

**E2554 v3**  
**ENVIRONMENTAL IMPACT ASSESSMENT**

**PROJECT TITLE :**  
**TONGA POST-TSUNAMI RECONSTRUCTION PROJECT FOR**  
**NIUATOPUTAPU(TPTRP)**

**November 2012**

# **ENVIRONMENTAL IMPACT ASSESSMENT; PROJECT TITLE : TONGA POST-TSUNAMI RECONSTRUCTION PROJECT FOR NIUATOPUTAPU(TPTRP)**

## **A. Introduction/Background**

As required by Regulation 16 of the Environmental Impact Assessment Regulation 2010 (“the Regulations”) and also by the World Bank Environmental and Social Safeguards Policy Framework, this Environmental Impact Assessment focuses specifically on assessing the potential environmental impacts relating to the following activities:

- i. Extension and Connection of Village Reticulated Water Supply to all the newly built cyclone-resistant houses for the new settlements at Hihifo, Vaipoa and Falehau Villages in Niuatoputapu.**
- ii. Repairing of the Existing 6.7km sealed road from the wharf at Falehau to the airport.**
- iii. Upgrading/Extension of Small Boat Jetty at Pasivulangi Wharf, Falehau**

These additional activities are to be funded from the unallocated balance of the IDA Grant for the Tsunami Reconstruction Project for NTT and are described in more details under Section B of this Report.

## **Project Objective**

The overall objective of the Tonga Post-Tsunami Reconstruction Project is to improve infrastructure, livelihood and normality to the people of Niuatoputapu following the 2009 tsunami.

The main activities for the overall rehabilitation/recovery program for Niuatoputapu include: relocation and reconstruction of residential buildings, small business building and community buildings including rainwater harvesting and sanitation facilities, reconstruction and rehabilitation of roads, construction of a new hospital, upgrading of school facilities, telecommunication, government offices, airport and wharf facilities, upgrading and extension of reticulated water system, solar electrifications, installation of an early warning system as well as improvements of livelihood activities.

## **B. Brief Description of the Additional Activities**

More detail descriptions of the three specific activities covered under this EIA, are outlined below.

### ***i. Extension of Village Reticulated Water Supply to Newly Built-Replacement Housing Units***

The World Bank Implementation Support and Review Mission which visited Tonga from 1-11 September 2012 agreed with Government to provide urgently needed permanent water supply to all the new buildings being constructed under the Tsunami Reconstruction Project which include: i) 73 residential buildings, ii) 3 community weaving houses and iii) 2 bakery buildings which upon completion of the construction works, permanent water supply system should be connected to them. The detailed design, technical specifications, cost estimates and the drawings for this activity has been completed and was undertaken by the Tonga Water Board to be installed/constructed by the existing Contractor for the Works Contract A.1.1- Construction of Replacement Housing Units under a variation to the existing contract A.1.1.

The works will basically involve digging of trenches of about 2 ½ ft for the water mains along the newly constructed roads leading up to the water pumps and tank stands for each of the villages of Hihifo, Vaipoa and Falehau and then connecting to all the newly built houses. The water pipes to connect the water supply from the individual houses to the water main have already been installed. What remains to be done are the connections of the individual water system to the water-mains as discussed above.

Estimated Cost : The total estimated costs for the extension of the village water supply to the newly built replacement housing units are as follows:

		<b>TOP</b>
Hihifo	-	176,858.00
Vaipoa	-	45,915.00
Falehau	-	<u>160,802.00</u>
<b>Total Estimated Costs TS</b>		<b><u>383,575.00</u></b>

***Refer to the Pipeline Plans for Hihifo, Vaipoa and Falehau which are attached.***

### **ii. Repairing of the Existing Sealed Roads**

This additional activity will involve repairing and resealing of the existing sealed roads of 6.7km from the wharf at Falehau to the airport. These sealed roads were constructed in 2011 by the Ministry of Works and the Tonga Defense Services. An inspection of these roads by the World Bank Implementation Support Mission and the PMU Project Engineer in April 2012, revealed extensive reflection cracking in the sand seal and loss of bond between surface and base, which could indicated i. scratches of the base due to excessive

plasticity and ii. Insufficient thickness of the seal, mostly likely caused by insufficient bitumen or iii. Possible over leaking of the bitumen before application causing brittleness.

