

**MINISTRY OF WORKS AND TRANSPORT:
TRUNK ROADS EXPANSION PROJECT**

**ENVIRONMENTAL IMPACT ASSESSMENT
FOR THE UPGRADE AND DEVELOPMENT
OF THE SOUTHERN MAIN ROAD
FROM PARIA SUITES TO ST. MARY'S JUNCTION**

(CEC APPLICATION NO. 2824/2010)

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NON-TECHNICAL EXECUTIVE SUMMARY

Background

The Government of the Republic of Trinidad & Tobago has embarked upon a Trunk Roads Expansion Project, which includes the extension of the Solomon Hochoy Highway to Point Fortin. This highway extension consists of several segments, one of which is the improvement of the Southern Main Road between Paria Suites and St. Mary's Junction.

A CEC Application for the Paria Suites to St. Mary's Junction segment was submitted by the Ministry of Works and Transport on March 29, 2010. The EMA indicated that an Environmental Impact Assessment (EIA) would be required for this development, and issued draft Terms of Reference (TOR) for the EIA. Final TOR were issued on May 26, 2010.

Objectives

The overall objective of this highway expansion project is to improve accessibility to areas within the southwest of Trinidad such as La Romain, Debe, Penal, Siparia, Fyzabad, La Brea and Point Fortin. Consequential objectives are:

- To stimulate social and economic development in the southwest region;
- To support development in the La Brea and Point Fortin areas (respectfully earmarked for light industrial activity, and currently hosts a liquefied natural gas plant);
- To encourage rural settlements by building up the area; and
- To eliminate flooding along and improve coastal protection for the nearshore coastal road commonly called "Mosquito Creek".

The objectives of this Environmental Impact Assessment are:

- To determine the extent of environmental and social impacts arising from the proposed highway extension; and
- Quantitatively and qualitatively evaluate the cumulative impacts from this proposed development, and ongoing and other proposed activities around the La Romain and South Oropouche communities.

Justifications

Presently the existing 2-lane Southern Main Road west of St. Mary's Junction is operating close to or above capacity. If existing traffic volumes were assumed to grow at an average rate of 6.0%, then over 20 years this would provide a growth factor of 3.2. The current capacity of the existing Southern Main Road would therefore be insufficient for the future traffic volumes. The peak capacity of an upgraded 4 lane Southern Main Road would be more than adequate for the future traffic volumes.

The segment of road commonly referred to as "Mosquito Creek", is protected from wave forces by a sea wall. However, over the course of several decades, the sea wall has become damaged, and is breached in a few areas where it exposes the Southern Main Road to erosion. Also, this road segment has experienced wave overtopping, and has also experienced flooding during exceptionally high tides. This situation is expected to slowly worsen due to sea level rise. Attempts to address these problems thus far have proved futile, but the design for the upgraded Southern Main Road (which proposes an elevation of both the roadway and the seawall), as well as the proposed revetment are expected to adequately alleviate these inconveniences.

Legislative and Regulatory Considerations

This project will be governed by the requirements of the Environmental Management Authority (EMA), the Environmental Commission, the Town and Country Planning Division (TCPD), and other national laws, including the following subsidiary legislation aimed at environmental protection in Trinidad and Tobago:

- i Certificate of Environmental Clearance (CEC) Rules, 2001
- ii Environmentally Sensitive Areas (ESA) Rules, 2001
- iii Environmentally Sensitive Species (ESS) Rules, 2001
- iv Noise Pollution Control Rules, 2001
- v Water Pollution Rules, 2005
- vi Draft Air Pollution Rules, 2005
- vii Draft Waste Management Rules, 2008

International guidelines on ambient water quality published by the Philippines Department of Environment and Natural Resources and sediment quality guidelines published by the Canadian Council of Ministers of the Environment were also used to provide context to specific test results, even though these guidelines have no legal force in Trinidad & Tobago.

Description of the Project

Highway Design

The existing road segment (which is approximately 5.1 km in length) will be widened on the south side and it will be elevated 0.8 to 1.2 m relative to the existing roadway. The highway will be designed to freeway standards with two lanes in each direction, a "safe" speed limit of 110 km/hr, and with enough space in the highway median to upgrade to three lanes if the need arises in the future.

The proposed width of the right of way (ROW) for this highway is 100 m for the section from St. Mary's Junction to Godineau River; 50 m on either side of the median. From the Godineau River to Mosquito Creek section and from Mosquito Creek to Paria Suites section, the proposed width of the ROW is 80 m; 50 m north and 30 m south of median.

Each side of the proposed highway will have two lanes, approximately 7.3 m wide, with shoulders on each side. It will also include drainage structures and changes to the existing services and utilities. The ROW will allow for utility corridors and future widening of the highway (both as may be required).

Project Components

The following will form an integral part of this highway segment:

Intersections

- Paria Suites Intersection, and
- Shore of Peace Intersection.

Interchanges

- St. Mary's Interchange.

Structures

- Sheet Pile Wall;
- Shoreline Revetment; and
- Recreational Fishing Jetty.

