- Rouna 1 yard shall be provided with garbage bins
- Disposal of solid wastes into drainage ditches, rivers, other watercourses, agricultural fields and public areas shall be prohibited
- If local waste disposal areas are used they should be approved by local authorities shall be operated in line with the DEC environmental code of practice for Sanitary Landfill Sites and rehabilitated, monitored, catalogued, and marked
- If waste disposal is not to local site it shall be to the Baruni dump in NCDC.

US MATERIALS AND HAZARDOUS WASTE DISPOSAL

Transformer oil and other oils and lubricants are hazardous substances used at Sirinimu. The use of hazardous substances such as oils and lubricants is controlled to skilled staff and drip trays are being used to collect surplus oils and lubricants after maintenance. Transformer oil drums are either stored upright or on the side on the open floor. There is no monitoring of waste oils and lubricants disposal.

In order to minimize impacts from incorrect storage and disposal of hazardous substances in the construction stage several mitigation measures have been proposed for the contractor to implement. These will be covered in the Hazardous Materials section of the WMP. Several of the mitigation measures are also relevant to routine operations at Sirinimu to bring the operations in line with SPS. The contractors shall ensure implementation of such measures.

- Ensure safe storage of fuel, other hazardous substances and bulk materials in line with DEC environmental code of practice for Vehicle/Machinery Workshops and Petroleum Storage / Resale / Usage is followed
- Ensure that transformer oil drums are stored drums on side with outlet at 9 o’clock or 3 o’clock to keep bung moist and avoid penetration of water vapour
- Ensure all storage containers are in good condition with proper labeling
Appendix D: Due Diligence of Existing Operations

- Regularly check containers for leakage and undertake necessary repair or replacement.
- Store hazardous materials above possible flood level
- Discharge of oil contaminated water shall be prohibited
- Used waste oil and other toxic and hazardous materials shall be disposed of off-site at the PPL Hohola maintenance area stockpile
- Adequate precautions will be taken to prevent oil/lubricant/ hydrocarbon contamination of drainage channel beds
- Make spill clean-up materials available (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored
- Immediately clear up spillage, if any, with utmost caution to leave no traces.

POLYCHLORINATED BIPHENYLS (PCBS)

PCBs were widely used as dielectric fluids in transformers and capacitors up to the 1980s. Since that time and since the 1990s new equipment has generally been supplied free of PCBs. It has not been possible for the maintenance section of PPL to identify any records of PCB content of the PPL equipment; much of which was inherited earlier from the PNG Electricity Commission. Discussions with the maintenance section at PPL indicated that many of the transformers and capacitors still in commission by PPL outside the NCD date from the 1980s to 1990s period and therefore they may contain or may have contained PCB.

Transformers and capacitors do not generally require frequent maintenance but the transformer oil is checked regularly and topped up as necessary. PCBs have not been used in transformer oils for many years.

Due to the gradual replacement of the transformer oil as the topping up proceeds over many cycles over several years PCBs in old transformers will be gradually flushed out but residual PCBs can remain trapped and leach out only slowly into fresh transformer oil. Thus the replacement transformer oil can become contaminated.

PPL have also been accustomed to reconditioning the transformer oil for reuse and therefore there remains a third possibility that reconditioned transformer oil can become contaminated if it is mixed with oil from PCB containing equipment. If this oil is reused in an otherwise uncontaminated or newer transformer this may lead to contamination of equipment that originally did not containing any PCBs.

The maintenance department of PPL indicated that most transformers in the distribution grid system in the NCD area had been replaced in recent years and that most of the transformers are fairly new. Therefore it seems unlikely that any replaced transformers in service in the distribution would have contained PCBs.

Some of the transformers at the substations have also been replaced in the last 20 years and it also seems unlikely that transformers in service in the substations contain PCBs. However the lack of record keeping regarding the sources and use of reconditioned transformer oil make it difficult to rule out any PCB contamination of the substation transformers.