***Refer to the photo attached showing cracking on the existing roads to be repaired***

The rehabilitation of existing main roads of 6.7km from Falehau wharf to the airport will essentially involve i. repairing the existing base course by patching or reconstructing poor areas and (ii). Resealing the surface over the full 6.7km with a nominal 5mm sand seal.

**The total cost for this activity is estimated at TOP\$294,280.00**

### **iii. Upgrading/Extension of Small Boat Jetty at Pasivulangi Wharf, Falehau**

This activity involves the upgrading and extension of the small and safe landing space for small boats jetty to provide ample and safe landing space for small boats from Tafahi Island and for fishermen when loading and off-loading agricultural produce and their fishing gear and catches. The design and cost estimates for this activity has been prepared by the Project Engineer at a total estimated costs of TOP\$75,000. Implementation will await pending availability of funds from the unallocated balance of the Project Fund.

***(See photo of the Pasivulangi wharf showing the small boat jetty to be upgraded)***

## **C. Environmental and Social Safeguards - Overview**

The new settlements at Hihifo, Vaipoa and Falehau were inspected by the World Bank Environmental and Social safeguards Specialist as a member of an Implementation Support and Review Mission from the Bank which visited Tonga in April and September 2012. The materials for the construction of the houses and roads have been sourced locally from an inland quarry and three coastal sites where sand and coral materials were taken. There was no significant negative environmental impacts observed from the implementation of these activities. The Contractor has complied with the Environmental Management Plan as required under the Contract.

Summarized below are the findings and recommendations by the World Bank Mission in relation to environmental and safeguards for the Project.

### **i. Cyclone Resistant Housing**

Impacts related to construction of the houses such as dust and construction debris have been minimal. The three sites for the replacement housing project, are at Hihifo, Vaipoa and Falehau. Notable in the design of these houses are improved sanitation, disaster resistance and adequate water supply. The use of Roto-Mould plastic septic tanks will provide leak proof septic tank. A proper soak-pit with coral material providing enhanced filtration of the over flow, provides adequate mitigation of the domestic waste water generated by the occupants of the houses. The inland location of the houses and the use of tension connectors for all elements of the house provide disaster resilience from tsunami, floods

and cyclone force winds. The use of rainwater harvesting will have a positive impact on the environment as large plastic tanks with a 5000 liter capacity have been installed and should provide for most of the water requirements of each family. The addition of reticulated water supply for all the families in the new settlements will augment the harvested rainwater supply. No complaints from the communities have been reported. There have also been no reports of injuries to workers. There is a general agreement in the communities regarding the objectives of this project which is providing a very basic need – housing.

## **ii. Quarries**

There is one inland quarry which has provided limited materials as road base and especially in filling the drainages. Excavation of the materials needed for the project has been limited to the minimum amount. Vegetation of the sites will be carried out as required under the EMP. As is usual in the tropics, vegetations has started to return naturally in areas previously excavated. Aside from the inland quarry, there are 3 quarry sites which provided sand and coral materials for the construction of the houses and the roads.

The Niua Development Committee, the PMU and the local communities have expressed a strong interest in implementing a “coral-sand quarrying restoration activity” to restore these areas. It has been observed, that despite the extraction of sand and coral materials from these areas, fish life has been thriving in the deep in the pools created at the quarry sites. The establishment of mangrove and other tree species will restore these areas as habitat for marine life.

The proposal for the coral sand quarrying restoration activity has been prepared by the MLECCNR at an estimated cost of T\$30,000 to be implemented during November 2012-February 2013.

Both the Contractors and the Construction Supervision team have been constantly reminded about the provisions of the EMP to ensure continued compliance with EMP and with good environmental practices, will ensure the good quality of the final infrastructures. The Project overall can be gauged as having achieved its objective in close compliance with the approved EMP.

**D. This Section will address the various issues required under the Environmental Impact Assessment Regulation of 2010.**

**1. Description of the Purpose and Scope of the proposed development activity**

***a. Purpose : What goal and objectives of the society are served? Why is the Project needed.***

The Project aims at improving the cultural, social and economic well-being of the people of Niuatoputapu and to bring back normality following the tsunami in 2009.

