



# TRINIDAD AND TOBAGO: TT-L1055: TRINIDAD AND TOBAGO NATIONAL WATER SECTOR TRANSFORMATION PROGRAM

## Additional Study: Programmatic Environmental & Social Evaluation Annex to Additional Study: Programmatic Environmental & Social Guidelines

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS .....</b>	<b>3</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>10</b>
<b>1 .....</b>	<b>INTRODUCTION</b>
<b>.....</b>	<b>15</b>
1.1 PURPOSE .....	15
1.2 PROJECT DESCRIPTION .....	16
1.3 THE CONSULTANT’S MANDATE .....	17
1.4 THE STUDY AREA .....	19
1.5 LIMITATIONS .....	22
1.6 ANALYSIS OF ALTERNATIVES .....	22
1.6.1 The No Project/ No Action Alternative .....	22
1.6.2 Alternative Project 1 .....	22
1.7 ORGANIZATION OF THE REPORT .....	23
<b>PROGRAMMATIC ENVIRONMENTAL AND SOCIAL EVALUATION .....</b>	<b>24</b>
<b>SECTION I .....</b>	<b>24</b>
<b>2 .....</b>	<b>POLICY, LEGAL AND REGULATORY FRAMEWORK</b>
<b>.....</b>	<b>25</b>
2.1 POLICY AND PLANS .....	25
2.2 LEGISLATION AND REGULATIONS .....	27
2.3 INTERNATIONAL TREATIES AND PROTOCOLS.....	29
2.4 RELEVANT IDB ENVIRONMENTAL AND SOCIAL SAFEGUARDS .....	30
<b>3 .....</b>	<b>INSTITUTIONAL FRAMEWORK AND ASSESSMENT</b>
<b>.....</b>	<b>33</b>
3.1 WATER AND SEWERAGE AUTHORITY .....	33
3.1.1 General Challenges and Areas for Intervention .....	34
3.1.2 How CCLIP will Address General Challenges .....	37
3.1.3 Assessment of Capacity to Management Environmental, Social and Resettlement Issues .....	38
3.2 WATER RESOURCES AGENCY (WRA) .....	38
3.2.1 Challenges and Areas for Interventions .....	39
3.3 MINISTRY OF PUBLIC UTILITIES .....	40
3.4 REGULATED INDUSTRIES COMMISSION .....	41
3.5 ENVIRONMENTAL MANAGEMENT AUTHORITY .....	41
3.6 OFFICE OF THE PROCUREMENT REGULATOR .....	42
3.7 OCCUPATIONAL SAFETY AND HEALTH AUTHORITY AND AGENCY .....	42
3.8 MUNICIPAL CORPORATIONS OF TRINIDAD AND TOBAGO .....	42
3.9 THE TOWN AND COUNTRY PLANNING DIVISION .....	43
<b>4 .....</b>	<b>APPROACH AND METHODOLOGY</b>
<b>.....</b>	<b>44</b>



4.1	GENERAL APPROACH .....	44
4.2	PHYSICAL ASSESSMENT.....	44
4.2.1	<i>Topography, Geology and Soils</i> .....	44
4.2.2	<i>Climate</i> .....	44
4.2.3	<i>Natural Hazards</i> .....	45
4.2.4	<i>Hydrology</i> .....	45
4.2.5	<i>Air and Noise</i> .....	45
4.3	ECOLOGICAL ASSESSMENT .....	45
4.4	SOCIOECONOMIC ASSESSMENT .....	45
4.5	IMPACT ASSESSMENT AND MITIGATION MEASURES.....	47
<b>5</b>	<b>..... THE EXISTING ENVIRONMENT</b>	
	<b>..... 48</b>	
5.1	OVERVIEW OF PHYSICAL ENVIRONMENT IN TRINIDAD AND TOBAGO.....	48
5.1.1	<i>Topography</i> .....	48
5.1.2	<i>Geology</i> .....	51
5.1.3	<i>Water Resources and Land Use</i> .....	56
5.1.4	<i>Hydrology</i> .....	62
5.1.5	<i>Climate</i> .....	66
5.1.6	<i>Natural Hazards</i> .....	67
5.1.7	<i>Air Quality</i> .....	73
5.2	OVERVIEW OF ECOLOGICAL ENVIRONMENT IN TRINIDAD AND TOBAGO.....	74
5.2.1	<i>Ecosystems in Trinidad and Tobago</i> .....	74
5.2.2	<i>Flora</i> .....	76
5.2.3	<i>Fauna</i> .....	77
5.2.4	<i>Ecosystem Functions and Linkages</i> .....	80
5.3	OVERVIEW OF SOCIO-ECONOMIC ENVIRONMENT IN TRINIDAD AND TOBAGO.....	80
5.3.1	<i>The Locational Setting</i> .....	80
5.3.1	<i>Socio-Economic Description of Trinidad and Tobago</i> .....	81
<b>6</b>	<b>..... IMPACT ANALYSIS AND MITIGATION MEASURES</b>	
	<b>..... 114</b>	
6.1	CONSTRUCTION PHASE.....	114
6.2	OPERATION PHASE .....	151
6.3	CUMULATIVE IMPACTS .....	167
<b>7</b>	<b>..... CONCLUSION</b>	
	<b>..... 167</b>	
	<b>PROGRAMMATIC ENVIRONMENTAL AND SOCIAL GUIDELINES .....</b>	<b>170</b>
	<b>SECTION II .....</b>	<b>170</b>
<b>8</b>	<b>..... INTRODUCTION</b>	
	<b>..... 171</b>	
8.1	PROJECT OVERVIEW .....	171
8.2	SCOPE OF THE PROGRAMMATIC ENVIRONMENTAL AND SOCIAL GUIDELINES .....	173
8.3	RESPONSIBILITIES AND COMMITMENTS.....	173

8.4	INSTITUTIONAL, LEGAL AND FUNDING REQUIREMENTS .....	174
8.4.1	WASA's Environmental Policy .....	174
8.4.2	Local and International Requirements .....	176
8.4.3	Funding Requirements - Relevant IDB Environmental and Social Safeguards .....	177
8.5	EVALUATION OF RELEVANT ASPECTS OF PREVIOUS STUDIES OF ESA CONDUCTED FOR THE NATIONAL WATER SECTOR TRANSFORMATION PROGRAM .....	180
<b>9</b>	<b>KEY ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION</b> .....	<b>181</b>
<b>10</b>	<b>ENVIRONMENTAL AND SOCIAL MANAGEMENT PROCESS</b> .....	<b>184</b>
10.1	PROJECT SCREENING .....	185
10.1.1	Eligibility Criteria .....	185
10.1.2	Screening Procedure .....	186
10.2	PROJECT IMPLEMENTATION AND MONITORING .....	194
10.2.1	Types of Management Plans .....	194
	b .....	<b>Error! Bookmark not defined.</b>
10.2.2	Summary of Monitoring Frequency for Management Plan .....	234
<b>11</b>	<b>MONITORING AND EVALUATION OF THE CCLIP</b> .....	<b>235</b>
<b>12</b>	<b>AREAS FOR FURTHER ASSESSMENT</b> .....	<b>241</b>
<b>13</b>	<b>REFERENCES</b> .....	<b>242</b>
<b>14</b>	<b>APPENDICES</b> .....	<b>248</b>
14.1.1	Appendix 1 - Grievance Collection Form .....	261
14.1.2	Appendix 2 - Grievance Monitoring Form .....	263

## LIST OF FIGURES

Figure 1-1: The Location of Trinidad and Tobago .....	20
Figure 1-2: Population densities across Trinidad and Tobago (source: Trinidad and Tobago 2011 population and Housing Census Demographic Report) (CSO, 2012). .....	21
Figure 1-3: Local Government Corporations across Trinidad .....	21
Figure 3-1: Organisational Structure for the Water and Sewerage Authority.....	34
Figure 3-2: Spiral of Decline .....	35
Figure 3-3: Proposed Execution Mechanism .....	38
Figure 5-1: Digital Elevation Model of Trinidad and Tobago (Source: Mapsland, 2020) .....	49
Figure 5-2: Location of Swamp Areas across Trinidad (Modified from Darsan et al., 2020) .....	50
Figure 5-3: Location of Trinidad and Tobago on the south-eastern margin of the Caribbean Plate Margin (Weber, et al., 2011) .....	53

Figure 5-4: Major east-west trending faults which cut across Trinidad Roberson (Roberson & Burke, 1989)	54
Figure 5-5: Geology map of Trinidad (Saunders, 1998)	55
Figure 5-6: Geology map of Tobago (Snoke, Yule and Wadge, 1988)	56
Figure 5-7: Trinidad Hydrometric Areas and Watersheds (Genivar, n.d.)	57
Figure 5-8: Tobago Hydrometric Areas and Watershed (Genivar, n.d.)	57
Figure 5-9: Generalised Land Use Map of Trinidad (Chinchamee et al., 2006)	58
Figure 5-10: Trinidad Land Use and Watersheds (Genivar, n.d.)	59
Figure 5-11: Vulnerability of Watersheds to Land Degradation (Mahabir and Al-Tahir, 2008)	60
Figure 5-12: Surface Water Quality in Trinidad and Tobago (DHV Consultants in GORTT, 2016b.)	62
Figure 5-13: Surface Water Resources in Trinidad (Genivar, n.d.)	63
Figure 5-14: Location of Trinidad and Tobago (red circle) and the typical hurricane tracks and likelihood of experiencing a hurricane by month (NOAA, n.d.)	68
Figure 5-15: Flood Prone Areas in Trinidad and Tobago (Genivar, n.d.)	70
Figure 5-16: Earthquake Caribbean Seismicity showing Trinidad at the bottom of the map (UWI SRC, 2010)	71
Figure 5-17: Earthquake zones around Trinidad and Tobago (UWI SRC, 2010)	72
Figure 5-18: Earthquakes with magnitude greater than 5 occurring around Trinidad and Tobago between 1955 – 2008 (UWI SRC, 2010)	72
Figure 5-19: Landslide occurred on September 13, 2017 along the North Coast Road in the Northern Range, Trinidad (Photo From: Trinidad and Tobago Weather Center) (TTWC, 2020)	73
Figure 5-20: Forest Association and Land Cover Map for Tobago (Helmer, et al.2012)	75
Figure 5-21: Forest Association and Land Cover Map for Tobago (Helmer, et al.2012)	76
Figure 5-22: Protected Areas in Trinidad and Tobago (GORTT, 2011)	78
Figure 5-23: Map of Trinidad (including municipal boundaries) and Tobago	81
Figure 5-24: Mid-year Population Estimates by Sex, 2006-2019	82
Figure 5-25: Population Change by Municipalities in Trinidad and in Tobago, 2000-2011	84
Figure 5-26: Age and Sex Pyramid, 2000 and 2011	86
Figure 5-27: Distribution of the Poor as a Percentage of Total Population	95
Figure 5-28: Percentage Population Below the Poverty Line by Municipality	96
Figure 5-29: Water Tariff Structure Extracted from WASA's Tariff Book, 1993 Revised 2008	105
Figure 5-30: Reported Major Crimes in Trinidad and Tobago, 1990-2019	106
Figure 5-31: Reported Minor Crimes in Trinidad and Tobago, 1990-2013	107
Figure 5-32: Health Services in Trinidad and Tobago	109
Figure 5-33: Fire Stations in Trinidad and Tobago	110
Figure 5-34: Police Stations in Trinidad and Tobago	111
Figure 5-35: Listed Heritage Sites and Heritage Assets in Trinidad and Tobago	113
Figure 11-1: Organisational Structure for the Water and Sewerage Authority	174
Figure 13-1: Environmental and Social Management Process	185
Figure 13-2: Ambient Water Quality Standards Extracted from the Water Pollution Rules, 2019	209
Figure 13-3: Stakeholder Priority Mapping	226
Figure 13-4: Stakeholder Mapping Results and Strategy for Engagement	228
Table 13.5: Likely Stakeholder Consultations under the Project	229