PPL have not been accustomed to keeping detailed records of the sources of oil used to top-up transformers and therefore there is a low possibility that some of the PPL transformers in service may have been contaminated with PCB or may still contain oil that may be leaching residual PCBs. The only way to check this would be to analyze the transformer oils for PCB. However there is no accredited laboratory in PNG that can make this analysis and samples would need to be transferred overseas.
Appendix D: Due Diligence of Existing Operations

Options for treatment of PCB contaminated transformers have been developed by specialist companies and include:

i. Collection of PCB-contaminated transformers and equipment
ii. Pumping-out and rinsing of this equipment (using solvents)
iii. Disassembly and cleaning of these objects for purposes of removing PCBs
iv. Sorting and processing into scrap of the cleaned metal parts
v. Distillation of the solvents

End disposal of waste PCBs can include high temperature incineration. Co-disposal in secure landfills has also been used.

If oil in transformers or waste transformer oil is subsequently discovered to contain PCBs there is no disposal facility in PPL or PNG and therefore treatment by specialist company overseas would seem to be the only option at this stage. However these types of facilities are not available in PNG. Replacement of the transformers is one option. In the interim waste transformer oil is being stockpiled at Hohola maintenance depot.

For this subproject, new equipment and transformer oil will be supplied without PCB and for purposes of the subproject a way forward would be to ring fence the new subproject transformers and other equipment needing dielectric oil and make sure that new equipment is only serviced with new PCB free transformer oil. It future the subproject transformers and capacitors will only receive PCB free transformer oil so that they do not become contaminated and remain PCB free. A rule can be made that no new equipment supplied under the subproject can be serviced with reconditioned dielectric oil.

Subsequent purging of older equipment can take place as PPL finances permit.

In order to minimize impacts from unknown status of PCBs at Sirinimu substation the following measures are proposed to be included in the Hazardous Materials section of the WMP and implemented to bring the subproject in line with SPS.

- Enforce a rule in line with ADB guidelines on environmentally responsible procurement that new equipment is supplied free of PCB and certified to be PCB free. No new equipment shall be supplied with PCB contamination.

- Ring fence the new subproject transformers and other equipment needing dielectric oil.

- Enforce a rule that no new equipment supplied under the subproject can be serviced with reconditioned dielectric oil.

- Ensure that the new equipment is only serviced with new PCB free transformer oil.
- Ensure that in future the subproject transformers and capacitors will only receive PCB free transformer oil so that they do not become contaminated and remain PCB free.

The following mitigation measures are also relevant to routine operations to bring them in line with SPS. PPL shall ensure the contractors implement these measures.

- Isolate and stockpile waste dielectric oil from transformers and stockpile at Hohola maintenance depot.
Appendix D: Due Diligence of Existing Operations

- Store waste dielectric oil from transformers in line with DEC environmental code of practice for Vehicle / Machinery Workshops and Petroleum Storage / Resale / Usage.

- In the medium term identify a safe disposal option for PCB waste dielectric oil from transformers in line with SPS and ADB guidelines on environmentally responsible procurement and DEC environmental code of practice.

There is a need to maintain local existing drainage ditches and culverts to prevent damage to the site from heavy rainfall on the surrounding hills. Maintenance of drainage should focus on:

i. Prevention of flooding and ponding around Sirinimu TOD and adjacent channels;

ii. Protection of work crews from hazards associated with heavy rainfall draining towards the site;

iii. Maintenance of access to adjoining properties; and

iv. In areas close to the PPL residential compound, the existing drains would be maintained so that the outfalls of the surface run-off are diverted away from the sensitive receptor.

OCCUPATIONAL HEALTH AND SAFETY

Routine health and safety measures are in place at Sirinimu and PPL’s other long-standing facilities and operations. The PPL occupational and health and safety manager is on call to Sirinimu and contact numbers are posted on the notice boards at the Sirinimu site. The site manager as local safety representative instructs and inducts all workers and visiting contractors in health and safety matters before they start work and site agents/foremen will follow up with toolbox talks on a weekly basis.