***b. Direct benefits expected, products, services, jobs return on investment***

The improved water system will cater for an essential basic human needs essential for good healthy living. The extension of the reticulated water system at a Contract Cost variation of TOP\$383,576 will provide employment and incomes for about 3 people from Tongatapu and about 15 casual workers from Niuatoputapu during the construction phase which runs from late October – mid December 2012 thereby providing income for the local workers.

***c. Location and Extent of Site boundaries and associated facilities at preferred sites and other feasible sites (maps are attached)***

The new water tank 5000gal with tank stand to provide water to the new settlement at Hihifo will be located on higher ground on the site for the new hospital. For Vaipoa, the new settlement will be serviced from the existing reticulated water system just across the road. For Falehau, a new 5000gal water tank with stand will be located on community land at the new settlement which is about 1km from the existing well and pumping stations. The water for the new overhead tanks for Hihifo and Falehau will pumped from the existing wells.

***d. Technology to be used***

No sophisticated technology is required for the implementation of the three activities except a chain digger and other earth moving equipment, loader etc for clearing and digging the trenches for the water mains. The upgrading of the wells and water pumps, being funded under Japan's aid, will involve the installation of solar pumps for all the 3 villages in order to reduce and/or maintain costs at low level.

***e. Local Infrastructure required: roads, utilities etc***

The key objective of the Project is to improve living standards of the island population through the reconstruction/rehabilitation of much of the infrastructures on the island such as housing, water and sanitation, roads, harbour and wharf, hospital, schools, banking, telecommunications etc.

### ***f. Duration of Construction Period and Operating Life***

The extension of the community reticulated water system is planned to run from mid-October to mid-December 2012 and for rehabilitation/resealing of the existing roads, this is planned to be implemented from September 2012- January 2013. The expected life of the new water tank and stand would be about 10-12 years and for the resealed roads, 7-10 years.

## **2. Justifications for the development activities in terms of environmental, economic, cultural and social considerations**

- **Environmental** – The extension of the water mains and connecting to the newly built houses will involve basically, trenching for the main water pipes and the trenches will be refill and regrowth of vegetation will be natural. The environmental impact of this activity will be minimal.
- **Social and economic** : the improve reticulated water system and roads when completed will have direct positive impact on improving the communities health and standard of living as well as their economic livelihood.

## **3. Identify, describe and analyze the potential direct and indirect physical, biological, social, cultural and economic impacts of the development activities for both construction and operational phases of the development.**

The potential environmental impacts of the proposed activities that may arise during both the construction and operational phases are as follows:

### **a. Air Quality**

#### **Construction Phase**

#### **Possible air quality impacts during construction phase include:**

- fugitive dust arising from excavation, demolition and construction of structures, movement of construction traffic over the site area, and wind erosion of open sites; and
- cumulative impact of fugitive dust resulting from any adjacent construction works.

#### **Air Sensitive Receivers (ASRs)**

- such as residential premises, offices, shops, and active open spaces in the vicinity of the work sites may be impacted.

#### **Operation Phase**

- Operation phase air quality impact arising would be vehicle emissions of nitrogen dioxide and respirable suspended particulates from traffic on the proposed roads.

- Cumulative air quality impact taking into account emissions of dust from the existing road may have impact on the nearby ASRs.

## **Noise**

### **Construction Phase**

- During the construction phase, powered mechanical equipment which are expected to generate noise include: breakers (both portable and excavator-mounted), power units for various types of plant, including air compressors, excavators, trucks, graders and loaders. Moreover, major noisy activities include breaking road surface, excavation, and road surfacing and handling of earth materials.
- Noise sensitive receivers (NSRs) such as residential premises and schools in the vicinity of the work sites may be impacted.

### **Operation Phase**

- During the operational phase, traffic noise from the new road may have impact to the NSRs.

## **b. Water Quality**

### **Construction Phase**

- Excavation of road construction materials from reef may affect the quality of seawater around the vicinity.
- During the excavation for construction materials and the construction of the new marine boat landing place there could be temporary elevation in concentrations of suspended solids and generation of sediment plumes, leakage of concrete, possible release of organic and inorganic contaminants and nutrients as well as creation of potential embayment, which may affect the water quality.
- For the land-based construction works, site runoff from the bituminous road surface would be the major source of water quality impact.

### **Operation Phase**

- Water quality impact during the operation phase of the CBL is considered negligible, as the impact would be confined to the road surface runoff.