## LIST OF TABLES

Table 2-1: Relevant Policies and Plans .....	25
Table 2-2: Relevant legislation and regulations.....	27
Table 2-3: IDB Operational Policies.....	31
Table 4-1 Impact Assessment Criteria .....	47
Table 5-1: Tropical Storms and Hurricanes which have impacts Trinidad and Tobago (ODPM, n.d.).....	69
Table 5-2: Flora of Trinidad and Tobago (GORTT, 2012) .....	77
Table 5-3: Total population by Sex and Municipality, Land Area and Population Density, 2000 and 2011 .....	82
Table 5-4: Household Heads by Administered Area for Trinidad and Tobago and Sex 2011 .....	84
Table 5-5: Female and male age structure of Trinidad and Tobago, 2000 and 2011 .....	86
Table 5-6: Persons of disabilities and prevalence of disabilities by Administrative Area, 2011.....	87
Table 5-7: Educational Attainment of Population by Municipality.....	89
Table 5-8: Trinidad and Tobago Selected Economic Indicators.....	91
Table 5-9: Labour Statistics from Jan 2017 to Sep 2018.....	92
Table 5-10: Sectoral Distribution of Employment from Jan 2017 to Sep 2018 .....	92
Table 5-11: Registered Businesses in Trinidad by Municipality.....	93
Table 5-12: Tenancy in the Various Municipalities.....	94
Table 5-13: Estimated Poor Population in Trinidad and Tobago by Municipality, 2005 .....	95
Table 5-14: Types of Buildings by Municipality.....	97
Table 5-15: Main Water Supply Source to Households by Municipality .....	100
Table 5-16: Main Source of Drinking Water by Region.....	100
Table 5-17: Frequency of Water Supply to Households by Municipality .....	101
Table 5-18: Distribution of Dwellings by Main Source of Water by Quintiles .....	102
Table 5-19: Frequency of Pipe Borne Water Supply by Quintiles.....	103
Table 5-20: Type of Water Storage Facility by Quintile .....	103
Table 5-21: Benchmarking WASA's Performance Against Regional Utilities.....	104
Table 5-22: Sporting Facilities in Trinidad and Tobago.....	112
Table 6-1: Impacts, Proposed Mitigation Measures, Management Plans and Responsible Party for the Construction Phase .....	116
Table 6-2: Impacts, Proposed Mitigation Measures, Management Plans and Responsible Party for the Operational Phase.....	152
Table 11-1: IDB Operational Policies.....	177
Table 11-2: Evaluation of Relevant Aspects of Previous Studies for the TT National Water Sector Transformation Program .....	180
Table 12-1: Summary Impacts of CCLIP - TT Water Supply Improvement Program.....	181
Table 13-1: ESMF Checklist 1: Safeguard Trigger Checklist Criteria .....	186
Table 13-2: ESMF Checklist 2 - Permit/Licence Status Checklist .....	188
Table 13-3: ESMF Checklist 3: Identification of Environmental and Social Risks and Status Checklist ....	189
Table 13-4: ESMF Checklist 4: Management Plan Trigger Checklist.....	192
Table 13-5: Air Quality Standards Extracted from the Air Pollution Rules, 2014 .....	195
Table 13-6: Key performance Indicators for Air Quality Management .....	196
Table 13-7: Noise Standards Extracted from the Air Pollution Rules, 2014 .....	197
Table 13-8: Key Performance Indicators for Noise Management .....	199

Table 13-9: Key Performance Indicators for Waste Management .....	202
Table 13-10: Key Performance Indicators for Traffic Management .....	204
Table 13-11: Key Performance Indicators for Worker Health and Safety .....	206
Table 13-12: Key Performance Indicators for Worker Health and Safety .....	208
Table 13-13: Key Performance Indicators for Water Quality Management.....	211
Table 13-14: Key Performance Indicators for Management of Access to Communities.....	212
Table 13-15: Key Performance Indicators for Management of Emergency Response.....	213
Table 13-16: Key Performance Indicators for Management of Flora and Fauna .....	215
Table 13-17: Key Performance Indicators for Management of Social Conflict.....	216
Table 13-18: Key Performance Indicators for Management of Installation of Household Metering Stations .....	217
Table 13-19: Key Performance Indicators for Management of Under-representation of Women in Project Works .....	218
Table 13-20: Key Performance Indicators for Management of Disruption in Water Supply.....	219
Table 13-21: Key Performance Indicators for Management of Property Damage .....	220
Table 13-22: Key Performance Indicators for Management of Institutional Conflict .....	221
Table 13-23: Key Performance Indicators for Management of Contractors .....	223
Table 13-24: Key Performance Indicators for Management of Access to Communities.....	224
Table 13-25: Methods for Grievance Receipt, from Least to most formal.....	231
Table 14-1: Sample Monitoring Template .....	237

## EXECUTIVE SUMMARY

The purpose of the National Water Sector Transformation Program TT-L1055 in Trinidad and Tobago is to improve the efficiency and quality of potable water and services in Trinidad and Tobago. The Government of Trinidad and Tobago (GoRTT) has sought funding from the Inter-American Development Bank (IDB) through a Conditional Credit Line for Investment Project (CCLIP) to fund the program. The CCLIP will be implemented across Trinidad and Tobago. In compliance with the Bank's safeguards policy, the Consultants have been required to prepare the following:

1. Programmatic Environmental & Social Evaluation
2. Programmatic Environmental & Social Guidelines

The multi-disciplinary team of experienced scientists and environmental professionals conducted data gathering and analysis together to determine the dominant environmental issues relevant to the proposed project and to identify the potential impacts and mitigation measures. Detailed review of secondary data was used to inform the assessment. Among the key activities were:

- Desktop research
- Analysis of maps and plans
- Review of reports and background documents
- Stakeholder consultations

Other proposed developments and surrounding land use were also reviewed in the context of compatibility with the proposed project including potential positive, negative and cumulative impacts.

### **The Existing Environment**

#### ***Physical***

The climate of Trinidad and Tobago is tropical, warm and humid with two major seasons: a dry season from January to May and a wet season from June to December. A short dry spell, 'Petite Careme,' typically occurs in the middle of the wet season in September or October. Climate change is expected to affect the island by resulting in reduced rainfall, increased rainfall intensity resulting in higher runoff and flash floods, increased temperatures, sea level rise and more frequent storms.

Trinidad is located along the south-eastern margin of the Caribbean Plate along the southern strike-slip boundary with the South American Plate and several major faults through the island. The region is therefore tectonically active with both shallow and deep earthquakes.

Hilly areas in Trinidad and Tobago are largely concentrated in the Northern Range which has a high susceptibility to landslides. Here, the terrain is mountainous with deep valleys and flatlands mainly to the southern section of the mountain range leading into the flatlands of the Caroni Basin to the west and Nariva Basin to the east. These valleys and flatland areas have undergone significant development. The watersheds along Trinidad's North Coast are largely pristine and minimally impacted by anthropogenic activity. However, the watersheds that originate in the south slopes of the Northern Range as well as in the central and southern sections of Trinidad have been heavily impacted by the array of activities that occur within them. Trinidad and Tobago is typically affected by natural hazards such as floods, drought, landslides, earthquakes, hurricanes and climate change.



Trinidad and Tobago has an estimated population of 1.39 million people in 2018 (The World Bank, 2020) with over 96% of this population living in Trinidad and 4% in Tobago. The population density has been estimated to be 254 persons per km<sup>2</sup>; however, this is not evenly distributed and the majority of the population live within main urban areas such as Port of Spain (The Capital of Trinidad), San Fernando Chaguanas, Arima and Point Fortin in Trinidad.

### ***Ecological***

The ecology of Trinidad and Tobago is highly influenced by the fact that it the country lies on the South American Continental Shelf and are directly influenced by the Orinoco and the South Equatorial Current. The biota and terrestrial habitats of Trinidad therefore reflect the ecology of equatorial South America unlike the other Windward islands which have ecosystems dominated by island endemic species (GORTT, 2012). It is well evidenced that due to its small size, location, and geological relationship shared with the South American continent, the country has a high species diversity to surface area ratio. The main ecosystems in Trinidad and Tobago are terrestrial forests confined to 3 main mountain ranges, coastal ecosystems, marine ecosystems and freshwater ecosystems. The western sections of Trinidad are the most populated and strongly influenced by human activities (residential settlement, agricultural activity, commercial and industrial activities) and can be characterised as disturbed to highly disturbed.

### ***Social***

Mid-year population estimates by the CSO put the 2019 population of Trinidad and Tobago at 1,363,985 persons of which 679,635 were females and 684,350 were males. These figures are up from the 2011 count of 1,328,019 persons, made up of 661,714 females and 666,305 males.

The rate of urbanisation of Trinidad and Tobago has increased over the years, with an estimated 72 percent of the national population living in urban areas,<sup>1</sup> the majority of which is located along the East-West Corridor and North-South Corridor. The cities and boroughs remain the densest parts of the country.

Most of the country's poor can be located in Princes Town (13.8%), Sangre Grande (13.4%), Siparia (10.9%), San Juan/Laventille (10.4%) and Tunapuna/Piarco (10.2%); these regions together accounted for 58.7 percent of the total poor population.

Illegal occupation of lands, or squatting as it is known locally, has become a complicated and major issue for the State and private landowners. The issue is further complicated by individuals taking advantage of existing situation to clear and subdivide land to 'rent' to others. In 2005, the Land Settlement Agency (LSA) estimated that that 50,000 households were squatting, half of them on private lands and the other half on public lands. These settlements are characterised typically by poorly constructed housing, little or no access to basic amenities such as piped water, improper sewage facilities, inadequate drainage, and very limited mechanisms for risk transfer. Oftentimes, existing squatter settlements continue to grow, despite the passing of the Squatter Regularisation Act (Act 25 of 1998).