Workers are provided with personal safety equipment suitable for electrical work and ear protection is also available at no cost to the workers. There is provision of potable water in the work locations. Fencing is installed on areas next to walkways and deep pits into which workers could fall. The yard is provided with toilets/sanitation facilities and these will be also used by the contractors to prevent any hazard to public health or contamination of land, surface or groundwater. These toilet facilities need to be cleaned daily and well maintained to allow effective operation.

A health and safety plan (HSP) will be submitted along with the CEMP by the contractor and no difficulties are foreseen in being able to dovetail the HSP with routine health and safety procedures already being implemented at Sirinimu. Worker occupational health and safety is generally governed by the PNG Employment Act 1978 and meets the provisions of World Bank Environmental, Health, and Safety General Guidelines. Workforce training for all workers will include environment, safety and environmental hygiene.

In addition to maintaining the above facilities the occupational health and safety at Sirinimu should focus on:

i. Maintaining toilet facilities in a clean and tidy condition by cleaning daily and keeping flush toilets well maintained to allow effective operation.

ii. Dovetailing routine occupational health and safety measures with the HSP to be submitted by the contractor before construction commences.
Appendix D: Due Diligence of Existing Operations

River protection
Based on observation there is no ongoing disruption of the Laloki River bed. The river bed will not be modified. The flow regime of the river and tributaries will not be affected by the project. Waste materials are not being disposed to the rivers. The Laloki River supports subsistence fisheries in the area that will be protected during the works. Provisions in the EMP will protect the river. Water quality monitoring during the works is recommended in the IEE but should not be necessary for routine operations.

Water Resources
The water abstraction for Sirinimu was provided for in a Water Use Permit under the Water Resources Act. Action is being taken by PPL to contact DEC and regularize the water abstraction and other environmental permits required for the Sirinimu scheme and the Rouna cascade system. Provisions have been made in the EMP to ensure all necessary environmental permits are obtained before construction works commence.

E. CONCLUSIONS AND RECOMMENDATIONS
This DDR concludes that the environmental impacts from the existing activities at Sirinimu are not significant. However lessons have been learned from the DDR and some matters require attention on order that existing operations comply with the SPS. Potential impacts are manageable if the mitigation measures mentioned above are implemented thoroughly. The EMP in the IEE presents a more detailed analysis of the environmental impacts and the required mitigation measures based on the type, extent and duration of the identified environmental impacts. The EMP has been prepared through close reference to best practices and compliance with PNG laws and the SPS. The key actions are summarized below:

i. Set up a training program for the PMU for the Project and continue in-house training on environmental and social safeguards to support PPL projects and routine operations in future.

ii. Disclose the current situation with regards to environmental permitting for Sirinimu (and Rouna) to DEC and seek guidance on how to regularize the permitting.

iii. Introduce waste management planning, reduction, reuse and recycling methods and off-site disposal at authorized site and prevent burning of waste in line with the DEC environmental codes of practice.

iv. Minimize impacts from incorrect storage and disposal of hazardous substances in line with DEC environmental code of practice for Vehicle / Machinery Workshops and Petroleum Storage / Resale / Usage is followed.

v. Stockpile used waste oil and other toxic and hazardous materials off-site at the PPL Hohola maintenance area stockpile, awaiting bulk disposal by PPL.

vi. Prevent flooding and protect work crews from hazards associated with heavy rainfall by maintaining existing drains so that the outfalls of the surface run-off are diverted appropriately away from the sensitive receivers.

vii. Dovetail routine occupational health and safety measures with visiting contractor health and safety procedures before maintenance works commences.

viii. Maintain clean toilet facilities by cleaning daily and keeping flush toilets well maintained to allow effective operation.

ix. Maintaining consultation and grievance redress mechanism for routine operations to enable focus on continuing good public relations and maintaining an open door policy for complaints and concerns from the public.
Appendix D: Due Diligence of Existing Operations

With these measures in place, the environmental impacts of Sirinimu’s current operations can meet the objectives of SPS and will not result in any residual impacts which are above accepted environmental standards.