## **c. Ecological and Fisheries**

### **Construction Phase**

- Excavation for road construction materials and the construction of marine landing facility works may impact isolated small colonies of corals and fisheries in the area. However, apart from an area of corals of significance close to the island, the marine ecology is considered to be of low conservation interest.

### **Operation Phase**

- The potential impacts on marine ecology may include loss of seabed and its surrounding which have loss of potential fishing ground is considered to be of little effect on fisheries production in Niuatoputapu as a whole.

### **d. Waste Management**

#### **Construction Phase**

- Wastes generated by the construction works are likely to include excavated spoil, construction wastes, used products and dredged sediment. The possible presence of contaminated sediments that may require excavation and disposal will need to be assessed.

#### **Operation Phase**

- There would be no waste during the operation phase.

### **e. Landscape and Visual**

#### **Construction Phase**

- Landscape and visual impacts are expected from construction works such as marine excavation and construction, road construction, construction plant, etc. The impacts would be temporary.

#### **Operation Phase**

- The landscape character of Niuatoputapu will not be affected by this construction works.

### **f. Cultural Heritage**

#### **Vai-ko-Niutoua; Underground Water Stream**

- Vai-ko-Niutoua is an underground water stream created by stalagmite and stalagmite has a cultural significance to the people of the island. It once supplied the island with fresh water for drinking and domestic hygiene. Its name also has a significant attachment to the island. The excavation from the reef was made sure that it would not affect the flow of water out from the stream.

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### **g. Major Elements of the Surrounding Environment**

- The major existing and planned sensitive receivers that may be affected by the proposed project are summarized as follows. The locations of these receivers are shown in the attached drawings.

## **4. Environmental Protection Measures and any Further Environmental Implications.**

## **Mitigating Measures to Minimize Environmental Impacts**

### **a. Air Quality**

- The following dust control measures to minimize the dust nuisance during the construction phase should be considered:
  - vehicle wheel and body washing facilities at site are provided
  - reduction of vehicle speed
  - reduction of unpaved roads
  - regular wetting of the site (using browsers, sprays or vapor mists) to reduce dust
  - the earthmoving activities must be carefully and well planned. Such planning shall include the transportation routes as well as protective measures such as the employment of water-spraying and tarpaulin sheets to suppress the dust generated during and after excavation
- Dust, which is predominantly associated with construction, is not expected to be an issue during the operational phase. Exhaust gaseous emission by vehicles should be considered in the air quality assessment under the EIA Study.

### **b. Noise**

- To mitigate the construction noise impacts, the following measures should be considered:
  - use of silenced equipment
  - use of mufflers, silencers and acoustic linings for noisy mechanical equipment
  - employment of alternative concrete breaking techniques
  - siting of equipment
  - careful scheduling of work, especially near the educational institution where examination periods shall be taken into consideration
  - use of temporary acoustic barriers if required
  - proper maintenance of equipment
  - use of construction noise specification and clauses
  - adequate site supervision to ensure that every practical means is adopted to minimize the noise impacts
- To reduce traffic noise during the operational phase, the following measures should be considered:
  - low-noise road surfacing materials
  - noise enclosure and/or barrier

### **c. Water Quality**

- Temporary drainage systems, with interceptor manholes and appropriate sediment settlement measures, will be required to trap oil pollutants and debris initiating from within the site, and to separate pollutants prior to discharging into the drainage system. The following mitigation measures should also be considered:

- before commencement of demolition works, sewer and drainage connections should be sealed to prevent debris entering the public sewers/drain
- stockpiles should be covered to avoid erosion and washing of solid waste into the drainage system
- for backfilling using public fill, the maximum fine content of fills should not exceed 5%
- installation of silt curtain during bored piling works
- During the operation phase, the following mitigation measures should be considered to reduce impact on water quality:
  - provision of silt traps to reduce the concentration of silt/sediments in storm water runoff
  - regular inspection and maintenance of the drainage system to ensure that pollutant removal facilities are in good working order

#### **d. Waste Management**

- The main source of solid waste during the construction phase will be excavated spoil and sediment. Other materials including surplus construction materials, used products and municipal type waste will also be generated. To minimize impacts, the following mitigation measures should be taken into consideration:
  - waste management in the way of avoiding, minimizing, reusing, and recycling should be adopted to reduce waste generation
  - solid waste shall be removed from the site and taken to a designated disposal site
  - contaminated sediment will, subject to its detailed classification by a forthcoming site investigation, be properly disposed of to relevant designated dumping ground.