According to the 2011 Census, there was near universal access to improved water supply with over 90 percent of households in each municipality either having water piped publicly or privately into dwellings, plots or yards and communities (standpipes); or captured with a private catchment. Households in

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<sup>1</sup> Leontine Alkema, Gavin W. Jones, Cynthia U. R. Lai, 2012. Levels of Urbanization in the World's Countries: Alternative Estimates. Available [online]: <https://paa2012.princeton.edu/papers/121285>.

municipalities with a largely rural character, such as Point Fortin, Mayaro/Rio Claro, Penal/Debe, Princes Town and Siparia, relied to a lesser extent on piped water than more urban municipalities and featured a higher proportion of households who mainly utilise truck borne water or water captured via a private catchment. The challenge in the provision of water was demonstrated in the frequency of water supply to households. In 2011, more than 68 percent of households in Arima, Chaguanas, Couva/Tabaquite/Talparo, Diego Martin, San Juan/Laventille, Sangre Grande, Tunapuna/Piarco and Tobago had water supplied more than three times or more a week. In contrast, up to 43 percent of households in the rural municipalities of Point Fortin, Mayaro/Rio Claro, Penal/Debe, Princes Town and Siparia received water at most once or twice weekly.

### **Impact Assessment and Proposed Mitigation Measures**

The overall CCLIP is likely to result in moderate negative environmental impacts. With respect to the physical and ecological impacts, these are mostly short-term and reversible and can be mitigated to minimize the residual impact.

The Table below summarises the identified impacts in terms of their magnitude, nature of the impact, spatial extent of the project impacts, duration, direction and permanence of the impact.

<b>RISK</b>	<b>MAGNITUDE OF IMPACT</b>	<b>NATURE OF POTENTIAL IMPACT</b>	<b>SPATIAL EXTENT</b>	<b>DURATION</b>	<b>DIRECTION OF IMPACT</b>	<b>PERMANENCE</b>	<b>RESIDUAL IMPACTS POST MITIGATION</b>
<b>Soil erosion</b>	Minor	Loss of topsoil; Sedimentation; soil disruption; negative water quality impact	Areas surrounding construction activities	Medium-long term	Negative	Irreversible	Minor
<b>Soil contamination</b>	Minor	Contamination of water resources	Areas surrounding construction activities	Medium term	Negative	Reversible	Minor
<b>Land pollution</b>	Minor	Poor aesthetics; soil contamination; contamination of water resources	Areas surrounding construction activities	Short term	Negative	Reversible	Minor
<b>Water pollution</b>	Moderate	Contamination of water resources (surface and groundwater)	Areas surrounding construction activities	Medium-long term	Negative	Reversible	Minor
<b>Increased noise</b>	Moderate	Nuisance; Hearing impairment; wildlife disruption	Areas surrounding construction activities	Short term	Negative	Reversible	Minor
<b>Increased dust and emissions</b>	Moderate	Respiratory conditions; possible	Areas surrounding construction activities	Short term	Negative	Reversible	Minor

*Programmatic Environmental & Social Evaluation and Guidelines for the Trinidad and Tobago National Water Sector Transformation Program*

RISK	MAGNITUDE OF IMPACT	NATURE OF POTENTIAL IMPACT	SPATIAL EXTENT	DURATION	DIRECTION OF IMPACT	PERMANENCE	RESIDUAL IMPACTS POST MITIGATION
		contribution to climate change					
<b>Over-extraction of water resources</b>	Moderate	<p>Aquifer mining; saltwater intrusion; aquifer depletion</p> <p>Loss of use of the resources from the aquifers if mined to depletion</p> <p>Excessive extraction from surface water resources can negatively reduce volume water available for downstream users (domestic, commercial, recreational) and environmental flows.</p>	Study area in particular aquifers and rivers	Medium-Long term	Negative	Reversible if mining managed but Irreversible if there is depletion	Minor
<b>Landslides</b>	Major	<p>Soil erosion; sedimentation</p> <p>Damage caused to property and roads</p>	Localised works that may be required on slopes within the study area	Short-medium term	Negative	Irreversible	Minor
<b>Earthquakes</b>	Moderate	<p>Damage to infrastructure, landslides</p> <p>Damage caused to property and roads</p>	Study area and entire island	Short-Long term	Negative	Reversible	Minor
<b>Flooding</b>	Major	<p>Soil erosion; sedimentation; Surface water contamination</p>	Flood prone areas within study area including RSSP reservoir	Short-medium term	Negative	Irreversible	Minor

RISK	MAGNITUDE OF IMPACT	NATURE OF POTENTIAL IMPACT	SPATIAL EXTENT	DURATION	DIRECTION OF IMPACT	PERMANENCE	RESIDUAL IMPACTS POST MITIGATION
		Damage to property and roads	and Caparo River				
<b>Disruption of biological communities</b>	Moderate	Full or partial habitat loss; impaired habitat functionality; loss of biodiversity	Areas surrounding construction activities	Long term	Negative	Partially irreversible	Minor
<b>Minimisation of non-revenue water</b>	Major	Reduction in losses of non-revenue water  Better assessment of demand due to metering customers	Study area and entire island	Long term	Positive	Reversible	Major
<b>Increased reliable water supply to customers</b>	Major	More reliable water for the public and T&T can meet the SDG goals.	Study area and entire island	Long term	Positive	Reversible	Major
<b>Improved institutional efficiency of WASA</b>	Major	Sustainability in managing the water resources in T&T  Better customer relations and customer satisfaction	Study area and entire island	Long term	Positive	Reversible	Major

The CCLIP is expected to result in significant positive social impacts associated with the improvement in the supply of water to customers in Trinidad and Tobago. With the proper implementation of all phased activities, it is anticipated that persons will be able to get water 24/7 as opposed to the current scheduled system. Additionally, significant improvements in the efficiency at which WASA operates and the ability of being able to properly assess demand with metering infrastructure this will result in improved long-term integrated water resources management, which in the face of climate change will result in the sustainable supply of water to the benefit of all.

## 5 INTRODUCTION

### 5.3 Purpose

This Programmatic Environmental & Social Evaluation and Guidelines Document has been prepared for **The Water Sector Transformation Program TT-L1055 in Trinidad and Tobago** in accordance with the Terms of Reference received from the Inter-American Development Bank (IDB). The purpose of the overall program is to improve the efficiency and quality of potable water and services in Trinidad and Tobago.

Currently, potable water is not supplied to all households in Trinidad and Tobago on a 24/7 basis; only 53% of customers receive water on a 24/7 basis in the wet season and 31% in the dry season (Water and Sanitation Division of the IDB, 2020). The other customers receive water on a scheduled basis. Most of the domestic customers pay a flat fee per month or per quarter and 100% of industrial customers are metered and pay for water by volume used.

There is a high percentage of non-revenue water (NRW) lost through leaks, metering and billing issues. NRW is as high as 40-50% and in some cases estimated at 60% of total water produced. Demand and consumption on the islands are very high compared to the rest of the Caribbean. Water usage/demand is estimated at 364 litres of water per day per capita. Other issues and challenges include:

*The purpose of the Water Sector Transformation Program TT-L1055 in Trinidad and Tobago is to improve the efficiency and quality of potable water and services in Trinidad and Tobago.*

- Poor governance and implementation arrangements: there has not been a consistent focus on WASA's accountability for the resources allocated and WASA's management structure.
- WASA is dependent on subventions from the Government of the Republic of Trinidad and Tobago GoRTT of TT\$1.8 billion to TT\$2 billion without defined performance targets to account for its use of the resources and in the absence of these subventions.
- Water tariffs charged on domestic customers, average US\$0.23 per cubic meter, is the lowest in the Caribbean and have not been adjusted since 1993. Revenues are insufficient to meet operating costs.
- There is an inability to take advantage of abundant water resources to meet dry season demand due to WASA's inadequate storage capacity.
- The aging infrastructure and bottlenecks in the network that inhibits the transmission of water from water rich areas to water scarce areas.

Considering these issues, the Government of the Republic of Trinidad and Tobago (GoRTT) has targeted a reduction in non-revenue water in order to increase the supply of water to customers. The GoRTT has sought funding from the Inter-American Development Bank through a Conditional Credit Line for Investment Project (CCLIP). This overall CCLIP is for US\$315 million credit line to address water supply issues across the entire country and is to be implemented through three individual loan operations the first of which is in the amount of US\$80 million.

## 5.4 Project Description

In August 2022, the Government of Trinidad and Tobago (GoRTT) announced that will carry out its mandate to transform the water sector. Significant investments will be required to achieve wider water sector transformation and undertake long-term infrastructural improvements to improve water supply, increase water security, protect watersheds, and water resources, strengthen sector institutions, and support the sector in its planning capacity and execution. The Bank is therefore proposing to provide financing for water sector support through the CCLIP instrument. The CCLIP will allow the GoRTT to access financing through several phased loan operations that are smaller tranches of commitment and provide greater flexibility to define the individual loan operations. In addition, the CCLIP will allow the Bank to support the development of water and sanitation services in the medium and long-term.

The CCLIP is proposed with Bank financing for an amount up to US\$315 million from Ordinary Capital resources to be implemented through three individual loan operations over a ten-year period. The first operation is designed as a specific investment loan for a total amount of US\$80 million with disbursement period of 4 years to allow sufficient time to procure and implement a 3-year co-management contract. To support the preparation of the project, a non-reimbursable Technical Cooperation in the amount of US\$800,000 has been approved (ATN/OC-18337-TT), which will finance field work to conduct a water audit.

The CCLIP will be implemented in various operations throughout Trinidad and Tobago. The first operation has three components which are outlined below as extracted from the Terms of Reference.

- **Component 1. Water Stabilization and Improvement: (US\$44 Million).** This component will finance the development of a comprehensive program to urgently stabilize water supply services to prevent further service decline throughout the country and to ensure access to water, sanitation and hygiene to unserved and underserved households. The activities to be financed include: (i) Construction of new water treatment infrastructure in six locations at Ravine Sable, Sangre Grande, Santa Cruz-Green Meadows, Goldsborough River, Blue Basin and Mayaro, inclusive of intakes; (ii) Refurbishment & upgrading water treatment infrastructure for nine WTPs at Freeport, Caroni, North Oropouche, Guanapo, Maraval, Navet, Hillsborough, Chatam and Courland; (iii) Drilling and equipping of three new wells at Freeport; (iv) Rehabilitation of El Socorro high lift and booster station (v) Drilling and equipping new wells at Penal, Chatam/Palo Seco, and Tucker Valley.
- **Component 2. Support for Water Sector Transformation Plan: (US\$2.74 Million).** The Bank's AquaRating International Standard will be used to characterize the performance of WASA and establish a baseline for the restructuring efforts. The results of the assessment will inform the effort to restructure and transform WASA, including addressing issues such as (i) gender equality, diversity and inclusion at the company level; (ii) Resilience to Climate Change, Natural Disasters and Risk management and promulgation throughout WASA; and (iii) Improvement of the Ministry of Public Utilities' (MPU) technical oversight capacity for coordination of water sector



transformation and stabilization. In addition, institutional strengthening could be considered to separate the functions of water resources management from WASA and to implement Integrated Water Resources Management (IWRM) supported by a HydroBID based information system.