Bridges

- Mosquito Creek Bridge; and
- Godineau River Bridge.

Other

- Two recreational areas will also be provided.

Description of the Affected Environment

Study Area

The Terms of Reference stipulates that "the study area" should be determined by the extent of direct and indirect impacts on the physical, biological and social environments". On this development, the study area varies between environmental components, and so was defined as applicable.

Physical Environment

Topography and Drainage

- The area is generally flat with increases in gradient towards the western end of the alignment. The Paria Suites to Mosquito Creek area in the east is flat, ranging from 6.09 to 7.62 m above sea level. The western end of the project area, from the Godineau Bridge and St. Mary's Junction was approximately 17.5m above sea level.
- The South Oropouche Lagoon is blocked from flowing into the nearshore area by an earthen bund and therefore outfalls in the east via the Mosquito Creek, and in the west through the Godineau River. An interceptor drain along the foreshore roadway also drains into the Mosquito Creek.
- The only area known to flood along the proposed alignment is the foreshore roadway, and this is due to wave overtopping.

Geology and Seismicity

- The South Oropouche Lagoon deposits are of geologically Recent origin. The Ciperó Formation forms a wide band along the shoreline east of the swamp and a narrower band along the shoreline west of the swamp. South of the Cedros Formation are interspersed bands of the Upper Lengua Formation and the lower Cruse Clay. All of these formations date from the Miocene.
- There are several minor faults in the vicinity of the proposed project. These include one observed fault (south along the Southern Main Road) and two inferred faults (one to the east and another at the south-west of the study area). These faults appear to be either inactive or to have very low activity rates.
- The major fault within the Southern Basin is the Los Bajos, which cuts across the Southwest Peninsula with a NW and SE alignment for approximately 30 km. This fault occurs south of the study area for the proposed Paria Suites to St. Mary's Highway.
- As expected, the hydrogeology of the project area is dominated by the Oropouche Lagoon. Outside the lagoon, the western and eastern ends of the alignment lie on

strata with local and limited groundwater resources or on strata with essentially no groundwater resources.

Soil and Land Capability

- The proposed highway upgrade between Paria Suites to St. Mary's junction crosses six soil types including:
 - Talparo clay
 - Caroni peaty clay
 - Cap-de-ville sandy clay loam
 - Debe clay
 - Avocat sandy loam
 - Princes Town clay

Climate

- Annual rainfall at Otaheite (just west of the study area) was 1440 mm, of which 86% fell during the wet season. In comparison, annual rainfall at Siparia (6 km south and inland of the highway alignment) averaged 1691 mm, of which 80% fell during the wet season.
- Wind speeds at Otaheite were higher in the dry season (1.74 m/s) than in the wet season (1.43 m/s).
- Winds were predominantly from the eastern quadrant, and there is little difference between the wet and dry season wind roses, the Northeast Trade Winds being very influential.
- Temperatures were highest between May and October (averaging approximately 26.4°C). Temperatures between November and April were lower, with a minimum monthly value of 24.53°C in February 2008.
- Relative humidity is highest between June and January (more than 82%), with a decline as the dry season progresses (to less than 75% in April)
- Only six cyclones (one hurricane and five tropical storms) have made landfall in Trinidad, and only two tropical storms, Alma (in 1974) and Fran (in 1990), were recorded as having passed over Southern Trinidad.

Water Quality

- River water quality was generally good. However, turbidity; TSS; BOD; COD; and total and faecal coliforms were unfavorable.
- Swamp water quality was generally good. Those parameters considered unfavorable were: TSS; DO; COD; and total and faecal coliforms.

- Marine water quality was generally good. However, turbidity; TSS; DO; COD; and total and faecal coliforms were unfavourable.

Sediment Quality

- In the nearshore marine area, the sediment was predominantly in the silt and clay size range (less than 0.005 mm nominal diameter). There were a few samples where the sediment was predominantly sand (0.005 mm to 0.8 mm nominal diameter). Specific gravity of these sediment samples was consistently in the range 2.6 to 2.8.
- Arsenic and cadmium values exceed the guidelines for these parameters in the nearshore marine sediment. Chromium, lead, copper, and zinc were also detected in the sediment, but were within guideline concentrations. High concentrations of TPH were recorded.
- Arsenic, cadmium, lead, mercury, copper, and zinc exceed the guidelines for swamp sediment quality. TPH is also quite high.

Air Quality

- Generally, inhalable dust and total dust concentrations at most locations were below the proposed standards.
- Carbon monoxide was compliant with its proposed standard. However, nitrogen dioxide was above its proposed limit but only during the dry season.

Noise

- The maximum permissible L_{eq} level of 80 dBA was not exceeded during the daytime at any locations within the defined General Area.
- Nighttime L_{eq} values at all locations on all sampling days exceeded the stipulated maximum permissible L_{eq} level of 65 dBA.
- Noise levels at Location PSSM2 during both daytime and nighttime hours were within the stipulated maximum permissible L_{eq} of 75 dBA and L_{peak} of 130 dB for Industrial Areas.