#### **e. Landscape and Visual**

##### **Mangrove enhancing replanting**

- Mitigation measures to minimize the landscape and visual impacts may include but not limited to:
  - compensatory planting of mangrove, toa and feta'u trees around the vicinity of the area where the road construction materials were excavated and this would stop coastal erosion hence improve visual effects.

#### **f. Cultural Heritage**

- Impacts to sites of cultural heritage or archaeological resources that are affected by the project should be assessed and mitigation measures may include but not limited to:
  - preservation in whole or in part
  - temporarily fenced off buffer zone
  - monitoring of vibration impacts

**Note :** The Environmental Impact Assessment and Management Plan including costs estimates are summarised in Table A attached.

## **5. Evaluate and describe any feasible alternative activities, including locations for achieving the objections of the development**

Given that the reticulated water system – wells, water pumps, tanks and stands as well as all the replacement houses have all been constructed on the approved sites, it is not necessary to consider other alternative sites. Similarly, the limited volume of coral materials and sand required for rehabilitation/resealing of the existing roads can best be excavated from the existing sites for which materials for the original roads construction were obtained from. Due to the existing conditions of the machineries currently on the island only limited quantities of coral materials can be excavated from the existing quarry for parts of the roads rehabilitation. Otherwise, much of the requirements for upgrading the existing roads would be the sand for tar-sealing.

## **6. Evaluate and describe the implications and Consequences of not undertaking the proposed development**

If the reticulated water is not extended and connected to the newly built houses on the new settlements, the modern septic toilets and shower facilities provided cannot be used properly and this can become a serious health risk. The existing roads from Falehau to the airport constructed in 2011, is already showing extensive reflective cracking and breaking up in many sections of the road which obviously needs urgent upgrading. The dilapidated conditions of the existing roads will only get worse if nothing is done to rehabilitate. The fact that there are existing plants and equipment including man power resources present on the island, provides an excellent opportunity for the rehabilitation of the existing roads.

## **7. Identifying, describe and analyze possible cumulative effects upon components of the environment with other existing or likely future development activities**

It is recognized that the excavation of coral and sand materials for roads construction from coral reef flats surroundings Niuatoputapu has potential for major environmental impacts including coral erosion or loss of biodiversity that should be avoided.

The EMP for the construction of replacement housing units and construction of the new roads and within the new settlements strongly support the additional activity for the restorations of the sand-coral quarrying sites by planting mangrove trees and other tree species (feta'u and toa) to restore the habitat of these sites. This activity has the strong support of the local communities. On the positive site, it has been observed that despite the negative impacts due to extraction of sand-coral materials from the three coastal sites at Hihifo, fish life has been thriving in the deep in the pools created on the quarry sites.

## **8. Public/Community Consultations**

Public consultations were undertaken prior to commencement of the reconstruction with communities of the 3 villages of Hihifo, Vaipoa and Falehau regarding the design and scope of the replacement housing units including the provision of rain water harvesting and sanitation facilities. In addition, community consultation were also conducted regarding the excavation of coral materials and whilst there were strong views against the proposed excavations of sand and coral materials from the flat coastal reef due to possible negative environmental impacts, but given that there was no other feasible option for sourcing the base materials for the construction of new roads, and the extension of the reticulated water system, the majority of the communities agreed to allow the sand-coral excavations to be implemented in order for the construction works to be completed as soon as possible.