- **Component 3. Network Optimization: (US\$31 Million).** This component will finance priority works to optimize network performance and reduce non-revenue water. These works will be executed through a Co-Management Performance Based Contract with a specialized consulting firm (CF) which would involve WASA and the CF working together as a single Project Team to deliver the targeted results. This would allow for the seamless transfer of know-how and expertise to WASA that is crucial to the long-term sustainability and success of the program. The CF will be required to prepare and implement a Non-Revenue Water Reduction Strategy and Program for the country. The water audit under TT-T1108 will provide production and transmission flows and pressure data as well as hydraulic models to inform the NRW program. Reduction of commercial and physical losses as part of the NRW Reduction program will be implemented. The CF will also provide strategic advice and technical support to the Executive Team of WASA in the transformation of WASA. Under this component, flow and pressure monitoring and water loss reduction will be achieved through (i) the replacement of aged and fragile transmission and distribution network to reduce water loss and high leakages in Petit Valley, La Cuesta, Freeport, Wallerfield and Pt. Fortin; Mt. Lambert, North West; Nelson Street, POS; Laventille; Valsayn South; Freeport Todd and La Cuesta (ii) Installation of two hundred and fifty-six (256) bulk meters and loggers to monitor via telemetry systems production and flows for various facilities (water treatment plants, wells and booster stations) throughout T&T, (iii) selective implementation of DMAs/PMAs, targeted leak detection and repair, smart water infrastructure tools (SWIT), and management information systems; (iv) Implementation of remote monitoring and control SCADA automation for real-time analysis of the most critical areas around T&T; and (v) training and capacity building of WASA personnel in water loss management and SWIT.
- **Project management and other costs: (US\$2.26 Million).** This component will finance administrative expenses including, support for project execution (PEU) dedicated staff, audits, monitoring and evaluation, communication, and supervision and implementation of an Environmental and Social Management Plan (ESMP).

## 5.5 The Consultant's Mandate

The Consultants have been mandated to review and examine the project activities under *the Water Sector Transformation Program TT-L1055 in Trinidad and Tobago* for the overall CCLIP. In compliance with the Bank's safeguards policy, the Consultants have been required to prepare the following:

1. Environmental and Social Assessment (ESA) with framework approach

2. Environment and Social Management Plan (ESMP) (including a Stakeholder Engagement Plan and a Grievance Management Mechanism) with framework approach
3. **Programmatic Environmental & Social Evaluation**
4. **Programmatic Environmental & Social Guidelines**

The ESA and the ESMP that have already been prepared and submitted only focused on the first operation of the CCLIP. Whereas, as per the TOR, the Programmatic Environmental & Social Evaluation is to be conducted of the overall CCLIP, assessing the possible impacts of the future phases of the program, and Programmatic Environmental & Social Guidelines be developed. The Programmatic Environmental & Social Evaluation and Guidelines have been developed in accordance with the requirements established in the IDB Environment and Safeguards Compliance Policy and Guidelines<sup>2</sup>. The documents focus on issues of potentially significant impact including:

- **Social impacts:** i) possible physical resettlement and/or temporary/permanent loss of livelihoods; ii) potential negative impacts linked to gender; iii) risk of social exclusion; iv) risk of indirectly inducing poverty (for payment of services for instance); v) governance or social conflicts that might affect project implementation.
- **Environmental impacts:** during construction and operation: in the general environment in the project's area of influence and to the biodiversity in particular. Additionally, natural disaster risks, cultural heritage impacts and any potential negative impacts to the long-term sustainability of the area should be identified. Also, current environmental liabilities at the site and existing infrastructure to be repaired/substituted should be identified.

More specifically, the **Programmatic Environmental & Social Evaluation** has been conducted for all the planned activities to be rolled out across Trinidad and Tobago. The Consultant was specifically required to conduct the following activities:

- An information review of all the available documentation including ESAs of previous program, if any;
- Site reconnaissance the project site in selected locations in Trinidad, including visual observation of the relevant areas directly and indirectly affected by the operation; describe the reasoning drivers behind selected sites.
- Collect information to build the Environmental and Social baseline data and necessary for assessing possible impacts associated with each project/intervention. This diagnosis comprised:
  - a. Introduction and Program Description: objectives; location; site selection process; present status of the Program; and a timetable for construction activities;
  - b. Legal and Regulatory Framework (i.e. national and international): evaluation of the legal and regulatory framework applicable to the Program;

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<sup>2</sup> IDB Safeguard Policies and Guidelines are available at [www.iadb.org/sustainability](http://www.iadb.org/sustainability)

- c. Evaluation of institutional and technical strengthening needs for the Executing Agency to manage environmental, social, cultural, health and safety and labour issues involved with the Program;
- d. Environmental and Social Setting: A socioeconomic, cultural and environmental baseline; The socioeconomic baseline will include, without being limited to, (i) household composition pattern; (ii) access to basic services (water, sewage, electricity, mobility, etc.) for neighbourhood; (iv) presence of vulnerable populations – including but not limited to ethnic minorities and people without formal title to land – as well as their potential to be disproportionately impacted.
- e. Describe the flora and fauna in the project locations and determine if any threatened and endangered species and vegetations may be present in the zone of influence of the areas designated in the Law. Propose measures to eliminate these impacts (by picking alternatives sites) or to mitigate them (physical and institutional measures).
- f. Assess possible impacts associated with the development of the subsequent phases of the CCLIP, identifying major risks and red flags that would guide the preparation of future specific environmental and social assessments.

The Programmatic **Environmental & Social Guidelines** is a document that supports and is prepared based on the results of the Programmatic Environmental & Social Evaluation elaborated above, it involved the following activities:

- Define and develop the overall management framework for the CCLIP, specifying all procedures, mitigation measures, rules, and guidance that the Executing Agency will have to follow to ensure that future projects are properly presented to the IDB for approval (including for example, minimum requirements, exclusion list, general plans, etc.)
- Evaluation of relevant aspects of previous studies of NRW in TT, especially the ones financed by the IDB.
- Eligibility criteria for subsequent projects in compliance with the Bank's safeguards.
- Description of the environmental and social management process of the entire Program during the execution stage (requirements, organizational structure, responsibilities, timelines, etc.), covering the entire cycle of each project (from the "eligibility" phase, covering the phases of "implementation" and "monitoring" of each).
- Management frameworks that describe the main guidelines to guarantee compliance with the environmental and social requirements identified for the following projects, including, among others, Framework for Resettlement and Restoration of Livelihoods, guidelines for conducting meaningful consultations.

## 5.6 The Study Area

The Republic of Trinidad and Tobago is situated in the Southeastern Caribbean less than 20 km off the east coast of Venezuela in South America (Figure 5-1). The Republic consist of two main islands, Trinidad with a land area of 4,768 km<sup>2</sup> with three main mountain ranges separated by relatively flat lands and

swamps. Tobago consist of just 300 km<sup>2</sup> of land area with most of this consisting of a central mountain range.

Trinidad and Tobago has an estimated population of 1.39 million people in 2018 (The World Bank, 2020) with over 96% of this population living in Trinidad and 4% in Tobago. The population density has been estimated to be 254 persons per km<sup>2</sup>; however, this is not evenly distributed, and the majority of the population live within main urban areas such as Port of Spain (The Capital of Trinidad), San Fernando Chaguanas, Arima and Point Fortin in Trinidad (Figure 5-2). In Tobago, the majority of the population lives in the south-western area of the island (Figure 5-2). The project area focusses on the main island of Trinidad which is divided into 14 municipalities and regions (Figure 5-3).

The Trinidad and Tobago Electricity Commission (T&TEC) is responsible for power transmission and distribution across both countries, and the power is produced by several independent power suppliers across the island. The country has an advanced telecommunications network with several private and public companies providing landline, mobile, internet and other relates services. The Water and Sewerage Authority (WASA) is the sole provider of water and sewerage services in the country and falls under the Ministry of Public Utilities.



**Figure 5-1: The Location of Trinidad and Tobago**

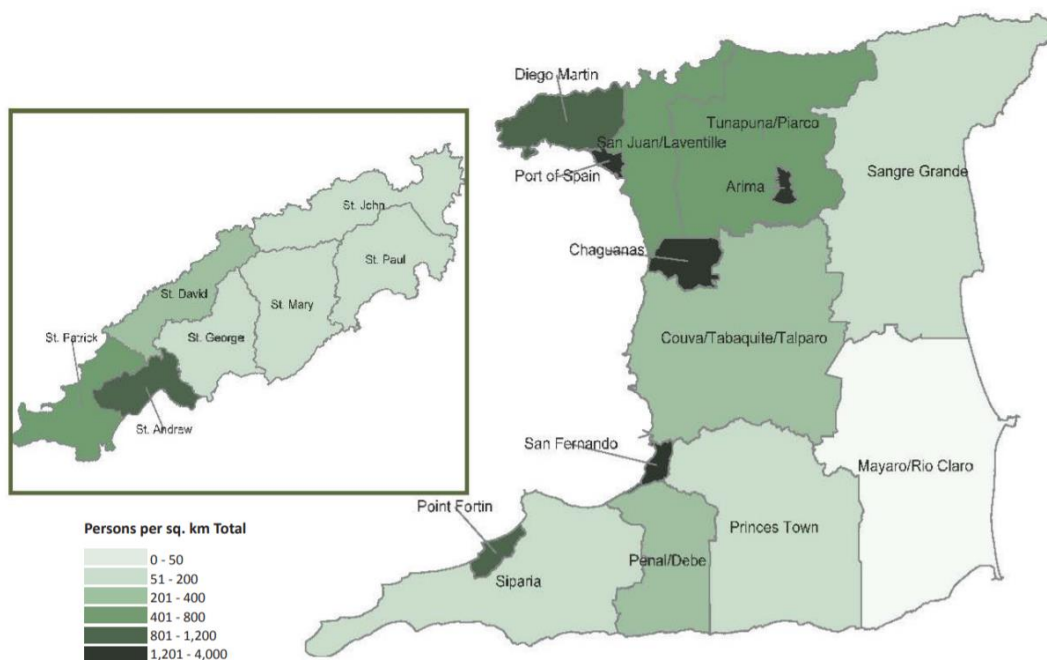


Figure 5-2: Population densities across Trinidad and Tobago (source: Trinidad and Tobago 2011 population and Housing Census Demographic Report) (CSO, 2012).