Oceanography

- Year-round, the study area experiences two high and low tides each day.
- Current speeds range from 50 mm/s to 150 mm/s throughout the water column. The general trend appears to be a uniform flow of currents in all directions. However, there is an overall south-west drift.

- The majority of waves approach from the north-west and north-north-west, with wave heights ranging from 0.05 m up to 0.35 m.
- No salinity stratification was observed in the study area, except (as expected) very close to the mouth of the Godineau River.
- The bathymetry in this area is fairly uniform, with no significant features, ranging from less than 1 m at the foreshore of the Southern Main Road, to just under 3 m two kilometers offshore.

Biological Environment

Flora

- The majority of the tree species in the Oropouche Lagoon were mangrove, with Red Mangrove (*Rhizophora mangle*) being the dominant species.
- Species present in the other areas represent disturbance, consisting of grasses and shrubs typical of roadsides, way sides and neglected areas; palms and flowering plants planted for beautification.

Fauna

- Fifty seven species from twenty eight families of birds were observed in the project area. Most of the species recorded were common or abundant, 4 are noted as uncommon residents, and 12 as visitors.
- Two species of fish were observed in the study area, whilst several others have been noted to occur in the area.
- In the nearshore marine area 8 major groups of benthic organisms were recorded, with organisms of the phylum Annelida (70 %) dominating the total macrobenthic fauna sampled. In the Godineau Swamp approximately 7 phyla were recorded, with organisms of the Phylum Annelida (~ 85 %) also dominating the total macro benthic fauna sampled.
- Five Penaeid shrimp species are commercially harvested and these are an important resource for fishermen. These shrimp species all share a common life cycle, and rely on the mangrove for a portion of their life cycle.

Commercially Important Species

- There are not enough trees of good quality to be considered as commercially important.

- According to the Conservation of Wildlife Act (CWA), the Violaceous Euphonia (*E. violacea rodwayi*) and Parrotlet (*Forpus passerinus*) are birds that can be harvested. Caiman (*C. crocodilus*) and the Iguana (*I. Iguana*) are animals that can be hunted during the hunting season.
- Oyster (*C. rhizophora*) and Crab (*U. cordatus*, and *C. guanhumi*) are also important to local livelihoods, and fish and shrimp are important to the local fishermen.

Rare, Endangered and Vulnerable Species

- No rare or endangered species were observed in project site. The Scarlet Ibis (*E. ruber*) and the Crab-eating Raccoon (*P. cancrivorus*) are considered as vulnerable species in proposed revisions of the CWA.

Human Environment

Land Use

- Town and Country's land use policy for the study area consists of residential, agricultural, commercial/industrial, institutional, and an "environmentally sensitive area". The present land use also consists of these categories.

Demography

- The gender distribution was found to be approximately evenly divided, and there were approximately 4.54 residents per household. Two-thirds of these were employed, and the largest occupation groups were Drivers/Operators and Administrative/Clerical Workers.

Attitudes to the Proposed Highway

This was assessed by house to house surveys and focus group meetings with fishermen. Comments and concerns included:

- The upgrade of the existing road between Paria Suites and St. Mary's junction was sorely needed, and would benefit the area generally.
- Objection to the clearing of mangrove in the project area, and suggested that alternative routes are available for consideration.
- The adequacy of shoreline protection as designed – both to resist wave forces and to prevent flooding.
- Relocation and compensation issues were raised by most stakeholders.
- Fishing access/restrictions, loss of catch, and compensation.

- Traffic congestion in the area, and had objections to the use of traffic lights on the upgraded road.
- Noise, dust, public safety, and public access/restrictions were concerns raised by stakeholders.

Traffic

- The major road in the area is the Southern Main Road, with major intersections at Paria Suites and at St. Mary's Junction. The current capacity of this road is insufficient for future traffic volumes.

Services and Community Centres

- The South Oropuche Health Centre is the only health centre located in the vicinity of the study area.
- The closest fire station to the study area is located at Siparia.
- The Oropuche Police Station is the closest Police station within the study area, The Fyzabad Police Station is also located in relatively close proximity.
- There are two schools, four churches of different faiths, and one community centre in the study area.
- Generally, persons were pleased with the garbage collection service.
- Water, electricity and cell phone service was acceptable by persons, whereas they were not pleased with the land line telephone service.

Commercial Fishing

- The Gulf of Paria is a major commercial fishing ground for many fishermen who reside in the Otaheite and Woodland areas, with trawling and seining being their major methods of fishing.
- Otaheite and Woodland have 28 and 65 registered fishing vessels respectively, with an estimated two fishermen per boat. Fishing is the primary source of income for these fishermen.
- The nearshore marine area is a documented fishing ground, in particular for shrimp, and several species of fish are targeted.
- The Woodland fishing community accesses the Gulf of Paria via the Godineau River.

Recreational Fishing

- The majority of recreational fishermen fish approximately once per month, and some have been doing so for more than a decade. Recreational fishing is not seasonal (it takes place year-round), but weekends are more popular than weekdays. Hook and Line is the most common method of fishing. Problems presently encountered relate to safety concerns, inadequate parking, lack of facilities and mosquitoes.