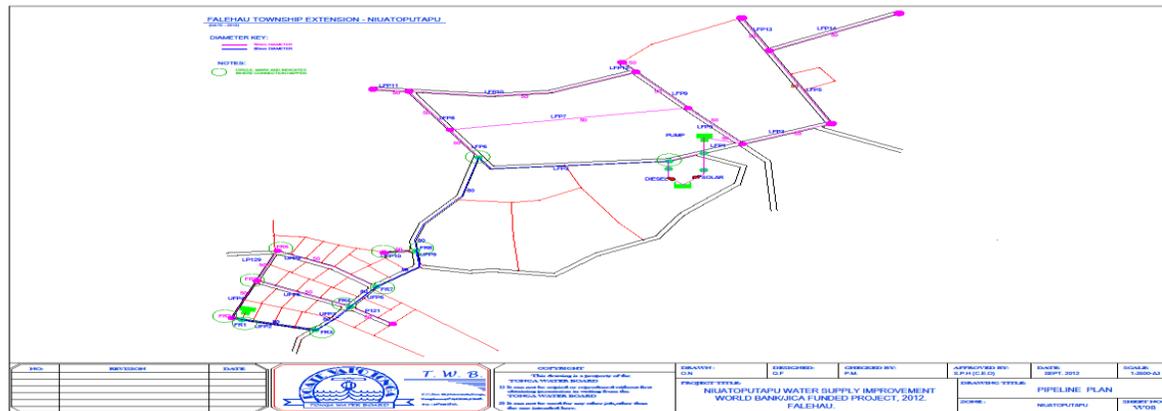
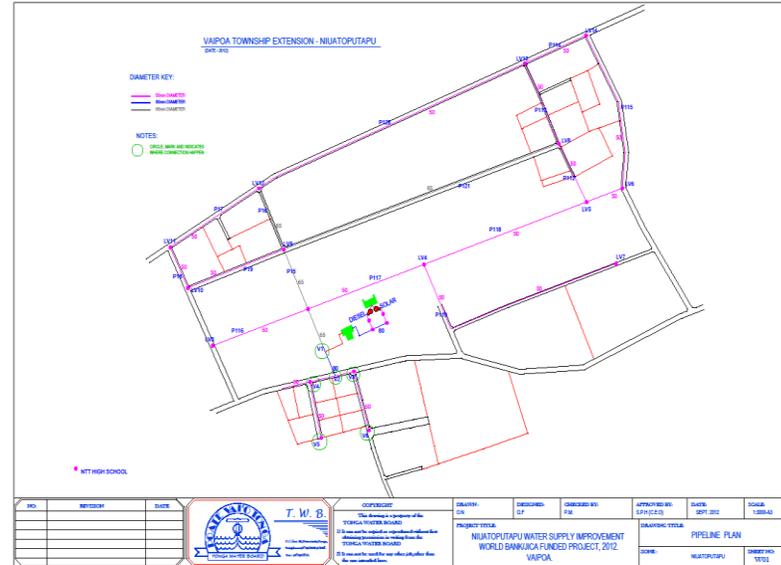
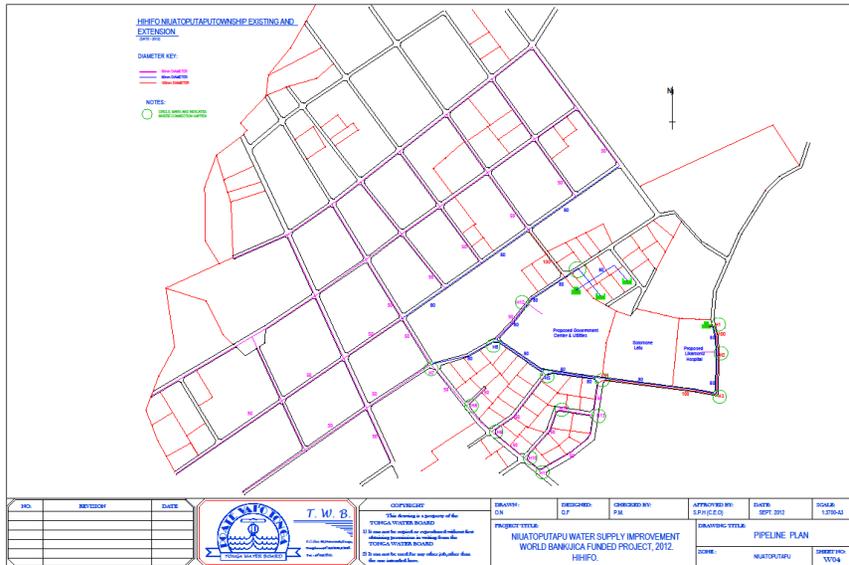
**Table A : Environmental Impact Assessment and Management Plan**