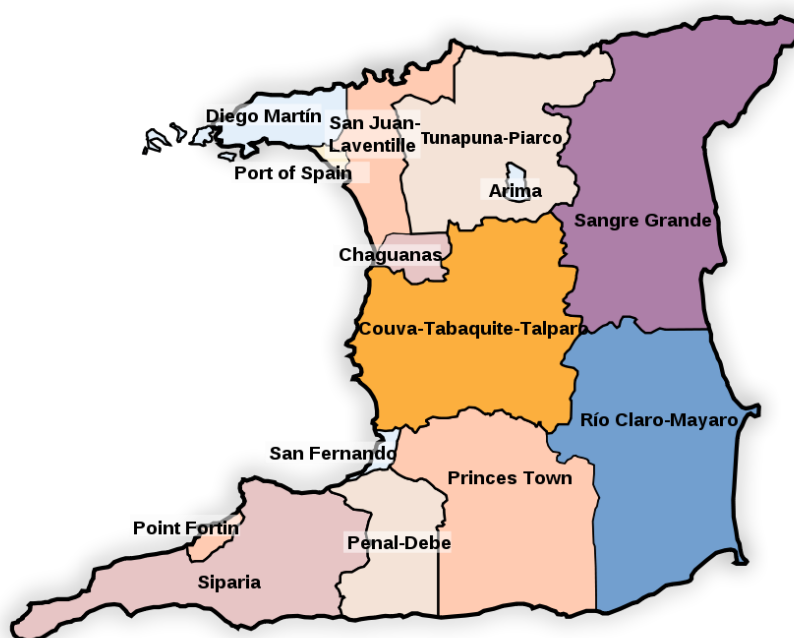


Figure 5-3: Local Government Corporations across Trinidad

**Figure 5-4: Location of Caparo River Basin in Trinidad (NIDCO, n.d.)**

## 5.7 Limitations

It is important that the following limitations are noted and understood prior to the review of the report:

- The timeframe for carrying out the assignment was very short and so this limited the ability for extensive field verification activities. As such a heavy reliance was placed on the use of secondary data that is already available for the study area, referenced documentation, review of satellite imagery and maps, and the conduct of key informant interviews.
- The project took place during the Corona Virus (COVID-19) pandemic which has led the GoRTT, like other nations worldwide, to impose a range of protocols and strategies to stymie the spread of the disease. Measures such as physical distancing, the closure of schools as well as stay-at-home orders for non-essential activities, have restricted the movement of the population with many citizens having to work from home. Trinidad and Tobago has since reopened the economy, however the Central Statistical Office and other Ministry Offices where some data was closed at the time of this Assessment. However, access to statistical data from the last Population and Housing Census was obtained online. It should be noted that the Census is dated, having been completed in 2011.
- COVID-19 also affected the availability of key stakeholders as well as the nature of the consultations. There was heavy reliance on virtual meetings and consultations. Although, this may be skewed to persons having internet access or access to telephone, this mechanism is still believed to have the potential to capture a wide audience especially since the project area is so large. The nature of the public consultations to be held to present the findings will be agreed upon following further discussions with the IDB and the GoRTT prior to the completion and submission of the Final ESA and ESMP.

## 5.8 Analysis of Alternatives

### 5.8.1 The No Project/ No Action Alternative

If the project is not implemented, water production from several of the critical plants and facilities would continue to decline and would be at risk of failure as a result of inadequate maintenance over the years, as well as, the issues related to large percentage of NRW will continue to plague the country. And as a consequence, the corresponding issues of unreliable 24/7 water supply will also continue. The projected impacts of climate change are expected to result in overall lower rainfall amounts and increased temperatures (increased evaporation) and thus reduced aquifer recharge. If this is coupled with continued over-pumping it can result in deleterious effects on the country's water resource in the long run.

### 5.8.2 Alternative Project 1

It has been recommended by some technocrats that an alternative could be to increase the amount of water being pumped from the aquifers currently. It is their belief that Trinidad and Tobago has more than enough water resources available at this time to be accessed.



However, pumping more water to account for the over 46% of the existing non-revenue water losses can be considered a very short-sighted approach, which can result in deleterious effects on the water resources being exploited. There is great risk in losing environmental balance which is critical to assess before taking any decisions on increased pumping. Additionally, without addressing the various inefficiencies of the system, this will only result in more wastage.

It would be best to implement the project holistically as was designed based on the challenges that were identified in the supply and management of water sources. Leaving out components would yield only short-term solutions and reduce the resilience of the sector, which is not sustainable considering the climate change risk faced by the island. Further, the benefit to be received from better demand analyses and control and accountability for water supply, as well as address major losses due to non-revenue water inclusive of aged infrastructure would not be accrued.

Increasing pumping would also not address the significant institutional challenges that currently affect the operations of WASA that would have been addressed under the institutional strengthening component of the project.

## **5.9 Organization of the Report**

This document is divided into three main Sections and several subchapters are presented below.

### **1. Introduction**

Section I presents the Programmatic Environmental & Social Evaluation for CCLIP:

- 2. Policy, Legal and Regulatory Framework**
- 3. Institutional Framework and Capacity**
- 4. Approach and Methodology**
- 5. The Existing Environment**
- 6. Impact Analysis and Mitigation Measures**
- 7. Conclusion**

Section III presents the Programmatic Environmental & Social Guidelines for CCLIP:

- 8. Introduction**
- 9. Key Environmental and Social Impacts and Mitigation**
- 10. Screening and Social Management Process**
- 11. Monitoring and Evaluation**
- 12. Areas for Further Assessment**

# SECTION I



## PROGRAMMATIC ENVIRONMENTAL AND SOCIAL EVALUATION

## 6 POLICY, LEGAL AND REGULATORY FRAMEWORK

### 6.3 Policy and Plans

Table 6-1 presents several policies and plans relevant to the Water Supply Improvement Program.

**Table 6-1: Relevant Policies and Plans**

POLICY/PLAN	RELEVANCE TO THE PROJECT
<b>National Development Strategy of Trinidad and Tobago – Vision 2030</b>	<p>This long-term National Development Strategy aims to put the country in a position to achieve developed country status by 2030.</p> <p>Under Theme III - Improving Productivity through Quality Infrastructure and Transportation, Goal 2 states: “Our public utility system will be better managed with improved access for all Public Utility Systems play a strategic role for human civilization, essential in economic and social development, whether they relate to water supply, sewerage treatment, electricity and public lighting systems, or telecommunication services. In order to achieve our National Vision, Trinidad and Tobago needs efficient, cost-effective and reliable water and wastewater services, electricity, and telecommunication services as these are key enablers which determine the quality of life.”</p> <p>This is aligned with Goal 6 of the Sustainable Development Goals: Ensure availability and Sustainable management of water and sanitation for all.</p>
<b>National Integrated Water Resources Management Policy 2005</b>	<p>The national goal for the water sector is to support the socio-economic development of Trinidad and Tobago through the integrated management of the water resources and the water environment (land, air, flora and fauna), satisfying and managing the growing demands for all water users in a sustainable, efficient and effective manner, while maintaining and/or enhancing the quality of the environment and the integrity of ecosystems, and minimizing losses to life and damage to property due to water related disasters.</p> <p>One of the principles upon which this policy operates is “<i>Potable water of such quality and quantity as to sustain life should be available to all citizens, irrespective of the citizen’s ability to pay. This minimum service is a requirement for reasons of public health and environmental condition.</i>” This is integral to the project being assessed.</p>
<b>National Environmental Policy, 2006</b>	<p>Environmental Management Policy, 2006, was prepared by the Environmental Management Authority in accordance with the requirements of the Environmental Management Act, 2000. The goal of the policy is to facilitate and encourage environmentally sustainable development so that there is a balance between economic and environmentally sound practices to enhance the quality of life and meet the needs of the present and future generations. The roll out of the project activities would therefore need to take place so as not to result in pollution</p>

POLICY/PLAN	RELEVANCE TO THE PROJECT
	<p>of the environment, result in ecological losses and not negatively impact the health and the well-being of humans.</p>
<p><b>National Climate Change Policy (NCCP) 2011</b></p>	<p>The goal of the National Climate Change Policy (NCCP) is “... <i>to provide policy guidance for the development of an appropriate administrative and legislative framework... for the pursuance of a low-carbon development path for Trinidad and Tobago</i>”.</p> <p>Trinidad and Tobago is particularly vulnerable to the adverse impacts of climate change such as those related to the increase in the frequency and intensity of extreme weather events such as hurricane, flooding and longer and more severe dry season, all of which will impact the water resources sector. As such climate change considerations are crucial to the activities planned under the Water Supply Improvement Project.</p>
<p><b>Draft National Policy on Gender and Development 2009</b></p>	<p>The National Policy on Gender and Development provides a framework for including gender perspectives in all activities of government and civil society, thereby promoting the full and equal participation of men and women in the development process. Therefore, the activities of WASA as the project is rolled out should be gender sensitive, accounting fully for and integrating the needs and interests of women and men into project activities.</p>
<p><b>National Protected Areas Policy, 2011</b></p>	<p>This objective of the National Protected Areas Policy is to provide guidelines for the selection, designation and management of all Protected Areas (PAs) established for the conservation of natural heritage in Trinidad and Tobago.</p> <p>The administrative framework for the management of PAs is complex. Several agencies and multi-sectoral committees have some responsibility for PAs management. The Caroni Swamp Forest Reserve, which falls within the project area and is protected by this policy and legislation elaborated in Section 2.1.2.</p> <p>The Northern Range is a sensitive ecosystem which also falls within the project areas.</p>
<p><b>National Wildlife Policy, 2013</b></p>	<p>Conservation and management of Wildlife in protected areas are elaborated in this policy. These strategies have been employed in the Caroni Bird Sanctuary which occurs within the demarcated project area.</p>

POLICY/PLAN	RELEVANCE TO THE PROJECT
<b>National Forest Policy, 2011</b>	<p>The objective of this policy is to conserve, manage and develop its forests and forest resources. This is pursued through three mutually reinforcing objectives:</p> <ol style="list-style-type: none"> <li>1. To optimise the contribution of forest resources to livelihoods; cultural and spiritual/religious use, while ensuring sustainable use of forests, including extraction of timber and wildlife</li> <li>2. To protect native genetic, species and ecosystem diversity</li> <li>3. To maintain and enhance the natural productivity of forest ecosystems and ecological processes (watershed functions, etc.) to provide important ecosystem services</li> </ol> <p>The management and protection of the Caroni Swamp Forest Reserve and its assets which is located within the study area is also governed by this policy.</p>

## Legislation and Regulations

Table 6-2 outlines several legislations and regulations relevant to the Water Supply Improvement Project.