Archaeological Sites

- The alignment does not directly cross any archaeological sites. However, there are 2 archaeological sites within the wider study area, and one of these is considered important to the Caribbean region.

Potential Impacts of the Proposed Project

Project Benefits

General

- Improved access to areas in southwest Trinidad (Fyzabad, La Brea, Pt. Fortin), and
- Social and economic development and progress in southwest Trinidad

Construction Phase

- Employment during site preparation and construction, and
- Increase in localized sales.

Operation Phase

- Improved access to areas in south Trinidad
- Improved recreational areas for picnicking and fishing.

Adverse Impacts

Adverse impacts were assessed (with and without mitigation measures, as well as those that are cumulative) and classified using a structured approach. The approach was based on numerical analysis, experience on earlier projects, and expert judgment. The results of the structured classification of adverse impacts are summarized as follows:

CLASSIFICATION OF ADVERSE IMPACTS			
ADVERSE IMPACT	CLASSIFICATION		
	PRE-MITIGATION	RESIDUAL	CUMULATIVE
Acquisition of Properties with Houses	N/A	MODERATE	N/A
Acquisition of Business Places	N/A	LOW	N/A
Acquisition of Undeveloped Private Lands	N/A	LOW	N/A
SITE PREPARATION AND CONSTRUCTION			
Drainage (increased surface run-off)	MODERATE	LOW	N/A
Drainage (culvert construction)	MODERATE	LOW	N/A
On-site Erosion	LOW	LOW	N/A
Slope Instability	MODERATE	LOW	N/A
Surface Water Quality (Spills and Leaks)	MODERATE	LOW	MODERATE
Surface Water Quality (Siltation)	MODERATE	LOW	MODERATE
Surface Water Quality (Solid Waste/Blowing Trash)	LOW	LOW	LOW
Soil Contamination	LOW	LOW	N/A
Noise	MODERATE	LOW	N/A
Air Quality (Dust and Exhaust from Vehicles)	LOW	LOW	MODERATE
Air Quality (Dust from Cleared Areas)	MODERATE	LOW	MODERATE
Air Quality (Dust from Stockpiles)	LOW	LOW	MODERATE
Aesthetics (Improper Disposal of Garbage)	LOW	N/A	LOW
Aesthetics (Burning of Debris)	LOW	ELIMINATED	
Clearing of Vegetation	N/A	LOW	MODERATE

CLASSIFICATION OF ADVERSE IMPACTS			
ADVERSE IMPACT	CLASSIFICATION		
	PRE-MITIGATION	RESIDUAL	CUMULATIVE
Loss of Wildlife Habitat	N/A	MODERATE	HIGH
Terrestrial Fauna	LOW	LOW	MODERATE
Aquatic Fauna (Water Quality Changes)	MODERATE	LOW	MODERATE
Aquatic Fauna (Altered Marine Habitat)	N/A	LOW	EXTREME
Traffic Congestion	HIGH	MODERATE	MODERATE
Damage to Existing Roads	HIGH	MODERATE	MODERATE
Impacts on Fishing (Loss of River Access)	HIGH	MODERATE	N/A
Impacts on Fishing (Loss of Offshore Fishing Areas)	LOW	LOW	HIGH
Disruption of Traditional and Cultural uses	MODERATE	MODERATE	N/A
Safety Concerns (Road Safety)	MODERATE	LOW	MODERATE
Safety Concerns (Public Safety on Site)	LOW	LOW	N/A
Safety Concerns (Worker Health and Safety)	LOW	LOW	N/A
Waste Disposal	MODERATE	LOW	LOW
OPERATIONAL PHASE			
Marine Erosion and Accretion	N/A	MODERATE	HIGH
On-Site Erosion	MODERATE	LOW	N/A
Surface Water Quality	MODERATE	MODERATE	HIGH
Contaminated Soil	LOW	LOW	N/A
Noise	MODERATE	N/A	MODERATE
Air Quality	MODERATE	MODERATE	MODERATE
Wildlife (Noise and Light)	HIGH	MODERATE	MODERATE
Public Safety	MODERATE	N/A	N/A

Note: N/A denotes Not Applicable.

Qualitative Risk Assessment

For hazard and risk assessment scenarios during site preparation and construction phase, thirteen had overall ratings of “Low”, eight (involving road transport) had overall ratings of “Medium”, and no scenario had a rating of “High”. For scenarios during the operational phase, three scenarios had overall ratings of “Low”, three scenarios had overall ratings of “Medium”, and no scenarios had ratings of “High”.

Analysis of Alternatives

ALTERNATIVE	COST (TT Million)	ENVIRONMENTAL IMPLICATION
Widening towards the Sea (stone berm)	1200	Loss of fishing grounds
Widening towards the Sea (sheet pile wall)	1300	
Widening towards the Mangrove	200	Loss of 2 ha of mangrove
Viaduct Over the Sea	2000	Loss of fishing grounds, and noise and light disturbance to mangrove animals.