<b>Key Activity</b>	<b>Potential Environmental Impact</b>	<b>Negative or Positive</b>	<b>Minor Or Major</b>	<b>Reversible Or Irreversible</b>	<b>Mitigating Measures</b>	<b>Implementing Agency</b>	<b>Cost Estimates</b>	<b>Timeline</b>
1. Clearing and digging of trenches for the reticulated water mains	<ul style="list-style-type: none"> <li>• Chain digger may cause damage to existing sealed roads</li> <li>• Trenches if not properly compacted especially on the slope from new hospital site to the new settlement at Hihifo can cause soil erosion</li> </ul>	Negative	Minor	Reversible	<ul style="list-style-type: none"> <li>• Contractor to ensure that the trenches for the pipelines are well compacted.</li> <li>• Communities are encouraged to plant ornamental plants along the road side to protect soil erosion</li> </ul>	Contractor, Govt Representative and the Communities	<ul style="list-style-type: none"> <li>• To be implemented by the Contractor</li> <li>• Community involvement to be provided free</li> </ul>	Nov – Dec 2012
2. Safe disposal of leftover plastic materials following completion of reticulated water Extension	<ul style="list-style-type: none"> <li>• Burning can cause air pollution</li> </ul>	Negative	Minor	Reversible	<ul style="list-style-type: none"> <li>• Left over unused plastic materials should be buried</li> <li>• Apply proper waste management</li> </ul>	Contractor and Tonga water Board Supervisor	As above	Nov- Dec 2012
3. Quarrying of materials for rehabilitation/resealing of Existing Roads	<ul style="list-style-type: none"> <li>• Disruption of habitat can affect fish and other marine organisms</li> <li>• Deep water ponds created can pose risk to children swimming in the area</li> <li>• Can cause coastal erosion and increase the</li> </ul>	Negative	Minor	Reversible	<ul style="list-style-type: none"> <li>• Carefully select area to be excavated</li> <li>• Limit the quantity of excavated materials only for whats needed for the road rehabilitation</li> <li>• Replanting of mangrove and suitable tree species to restore the excavated</li> </ul>	MOI PMU Roads Engineer	\$30,000	Nov 12- Jan 13

	risks of damages by tsunami, tidal waves and sea-rising				areas • Community involvement will be encouraged			
4. Grading and leveling of existing roads in preparation for coral base laying and sand sealing	<ul style="list-style-type: none"> <li>• Air filtration cause by dust created during construction</li> <li>• Water pollution cause by dust sediments on guttering of nearby residential houses</li> <li>• Sedimentation can affect other organisms</li> </ul>	Negative	Minor	Reversible	<ul style="list-style-type: none"> <li>• Expedite laying of coral materials to minimize erosion and sedimentation</li> <li>• Schedule works for coral material laying to coincide with low traffic flow time</li> <li>• Retention ponds may be constructed at critical spots during roads construction phase</li> </ul>	MOI Project Engineer and Road Supervisor	To be implemented as part of the construction phase	Nov 12- Jan 13
5. Upgraded and Extension of Small Boat Jetty	<ul style="list-style-type: none"> <li>• The cement/concrete to be used for the upgrading works can cause minimal pollution and may have pollution impacts on marine organisms and small fish living in the surrounding area</li> </ul>	Negative	Minor	Reversible	<ul style="list-style-type: none"> <li>• Pouring of any concrete mix should be scheduled to be done during low tides</li> <li>• Avoid spillage of any oil cement at the wharf during working hours</li> <li>• Close supervision of the works</li> </ul>	MOI Roads Engineer	To be implemented as part of the roads at no additional cost	Dec 12 – Jan 13
6. Environmental Assessment Monitoring	<ul style="list-style-type: none"> <li>• Failure to closely monitor the EMP can cause</li> </ul>	Negative/ Positive	Minor	Reversible	<ul style="list-style-type: none"> <li>• MLECCNR to ensure EMP is implemented</li> </ul>	MLECCNR MOI PMU	TSS\$3500 for monitoring visits by	Nov 12 – Jan 13

	negative impacts on the EMP expected outcomes				effectively <ul style="list-style-type: none"> <li>• Project Manger and Roads Engineer to constantly follow up to ensure effective implementation of the EMP</li> </ul>		MLECCNR	
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## Pipeline Plans for Hihifo, Vaipoa and Falehau



Maps showing the Pipeline Plans for Hihifo, Vaipoa and Falehau

*Photo attached showing cracking on the existing roads to be repaired*



Existing roads showing extensive cracking and damages to the surface sealing

*Pasivulangi wharf showing the small boat jetty to be upgraded*



The small boat jetty to be upgraded is adjacent to the buoy in black