**Table 6-2: Relevant legislation and regulations**

LEGISLATION/REGULATIONS	RELEVANCE TO THE PROJECT
<b>Water and Sewerage Authority Act of 1965</b>	<p>Under section 3(2) of the Statutory Authorities Act (Chapter 24:01), the Water and Sewerage Authority has been declared a statutory authority subject to the provisions of that Act.</p> <p><i>"The Act provides for the development and control of water supply and sewerage facilities in Trinidad and Tobago and matters of sanitation incidental thereto; the promotion of the conservation and proper use of water resources; and for the establishment of an Authority to administer the several purposes aforesaid and matters connected therewith."</i></p>
<b>The Environmental Management Act, 2000</b>	<p>This Act establishes an Environmental Management Authority (EMA) to execute the objectives of the Act. Functions of the EMA related to the project related to this project are to develop and establish national environmental standards and criteria, monitor compliance with the standards criteria and programmes relating to the environment and take all appropriate action for the prevention and control of pollution and conservation of the environment.</p> <p>The EMA has put in place a National Environmental Policy, 2001 and the Certification of Environmental Clearance Rules, 2001 to facilitate enforcement and compliance. The Act speaks to the requirement that</p>

LEGISLATION/REGULATIONS	RELEVANCE TO THE PROJECT
	persons must comply with the procedures and standards with respect to permits or licences required for any person to install or operate any process or source from which pollutants will be or may continue to be released into the environment.
<b>Certificate of Environmental Clearance Rules, 2001</b>	The Certificate of Environmental Clearance Rules, 2001 state that an application must be submitted to TCPD in respect of a designated activity constituting a development requiring express grant of permission under the Town and Country Planning Act.
<b>Noise Pollution Rules 2001</b>	<p>The Noise Pollution Rules, 2001 indicate that subject to any variation, no person shall emit or cause to be emitted any sound that causes the sound pressure levels to be greater than the prescribed standards.</p> <p>Construction activity when conducted on a construction site between the hours of 8.00 a.m. and 8.00 p.m. of the same day are exempt from the prescribed standards.</p>
<b>Environmentally Sensitive Species Rules, 2001</b>	<p>Environmentally Sensitive Species Rules, 2001 speak to the following objectives:</p> <ul style="list-style-type: none"> <li>a) <i>“maintenance of species abundance and diversity</i></li> <li>b) <i>preservation of the integrity of species’ populations to ensure genetic viability and to sustain their intangible and direct material benefits</i></li> <li>c) <i>maintenance of its importance of significance to the ecosystem (s) of the immediate locality or to wider areas</i></li> <li>d) <i>regulation of species which are or may pose a health or ecological liability</i></li> <li>e) <i>provision of valuable educational and non-destructive scientific research opportunities</i></li> <li>f) <i>demonstration of the benefits of wise use and the pitfalls of indiscriminate use of particular species”</i></li> </ul> <p>The Consultants will make a note of any endangered/sensitive species identified within the study areas.</p>
<b>Environmentally Sensitive Areas Rules, 2001</b>	The Environmentally Sensitive Areas Rules, 2001, outlines in its objectives the protection, preservation, management or rehabilitation of an area that is fragile, threatened or degraded and the regulation of the use of the natural resources contained within the area. The study area includes the Caroni



LEGISLATION/REGULATIONS	RELEVANCE TO THE PROJECT
	Swamp, which is considered a sensitive area. This area has been declared a Forest Reserve and a Bird Sanctuary.
<b>Forest Act #42 of 1915 Chapter 66:01 amended 1955, 1999</b>	The Caroni Swamp Forest Reserve (4,000 ha.) is protected under the Forests Act (Legal Notice # 141 of 1987). The Reserve occurs within the study area of this project.
<b>Occupational Safety and Health Act of Trinidad and Tobago, 2004</b>	This act speaks to the responsibility of the employer to ensure, so far as is reasonably practicable, the safety, health and welfare of its workers.
<b>Air Pollution Rules 2014 and associated Regulations</b>	This document provides monitoring standards for ambient air quality that should be adhered to during development activities.
<b>Water Pollution Rules 2019</b>	This document provides monitoring standards for ambient water quality that should be adhered to during development activities.

#### 6.4 International Treaties and Protocols

The following are relevant international treaties and protocols that should be considered prior to implementation of the program:

- **Convention on Biological Diversity** – The Convention on Biological Diversity (CBD), adopted in 1992, is the foremost international convention obliging its contracting parties to take action on invasive alien species.
- **The 2030 Agenda** – The 2030 Agenda is a Global Pact unanimously agreed to by the 193 Member States of the United Nations to take bold and transformative steps to shift the world on to a sustainable and resilient path, while leaving no one behind. The 17 Sustainable Development Goals (SDGs) and 169 targets of this Agenda, which is the successor to the Millennium Development Goals (MDGs), build on existing global agreements.
- **Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat), 1998**

The Ramsar Convention is an intergovernmental treaty that focuses on maintaining ecological wetland systems and planning for sustainable use of their resources. It was adopted on 2 February 1971 in Ramsar, Iran. The mission of the Convention was adopted by the Parties in 1999 and revised in 2005: *“the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”*. Trinidad and Tobago has three (3) Ramsar sites currently, totalling an area of 15, 919 hectares as listed below.

Ramsar Site	Date of designation	Region	Area	Coordinates
Buccoo Reef / Bon Accord Lagoon Complex	07/08/2005	Tobago	1,287 ha	11°10'N, 060°57'W
Caroni Swamp	07/08/2005	Trinidad	8,398 ha	10°34'N, 061°27'W
Nariva Swamp	21/12/1992	Trinidad	6,234 ha	10°23'N, 061°04'W

- United Nations Framework Convention on Climate Change (UNFCCC) Gender Action Plan** -The integration of gender into environmental initiatives has become a development priority globally and in the Caribbean. Subsidiary Body for the Implementation (SBI) of the Framework Convention on Climate Change (FCCC) at the 24th Conference of the Parties to the UNFCCC (COP 24) recommended that countries should begin review of the areas of progress, areas for improvement and further work to be undertaken under the Lima work programme on gender and its gender action plan. COP 24 called upon countries, constituted bodies and observers to intensify consultations in 2019, with the support of the secretariat, in order to advance the gender action plan. The National Determined Contributions (NDC) Partnership seeks to support its members in sharing and applying successful models for integrating gender equity into NDC planning and implementation. Member countries are already developing valuable approaches that provide useful learning opportunities for others. State Parties need gender expertise and resources that can be drawn upon through the SBI to support countries as they apply and scale-up gender-responsive climate policy and practices and develop nationally specific Gender Action Plans.
- Basel Convention** – Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 and entered into force on 5 May 1992. Trinidad and Tobago is signatory to the Basel Convention, which deals with the movement of hazardous waste across boundaries. By decision BC-III/19, the Conference of the Parties of the Basel Convention in 1995 selected Trinidad and Tobago as the location to establish a regional centre for the Caribbean sub-region. This resulted in the establishment of Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region (BCRC Caribbean) in 1998.

## 6.5 Relevant IDB Environmental and Social Safeguards

The IDB has several social and environmental safeguards that are applicable to all Bank-Financed Projects. They serve as a guide for the identification of potential social and environmental impacts of Bank-Financed Projects and how consultation should take place.

The principal Relevant Operational Policies are outlined in the table below. A brief description is provided along with its relationship of each policy to the project.

**Table 6-3: IDB Operational Policies**

NAME	CONTENT	RELATIONSHIP TO THE PROJECT
<b>OP-102: Access to Information Policy (April 2010)</b>	This policy sets out the principles which guide disclosure of information and the transparent use of public funds in order to enhance the Bank's accountability and development effectiveness.	The report will be required to be made available to the public and Project teams must comply with the Information Disclosure Policy.
<b>OP-703: Operational Policy on Environment and Safeguards Compliance (January 2006) and Guidelines (May 2007)</b>	This policy guides the environmental quality of the Bank's operations and its support to environmental projects in the Latin American and Caribbean region. Contained within are the policy directives related to both environmental mainstreaming and safeguards. The environmental safeguards establish procedures and standards to ensure quality and the environmental sustainability of both public and private sector operations.	The Bank requires that Category A and B operations be subject to Environmental Assessments (EA). This project is a Category B project which has required the need for an Environmental and Social Assessment and an Environmental and Social Management Plan (ESMP).  A Programmatic Environmental and Social Evaluation and a Programmatic Environmental and Social Guidelines Document is also required.
<b>OP-704: Operational Policy on Natural Disaster Risk Management (February 2007) and Guidelines (March 2008)</b>	<p>The purpose of the Bank's disaster risk management policy is to guide its efforts to assist borrowers in reducing risks emanating from natural hazards and in managing disasters, in order to support the attainment of their social and economic development goals.</p> <p>The Bank will not finance projects that, according to its analysis, would increase the threat of loss of human life, significant human injuries, severe economic disruption or significant property damage related to natural hazards.</p>	<p>This project is required to consider the necessary measures to reduce disaster risk to acceptable levels as determined by the Bank on the basis of generally accepted standards and practices.</p> <p>A Strategic Disaster Risk Assessment is being prepared as part of this project and is included in the Programmatic Environmental and Social Evaluation.</p>
<b>OP-708: Public Utilities Policy (November 2013)</b>	This Policy's objective is to guide the Bank's actions to promote universal access to and increase the efficiency and quality of public utilities service delivery under conditions that are affordable and environmentally and socially sustainable, so they contribute	This project is a public utilities project (water and sanitation) and aligns with the general Policy Principles of access, good governance, efficiency, innovation and environmental sustainability

NAME	CONTENT	RELATIONSHIP TO THE PROJECT
	<p>to the process of socially inclusive economic development.</p> <p>This Policy covers the following public utilities: water and sanitation, electricity, natural gas, solid waste, and telecommunications services.</p>	
<b>OP-710: Operational Policy on Involuntary Resettlement (July 1998) and Guidelines (November 1999)</b>	The objective of the policy is to minimize the disruption of the livelihood of people living in a project's area of influence, by avoiding or minimizing the need for physical displacement, ensuring that when people must be displaced they are treated equitably and, where feasible, can share in the benefits of the project that requires their resettlement.	<p>This project is unlikely to require involuntary resettlement. However, a Resettlement Plan will be developed if necessary.</p> <p>A grievance mechanism/management plan will also be prepared and included in the ESMP.</p>
<b>OP-761: Operational Policy on Gender Equality in Development (November 2010) and Guidelines (September 2013)</b>	This policy seeks to ensure that gender issues are addressed in the design of projects supporting infrastructure, economic opportunities and competitiveness, and institutional capacity of the State; and that gender elements are included in the execution and evaluation of projects	This project actively promotes gender equality and the empowerment of women and introduces safeguards to prevent or mitigate adverse impacts on women or men. A Stakeholder Engagement Plan will also be prepared. The ESMP will also consider any of these issues.
<b>OP-765: Operational Policy on Indigenous Peoples (July 2006) and Guidelines (October 2006)</b>	This policy directs the Bank to use its best efforts prevent or minimize exclusion and adverse impacts that Bank operations might generate with respect to indigenous peoples and their rights.	This project is not expected to impact any Indigenous groups in Trinidad.

## 7 INSTITUTIONAL FRAMEWORK AND ASSESSMENT

The Trinidad and Tobago water sector comprises the following entities:

- a. The Water and Sewerage Authority (WASA) – the service provider;
- b. The Ministry of Public Utilities (MPU) - the ministry responsible for policy direction;
- c. The Regulated Industries Commission (RIC) - the economic regulator;
- d. The Environmental Management Authority (EMA) - responsible for environmental regulation;
- e. The Water Resources Agency – the resource regulator is an agency within WASA;
- f. The Municipal Corporations – assist with the the distribution of truck-borne water in areas where there is a supply deficit.