No Action Alternative

The "No Action" alternative on this project would mean that this segment of roadway will not be upgraded and widened. At present this road is already congested and poses a significant traffic problem. In addition it is also prone to flooding during periods of rough seas and inclement weather, compounding traffic congestion and causing salt water damage to vehicles. As vehicle ownership in this area is expected to increase over time, this too will progressively making traffic congestion worse. In simple terms, this would translate to more and more hours spent on the roads commuting to and from school and work. This level of inconvenience and loss of productivity is not considered tolerable. For these reasons, the No Action Alternative is not considered viable.

Preferred Option

Based primarily on the vast differences in cost between the options, it is concluded that “widening toward the mangrove” is the preferred option.

Mitigation Management Plan

The following is a summary of the adverse environmental impacts and appropriate mitigation measures proposed:

Acquisition of Houses, Businesses and Undeveloped Private Lands

- Forty four houses were identified for acquisition along the alignment of the Paria suites to St. Mary's highway segment, six properties were of mixed use, and ten were businesses.
- Pay fair compensation (replacement cost as opposed to discounted value) for houses to be acquired.
- Allow sufficient time for relocation, or pay for temporary housing while permanent housing is sought or built.
- Assist in the relocation effort, including the allowance of a realistic time frame for moving. In the case of agricultural land, permit farmers to reap their crops before the land is cleared.

Drainage

- Design drainage systems to accommodate the increased runoff.
- Inspect all drains, culverts and bridges on a regular basis.
- Schedule an annual inspection and clearing for April of every year, ahead of the rainy season.
- Design parking facilities at the recreational area that includes storm water control systems that allow for greater infiltration of water.
- Schedule culvert construction during the dry season as far as is practicable.
- Provide appropriately-sized temporary drains, cofferdams, pumps, etc, to control drainage run-off.

On-Site Erosion

Construction Phase

- Schedule major earthworks for the dry season (to the extent practical).
- Consider using gravel working pads, soil stabilization or synthetic geotextiles to maintain stable subgrade conditions if work must be carried out during extensive wet weather conditions,
- Maintain natural vegetation cover as far as practical.
- Do not clear areas not required for construction.
- Re-vegetate, pave or otherwise cover cleared areas as early as practical.
- Retain vegetation in the vicinity of watercourses, existing drains and steep slopes.
- Install energy dissipating mechanisms (such as rip rap and/or Reno mattresses along natural watercourses and in artificial unpaved watercourses/drains that are to be constructed.
- Provide temporary drains to control runoff during site preparation and construction. Integrate these drains into the permanent site drainage to the extent practical.

Operation Phase

- Regularly inspect the vegetation on steep slopes, and replant any areas which may become denuded as soon as practical.
- Prohibit unauthorized clearing of roadside areas, particularly by squatters.
- To the extent practical, control bush fires which may develop during the dry season.

Surface Water Quality

Construction Phase

(Hydrocarbon spills, leaks and disposal of spent lubricant)

- Refuel equipment and vehicles in designated paved areas, provided with secondary containment (bund walls and an impermeable floor). These designated paved areas should be a minimum of 30 m from surface water bodies. For the Paria Suites to St. Mary's highway which is 5.1 km long, fuelling on site should be limited to at least 2 locations.
- Use appropriate pumps and nozzles for refuelling.
- Place disconnected hoses in containers to prevent spills of residual fuel.
- Perform ongoing maintenance of vehicles and machinery to ensure no leakage from equipment.
- Minimize spills of construction by "good practice" construction techniques such as use of appropriate containers, avoiding overfilling etc.
- Avoid "hosing down" of spills of construction material. Instead use dry clean up and mopping up techniques as appropriate.
- Collect spent lubricants for transport off-site to a facility capable of treating and/or disposing of waste of this kind.
- Treat contaminated soil on-site or dispose off-site. On-site treatment would consist of the application of a biological product to enhance remediation, while off-site disposal would be to a bioremediation cell for treatment.
- Ensure compliance with the requirements of the Ministry of Energy and Energy Industries "General Guidelines for Handling and Storage Of Petroleum Products and Combustible Liquids)

(Siltation)

- Confine temporary stockpiles of cleared material using wooden "cribs" (or other means, such as geofabric screens on stakes) around the perimeter. These should be removed after the material in the stockpile has been used or removed from the site
- Place temporary silt traps (for example stilling basins or barriers of straw bales) in drainage paths to reduce the migration of silt into rivers and streams.

(Solid Waste/Blowing Trash)

- Provide solid waste bins at active construction sites.
- Collect garbage regularly from these active sites.
- Provide for the collection of solid waste which cannot be temporarily stored in bins, for example scrap materials generated from construction material, and transport to the nearest landfill.
- Protect bins from animals and other scavengers.

(Discharge of Improperly Treated Sewage)

- Provide portable toilets or other appropriate toilet facilities for workers to use on site. Portable toilets should be removed from site for emptying and disposal of the waste at a WASA approved facility.
- Discharge of sewage into septic tank/ soakaway systems designed and built to WASA standard.

Operation Phase

- Develop Spill Prevention, Containment and Control (SPCC) plans which will provide for the collection and removal of large spills.
- Do not sweep or wash spills into adjacent surface drains.

Soil Contamination

Construction Phase

- Mitigation measures described previously for surface water - fuels spills and spent lubricants are applicable here.
- Treat onsite using a proprietary compound such as Oil Gator or remove contaminated soil to a suitable facility for remediation (e.g. LABIDCO's remediation cell).

Operation Phase

- Mitigation measures recommended for reducing the impact on water quality are also applicable here.

Noise and Vibrations

Construction Phase

- Regularly inspect and maintain construction vehicles and equipment to ensure noise emission control systems are properly functioning.
- Do not schedule on-site construction activities outside normal working hours to the extent possible.
- Do not schedule movements by truck before 7 a.m or after 7 p.m, to the extent practical.
- Obtain a Variation from the EMA if night work (8.00pm to 8.00am) involving noise intense activities is necessary
- Inform the public of noisy construction activities in the area.
- Inspect all properties in the vicinity of pile driving works by the Contractor prior to the start of such works, so that claims of damage during construction may be verified.

Operation Phase

- Monitor in areas considered sensitive for compliance to Noise Pollution Control Rules.
- Construct a noise barrier if considered necessary.

Air Quality

Construction Phase

(Dust and Exhaust from Vehicles)

- Properly service all vehicles and equipment to ensure that there are no visible sooty emissions.
- Cover (with tarpaulins etc.) all transport vehicles moving rock and fill to and from the site to prevent dust emissions.
- Wash truck tyres before entering the existing paved roads.
- Wet or apply a dust palliative to unpaved roads onsite.
- Enforce traffic speed regulations within the construction zone as speeding along roads can contribute to dust emissions.

(Dust from cleared areas)

- Use dust screens during major earthworks in areas where there are houses, schools etc close to the highway alignment.
- Clear only the area needed for construction, leaving vegetation in other areas intact within the project site.
- Retain vegetative buffer along perimeter wherever feasible.
- Implement dust control measures at the source of emissions. The standard method is to wet exposed surfaces on which construction equipment will run.
Encourage natural re-vegetation or replant with appropriate species as early as practical after the completion of construction.

(Dust from stock piling of Aggregate)

- Keep stockpiles to a minimum and use as soon as practical.
- Cover smaller stockpiles or store fine aggregates in bins or silos.

(Burning of Debris)

- Burning of debris on site (packaging material, construction scraps or felled vegetation) is not permitted.

Operation Phase

- Diligent policing of vehicles on the highway to remove those with visible emissions in context of the TTBS voluntary standard: Specifications for Motor Vehicles - Exhaust Emissions.

Aesthetics

Construction Phase

- Reuse/recycle as much of this waste as practical, to reduce the volume going to the dump.
- Encourage composting of biodegradable material on site. Suitable areas can be set aside for composting.
- Remove all garbage which cannot be composted on site for disposal at an appropriate landfill.

Operation Phase

- Replant areas of construction easement as soon as practical after construction.
- Provide landscaping in strategic areas (as designed by a landscape architect) to minimize the visual impact of cut or fill slopes or structures.
- Tend and care for plants (including fertilizing, mulching, etc.) for a period of two years after the completion of the proposed highway.
- Design parapet walls on bridges to minimize the obstruction of views by motorists and passengers, but only to the extent that this can be done without compromising the strength required for crash safety.

Light disturbance on Terrestrial Fauna (including Rare, Endangered, Vulnerable species)

Construction Phase

- Limit construction works to the daylight hour to the extent possible.
- If night work is to occur, shield light from the vegetation and avoid use of bare or upturned bulbs.
- Use the minimum intensity of light that can be safely used for night work.
- Prohibit hunting or harassing of animals by workers on the construction site.

Operation Phase

- Enforce speed limit along the highway so vehicles would remain within the speed limit and not cause excessive vibrations.
- Proper design of focused lighting along the highway.

Oceanography

- A monitoring program should be started prior to the construction of the proposed bridge and continue for at least one year after the completion of the bridge to capture the seasonal variations that occur.
- If the monitoring program shows accumulation of sediment within the entrance/exit of the Godineau River, then a maintenance dredging program may need to be implemented to ensure the channel depth is adequate for fishermen to enter/exit the Godineau River.

Land Transportation

(Traffic Congestion)

- Consult with the Police Service in the affected areas.
- Provide detours and temporary access routes wherever the construction works will obstruct existing roads or access routes.
- Schedule transport of material and equipment for off-peak hours, to the extent practical.
- Avoid the use of long convoys of trucks.
- Arrange for police outriders to accompany long or wide loads.
- Use flagmen at intersections with existing roads.
- Use signs to indicate construction zone and movement of trucks and equipment.

(Damage to Existing Roads)

- Carefully inspect the roads and bridges along the access to the construction site prior to construction checking the stated load capacity.
- If any roads or bridges are damaged as a direct result of traffic on this project, the nature of repairs should be agreed with the Ministry of Works and/or the Regional Corporation and repairs effected as soon as practical.