These main agencies above and some other supporting agencies are summarised in Sections 3.1 to 3.8 below as they are all integral to the undertaking of the Water Supply Improvement Project.

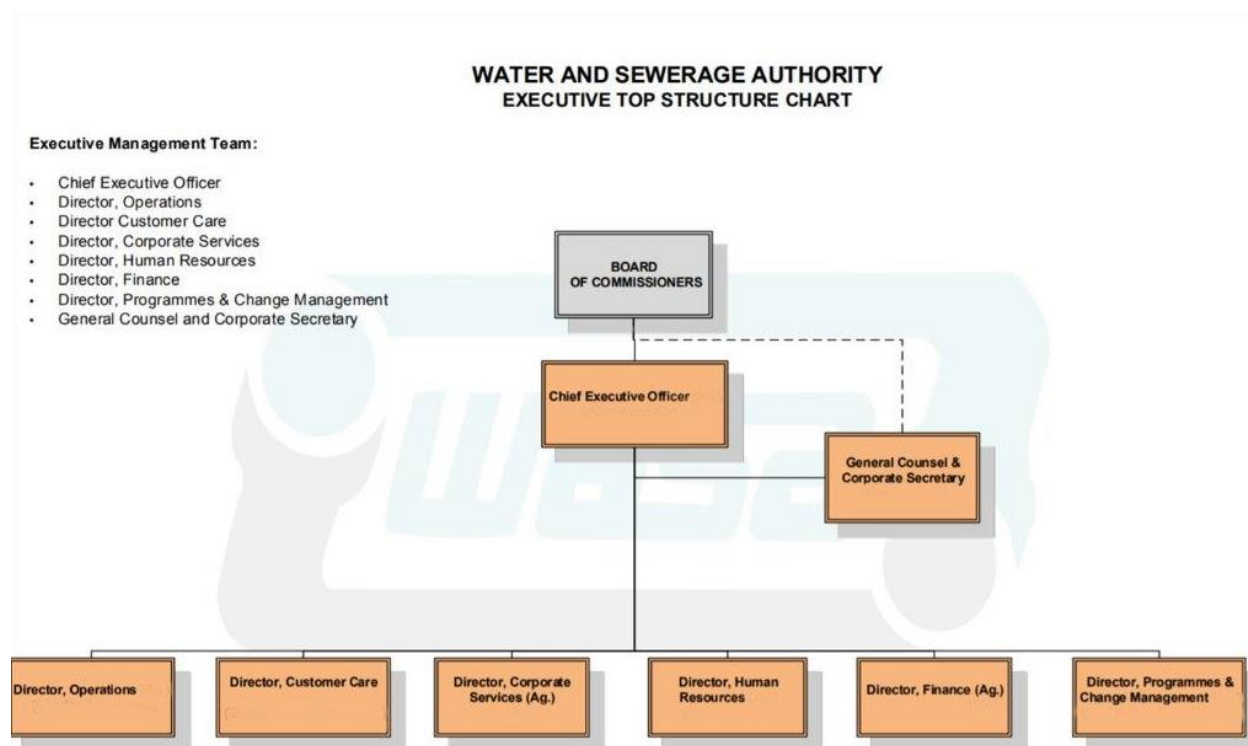
### 7.3 Water and Sewerage Authority

The Water and Sewerage Authority (WASA) is a state-owned utility mandated by the Water and Sewerage Authority Act of 1965 to manage the water and sewerage sector of Trinidad and Tobago. The Act had brought together several agencies, which were formally charged with the responsibility of providing water and sewerage facilities to Trinidad and Tobago. WASA is responsible for the development and control of water supply and sewerage facilities in Trinidad and Tobago and promoting the conservation and proper use of water resources.

The mandate of WASA is to secure water for every sector, deliver it and sustain it (WASA, 2008). The mission of the organisation is:

- To be a leading provider of water and wastewater services.
- To deliver customer service along the highest internationally recognised and accepted standards.
- To continuously develop best business practices utilizing advanced technology and a well-developed and motivated workforce.
- To leverage on industry expertise to offer global water and wastewater services
- To sustain a commercialised business while remaining sensitive to our stakeholders and our environment.

WASA operates upon 4 major developmental pillars, these include: human capital development, customer care cost optimisation and revenue enhancement. The organisational structure for WASA is illustrated below.



**Figure 7-1: Organisational Structure for the Water and Sewerage Authority**

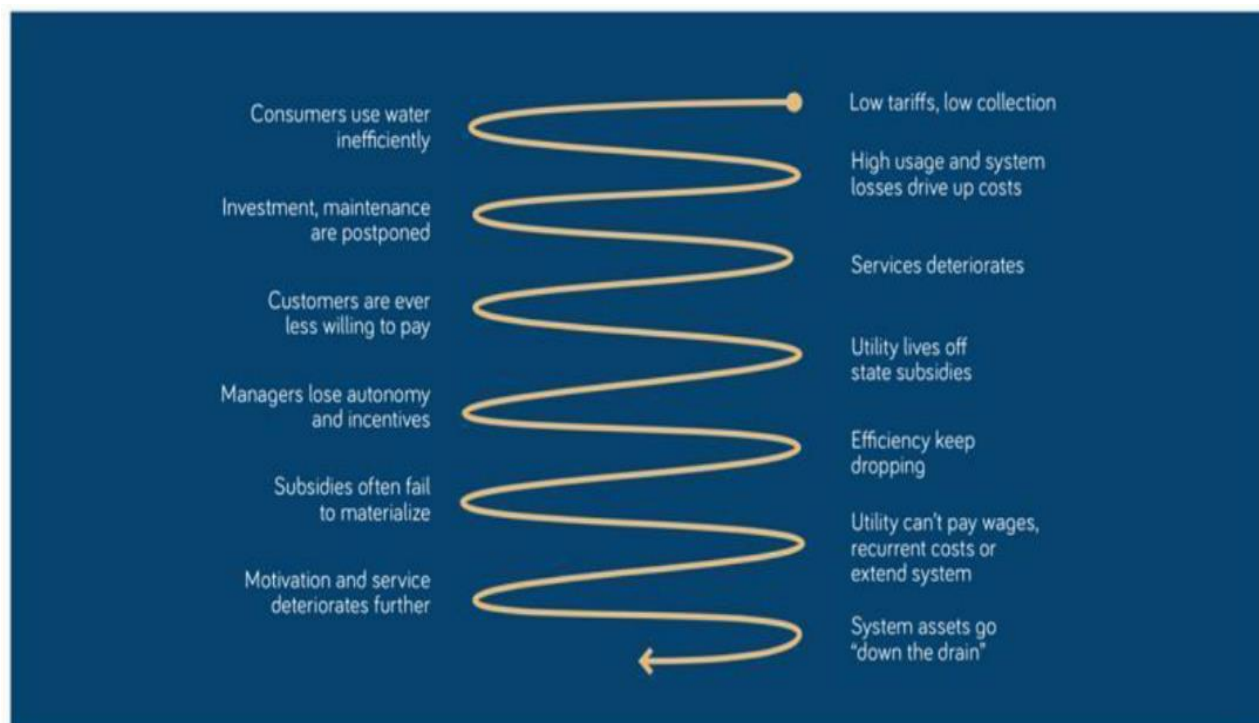
### 7.3.1 General Challenges and Areas for Intervention

Water and Sanitation Division of the IDB, 2020 indicated in their Guidance Brief on the scope and implementation of an Action Plan for WASA that a well-performing water utility is characterized by servicing a high proportion of the population with water and wastewater services that are reliable, continuous and responsive while operating in a cost-efficient manner. To be a well-performing utility, whether public or private, the utility needs to function within robust and transparent governance, legal/regulatory and institutional framework that provides the enabling environment for it to efficiently provide affordable quality water supply and wastewater services. At the same time, the utility should also be subjected to an accountability framework between the Board, Management, the parent and resource providing Ministries, customers and other key stakeholders.

The Guidance Brief spoke to the institutional weaknesses of WASA. Figure 7-2 below indicates that WASA is currently in a “Spiral of Decline”, that began with low tariffs and low collections ultimately resulting in WASA’s current position of degraded assets. It is recommended that to begin the turnaround of WASA will require improved governance at three levels – across the sector, at the Board level and at the organisational level. This will involve:

- (i) creating an effective enabling environment (legislation and regulation) to allow WASA to successfully function;
- (ii) ensuring the Board has the appropriate skills and targets as set by the Cabinet for WASA to transform; and

- (iii) equip the Executive team with a robust performance management system to invoke change in WASA's operations.



**Figure 7-2: Spiral of Decline**

In Trinidad and Tobago, the foundation for improved governance is there to be built upon as institutions such as the Regulated Industries Commission (RIC), Environmental Management Authority (EMA), and the Water Resources Agency (WRA), Office of the Procurement Regulator and the Occupational Safety and Health Authority already exist (SAFEGE, 2017 in Water and Sanitation Division of the IDB, 2020). The Government therefore needs to strengthen the legislative and regulatory tools of these regulators to provide proper oversight of WASA's performance.

Of major concern is that there is very limited measurement of the water moving within and around WASA's network which makes it difficult to estimate the volumes of water that is received by customers and that WASA receives no revenue for. In addition, data and information management is considerably lacking in WASA, inhibiting proper planning and performance monitoring to inform decision-making. Democratizing access to water data using social media and other platforms would be useful to get information into the hands of civil society and bring about accountability (Water and Sanitation Division of the IDB, 2020).

WASA has also been plagued by a range of operational inefficiencies, weak governance structures, poor management, public mistrust and a culture of underperformance. Of particular concern to WASA is its significant financial obligations under the DESALCOTT agreement which cannot be renegotiated at this time as well as the accumulated debt from previous years that continues to negatively affect its efforts toward achieving the desired financial viability.



The 2020 Report of the Cabinet Sub-Committee appointed to review the operations of the Water and Sewerage Authority (WASA) and to determine the strategy for enabling the Authority to achieve its mandate highlighted numerous acute challenges which must be addressed in any attempt to reform the water sector and WASA including:

- Use of Outdated Technology and Poor Data Analytics - Management and operational systems have not been modernised while systems and data architecture is poor;
- Water Demand/Supply Imbalances which exist across the country and between the dry and wet seasons. These are attributed to a very high per capita consumption of water, inadequate interconnectivity within the transmission and distribution network, unaccounted for water and inadequate water storage capacity;
- Derelict Assets, particularly within the distribution network - Successive years of under investment in asset maintenance and renewal has compromised and crippled operational efficiency;
- High Non-Revenue Water (NRW) due to a combination of aged network infrastructure, poor water pressure management,

The following are some specific challenges that impact WASA's performance negatively that is expected to be addressed with the roll out of the CCLIP.