Impacts on Fishing

Construction Phase

- Notify fishermen of schedule of construction works.
- Schedule the bridge works to ensure that fishermen are permitted to travel up and down the Godineau River during the construction period.
- Collaborate with fishermen in the area and discuss suitable times at which they can access the river, outside of construction hours. For example between the hours of 4:00 am to 8:00 am.
- Post warning signs and lighting to alert fishermen to areas on the river which are temporarily restricted for safety reasons.
- Keep the Godineau River and Mosquito Creek clear of construction waste which may obstruct or damage boats using the river.
- If disruption will last beyond 24-hours, collaborate with the Fisheries Department of the Ministry of Agriculture to agree on additional mitigation measures (including compensation of fishermen for loss of earning if appropriate).

Operation Phase

- Mitigation measures to prevent water quality contamination are applicable here.

Disruption of Traditional and Cultural Use Areas

- Consult the operators and users of the known cultural areas (such as the Shore of Peace) to alert them to the timing of works in the area.
- Ensure that access to the important cremation area is kept open.
- Limit the time of construction activities within this area to safely facilitate known annual usage.

Loss of Historical or Archaeological Sites

Existing Archaeological Sites

- Avoid using lands adjacent to the archaeological site for locating site offices, laydown yards, etc.
- Provide barricades around the area during construction works and alert Contractor(s) to the site and its significance.

Discovery of Archaeological Sites

- Have a qualified archaeologist conduct a walking search after the surveyors have laid out the route and before any distribution of the earth surface begins.
- Inform the History Department, University of the West Indies if new sites are discovered during the walking search so they can advise on the appropriate steps to be taken.
- Follow measures to protect archaeological sites which are identified during construction.
- Suspend work in the vicinity of the find.
- Include clauses in the contract document for Contractors, specifying actions and persons responsible.

Demand for Services and Utilities

Construction Phase

- Schedule the relocation of utilities to ensure minimum disruption to users.
- Ensure that the public is given adequate notice if planned shut-offs are required for construction.

Waste Disposal

Construction Phase

- The Contractor should develop a comprehensive Waste Management Plan utilizing the re-use, reduce, and recycle approach. It is recommended that as far as practicable, scrap metal, glass and paper be recycled.
- Burning waste on site will not be permitted.
- Encourage composting of biodegradable material on suitable areas set aside for this purpose. Dispose of excess excavated dirt in areas away from water-bodies.
- Dispose of excess excavated dirt in areas away from water-bodies. Excess dirt can also be stored in a designated area for re-use in landscaping.
- Remove all solid waste which is not composed on site to a landfill approved by the Solid Waste Management Company (SWMCOL).
- Store solid waste in sturdy containers with animal-proof covers prior to haulage from the site for disposal.
- Collect all spent lubricants for recycling or for appropriate disposal off-site.
- Collect spills with appropriate absorbent materials and dispose of appropriately.
- Provide portable toilets for construction workers throughout the site.

Public Safety Concerns

Construction Phase

- Clearly demarcate the construction zone in the rivers and the marine foreshore.
- Advise fishermen of the construction schedule and any restricted access.
- Publish notices to the public in the media at least two weeks prior to the start of construction works.
- Use Police officers to direct traffic during construction.
- Erect warning signs to demarcate the construction zone.
- Ensure that construction foremen and equipment operators remain vigilant during clearing. Escort all unauthorized persons who enter the site off the site as soon as they are discovered.
- Leave potentially hazardous areas within and adjacent to the site in a safe condition.
- Provide for 24 hour site security.

Public Consultation

A summary of the consultations undertaken is contained in the table below:

STAKEHOLDER	CONCERN
<p>Interviews with homeowners:</p> <ul style="list-style-type: none"> • Sunset Cove, La Romain, South Oropuche (includes St. Mary's Village) and Dow Village (includes Otaheite Residential Park) conducted in November 2009. • Four hundred and sixty six persons from 103 households. 	<ul style="list-style-type: none"> • The vast majority of respondents in the community expected benefits to the area as a whole. • Two-fifths of respondents felt that closeness of their communities to the Southern Main Road poses special challenges: traffic and accidents, flooding, vibrations and potholes. • A large majority of respondents anticipate • Problems during construction of the proposed highway extension: traffic congestion, noise, dust and air emissions. • About a third of respondents (including half the respondents in Sunset Cove) anticipate problems during operation of the new highway: traffic congestion, public safety (more accidents), noise, dust and air emissions.
<p>Interviews with businesses:</p> <ul style="list-style-type: none"> • La Romain and St. Mary's /Oropuche conducted in November 2009. • 20 businesses represented in survey. 	<ul style="list-style-type: none"> • Most of the respondents expected benefits to the area associated with upgrade of the Southern Main Road. • The majority of respondents stated that there were no challenges associated with their business being in close proximity to the Southern Main Road. However, a small percentage of respondents felt that traffic

STAKEHOLDER	CONCERN
	<p>congestion and flooding on the main road would be challenging.</p> <ul style="list-style-type: none"> • Approximately two-thirds of respondents said there may be problems to their place of business encountered during construction of the widening of the Southern Main Road. • The majority of respondents said that they did not anticipate any problems to their businesses during the operation of the widened Southern Main Road.
<p>Interviews with institutions:</p> <ul style="list-style-type: none"> • St. Mary's / Oropuche conducted in December 2009. • 5 institutions represented in survey. 	<ul style="list-style-type: none"> • The majority of respondents indicated that the proximity of Southern Main Road to the institution posed special challenges. The most common issues were traffic congestion and noise. • All of the respondents interviewed stated that the upgrade of the Southern Main Road will be beneficial to the area. The main benefit was reduced traffic congestion. • All respondents predicted problems during the construction phase of the upgrade of the Southern Main Road: traffic congestion, dust, noise and impeded access. • Two of the respondents in the area expected problems associated with the operation of the upgraded Southern Main Road: noise, traffic congestion, and dust.
<p>Interviews with recreational fishermen</p> <ul style="list-style-type: none"> • 9 fishermen represented in the survey conducted in November 2009. 	<ul style="list-style-type: none"> • Some of the challenges identified by fishermen related to this area are safety concerns, parking issues, inadequate facilities and mosquitoes. • Two-thirds of the respondents anticipated benefits from the proposed fishing pier. Just over half the fishermen expect to encounter problems during the construction of the widened roadway: reduced access to fishing, dust, noise, traffic congestion, increased marine traffic and spent lubricants from construction vehicles and equipment. • Just over half the fishermen also expect to encounter problems during the use of the • widened roadway: reduced access to fishing and safety and security issues. • The majority of fishermen indicated alternative fishing spots in the event that fishing was restricted in this area. Only one fisherman wished to fish only in the Mosquito Creek Road area.

STAKEHOLDER	CONCERN
<p>Focus group meeting with artisanal Fishermen</p> <ul style="list-style-type: none"> • Fishermen from Woodland and Otaheite South Oropuche Community Centre on February 07, 2010. 	<ul style="list-style-type: none"> • Restrictions to boat movements along the Godineau River; • The effects of the seawall revetments on shrimp trawling in the nearshore environment; • The amount of Mangrove to be removed and measures to deal with issues such as drainage / saturation and loss of habitat to avifaunal species; • Construction of the road seaward, rather than landward as an alternative; and • Relocation and compensation issues.
<p>Meeting with cultural users</p> <ul style="list-style-type: none"> • Siparia Regional Corporation representatives in charge of Shore of Peace- February 25, 2010 • South Regional Council - March 03, 2010 	<ul style="list-style-type: none"> • Representatives indicated that the development will be beneficial and impact positively on the traffic within the area; • The proposed development of the fishing jetty and recreational facility may exacerbate the erosion taking place at the Shore of Peace; • Other concerns were: accessibility to users to the river as well as users of the site for religious purposes; flooding; water flow to and from the mangrove, access roads to the proposed industrial area (opposite the Shore of Peace), traffic congestion and safety concerns. • How the highway would affect access to the Foreshore area. • What safety measures will be implemented to protect users of the area, particularly young children. Will there be parking facilities and security. • The close proximity of the Highway to this cultural area would mean high noise levels. This can be exacerbated by the anticipated increase in the volume of cars to use the new Highway. • There are no alternative areas which would be suitable for these religious ceremonies
<p>Meeting with Siparia Regional Corporation</p> <p>On June 24, 2010, at the Siparia Regional Corporation's Office</p>	<ul style="list-style-type: none"> • Would surcharging take place simultaneously with other works? • Would any new roads be developed in Otaheite, and what purpose will the road at Paria Suites facilitate? • Will the mangrove and the river which runs parallel to the existing roadway be affected? • Will the view of the coast be impeded as a result of the improvement works?

STAKEHOLDER	CONCERN
	<ul style="list-style-type: none"> • Will the traffic issues be the same as is currently experienced by the Godineau Bridge restoration? • The only detour around the working area needs to be upgraded before undertaking such construction works, including rehabilitation of the San Francique Bridge and road network.
<p>Public Consultation Meetings</p> <p>An Introductory public meeting and a Final public meeting was held on June 28, 2010 and August 11, 2010 respectively.</p>	<ul style="list-style-type: none"> • Sea wall around Sunset Cove • Construction Schedule/Phasing • Design plans (current and alternative alignments) • Detours/alternative routes during construction • Traffic congestion • Utilities relocation/ availability • Drainage/ flooding on the nearshore roadway • Noise and dust emissions • Light impacts • Clearing of mangrove • Loss of fish and shrimp habitat and loss of earnings to fishermen • Acquisition/ relocation/fair compensation • Loss of livelihoods • Commercial fishing/fisheries • Recreational fishing • Access to/parking for recreational Area • Road deterioration • Cultural/traditional uses • CEC process (TOR Consultation) • EIA (Access to the studies) • Opposition to project • Implementation and adherence to mitigation measures