- **Poor Strategic and Long-Term Planning:** SAFEGE found that WASA has been engaged to a limited extent in planning to achieve certain corporate objectives as identified in the Authority's medium-term strategic plans. It was noted that the Authority's planning documents do not make reference to the Authority's Master Plan for the sector, which usually covers a period of 30 years; and that the Authority's long-term planning seems to be done in a vacuum without any reference to past plans which have impacted the development strategy.
- **Human Resources Challenges:** based on benchmarks of similar agencies in the Caribbean<sup>3</sup>, WASA's staff productivity is characterized as low, with about 12.0 employees per 1,000 water connections (equivalent to 10.61 employees per 1,000 **water and wastewater connections combined**) while efficient utilities will typically have between 3 to 5 employees per 1,000 water connections<sup>4</sup>.
- **Lack of accountability:** WASA has a heavy reliance on Government subvention for both recurrent and capital expenditures, which is not tied to any performance targets resulting in a lack of accountability for funding provided.
- **Procurement Challenges:** As per IDB 2012 Institutional Capacity Assessment, WASA displays significant procurement-related challenges such as delays in procurement execution and timely payments to contractors due to weak intra-institutional communication and response-time framework. This negatively impacts the delivery of timely solutions to burning problems.

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<sup>3</sup> CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

<sup>4</sup> Leading utilities in the region have 1 employee per 1,000 connection and sub-contract a large number of their activities. Levels of 2 to 3 employees per 1,000 connections are considered reasonable levels.

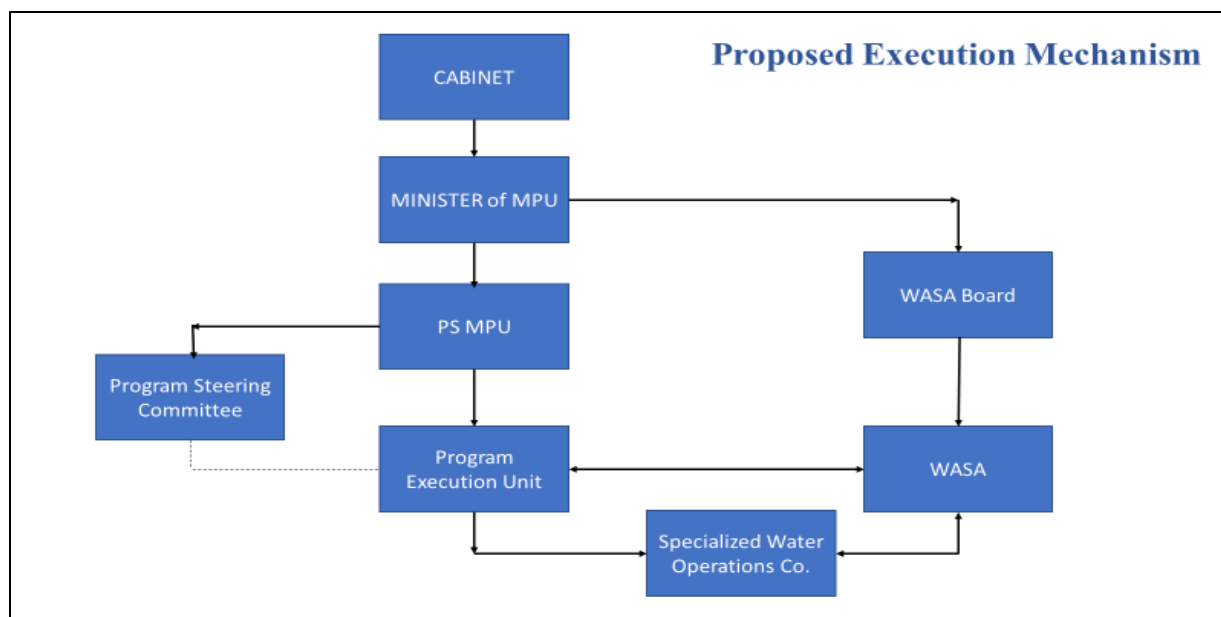
The Draft Revised National Integrated Water Resources Management Policy 2022 proposes the separation of the Water Resources Agency from WASA.

Overall, WASA lacks trained human resources, systems, technology and technical capability to turn around itself and provide 24/7 water supply to consumers.

### 7.3.2 How CCLIP will Address General Challenges

It is anticipated that the CCLIP will implement following recommendations that will help to improve WASA's efficiency.

1. Best practice of having **Performance-based contracts**, which are considered to be a very effective, and, ultimately, cost-efficient mechanism for implementing NRW projects.
2. An aspect of **change management** is making the best use of the people that will successfully deliver the implementation of WASA's Smart Business Model. This can be accomplished through culture change, leadership, assigning responsibilities and accountability, cross-business integration, change processes and teamwork for project delivery. It is important to develop a "Turnaround Roadmap" for WASA and to include specific policies and responsibilities. This would be done by the MPU in conjunction with WASA's Board.
3. WASA's **organizational restructuring and accountable performance management**. There is also the need to provide for increasing WASA's revenue stream and improve its customer relationship through increased efficiency and transparency. The MPU is committed to lead this transformation process and WASA's restructuring.
4. In order to establish the **smart water balance and the analytical and management tools**, an international water operator will be contracted on a Performance Based Contract for NRW Reduction, leak detection and repairs, planning and implementation of DMAs and to support and mentor the MPU, PEU, and WASA within the context of the overall transformation process and infrastructure rehabilitation.
5. The Project Execution Unit (PEU) will be responsible for **monitoring** the performance and progress of Programme execution. Monitoring will be against the Programme's result matrix that will establish the baseline and the projected annual targets of the Programme. The PEU will collate monthly status reports on the progress of the Programme. The PEU will submit to the IDB and Cabinet two semi-annual progress reports throughout the life of the Programme execution, within 90 days after the end of the calendar year or half year. Additionally, with Bank's resources, independent evaluators will be hired to conduct a midterm and final evaluation of the Programme. The proposed Execution Mechanism is illustrated in Figure 3.3 below



**Figure 7-3: Proposed Execution Mechanism**

### 7.3.3 Assessment of Capacity to Management Environmental, Social and Resettlement Issues

The development of the CCLIP is likely to have several physical, ecological and social impact in the surrounding area which would need environmental and social expertise to ensure these issues are properly managed. WASA would be the institution responsible for development of the RSSP as a reservoir.

WASA has an internal Environmental Department that identifies impacts and mitigation measures associated with planned activities. This department also ensures that all environmental related legal and regulatory requirements are satisfied such as may be required by the EMA. There is no social skillset on staff, nor is there a department to manage such issues. As such, the management of social issues including that associated with land acquisition and resettlement are lacking functions.

In order to properly implement the Trinidad and Tobago Water Supply Improvement project institutional capacity building would be required in the form of acquiring technical competent social experts to ensure the proper management of the social aspect of the project according to IDBs standard.

In 2012, WASA's Project Management Office developed a Land Acquisition and Compensation Strategy for development projects such as this.

## 7.4 Water Resources Agency (WRA)

The Water Resources Agency (WRA) is a subsidiary agency of WASA for which its mission statement is to effectively manage the country's water resources and promote conservation, development and protection of these resources, for sustainable use, in a cost effective and integrated manner to support socio economic growth (WASA, 2008). The primary roles and responsibilities of the WRA are as follows:

- Water Resources Assessment
- Water Resources Policy, Strategy Development and Implementation
- Development and Maintenance of a Water Resources Database and Information System
- Establishing and maintaining a hydrological and hydrogeological monitoring network to facilitate reliable and effective data collection
- Implementation of Integrated Water Resources Management including facilitating the participation and involvement of stakeholders in the process
- Master Planning and Water Resource Allocation
- Regulation of water abstraction from the national water resource
- Management of the permit and licensing system to regulate:
  - Drilling and construction of private water wells
  - Abstraction of water from the surface water and groundwater sources
- Water Demand Analysis

#### **7.4.1 Challenges and Areas for Interventions**

As stated above, the main objective of the Water Resources Agency (WRA) is to manage and control the nation's water resources in an integrated manner for sustainable use and to support socio-economic development. However, WRA is a subsidiary Agency of WASA, a state-owned utility to provide water and wastewater services. At present WRA therefore plays a supporting role in supplying potable water and providing sewerage services to the population. This relationship means that the Manager of the Nation's water resources reports to a user of the water resources. In fact, WASA is a user of the water resources for potable water supply. With the present institutional/organizational structure, the Water Utility has control of the management and allocation of the water resources.

Best practice water management dictates that the Planning and Regulatory functions should not be within WASA. Countries which have implemented effective water management institutional structures have the Water Resources Manager as a separate Agency/Authority.

The separate Water Resources Agency should have exclusive responsibility for Water Resources Policy and Strategy Development, Water Resources Assessment and Monitoring, Master Planning and Allocation, Pricing of abstraction water and Water abstraction Licensing among other functions. In all cases, there will be the need to consult with or seek approval from an outside agency or higher Authority such as Cabinet.

There must therefore be a demarcation of the Policy, Regulatory and Operational functions. WASA will need to keep operational functions to support its services.

Other Water Resources Management functions include Water Demand analysis, Conservation for water resources sustainability, Treatment /reuse of waste water, Watershed management, Water delivery, Legislation and Enforcement, Water Pollution Permits, Building / land use Permits, Demand Management for efficient use, Water Resources development and Distribution for domestic water, Industrial water and Agricultural water, Drainage/flood control, Sewerage/conveyance and Water treatment (Crichlow, 2008 a.).

The major stakeholders involved in undertaking these Water Resources Management functions are the 'Water Resources Management Authority', Water and Sewerage Authority, Ministry of Planning and Development, Environmental Management Authority, Town and Country Division, Ministry of Agriculture, Forestry Division, Ministry of Works, Drainage Division, Ministry of Agriculture-Land and Water Division, Ministry of Health, Meteorological Service, Institute of Marine Affairs, Regulated Industries Commission, Regional Corporation, Cabinet and Private Sector (Crichlow, 2008 a.).

The lack of an adequate legal and institutional framework for watershed issues discussed is a major factor against proper management of the resources and the treatment of flooding. The responsibilities are shared between a number of agencies operating under different legislative mandates, and there is no statutory requirement for inter-agency collaboration or consultation on the respective policies. In addition, the capacity of many of the agencies is limited in terms of personnel with the requisite skills and competencies.

Note the DHV Consultants (1999) from Holland, who were the Consultants on the Water Resources Management Strategy for Trinidad and Tobago recommended a separate Water Resources Management Authority<sup>5</sup>.

## **7.5 Ministry of Public Utilities**

The mission of the Ministry of Public Utilities is to facilitate the effective delivery of efficient, affordable and quality public utilities services through a committed, resourceful team of professionals in close collaboration with all stakeholders. It does this through:

- The provision of effective and efficient leadership and governance to the Utilities Sector;
- Ensuring that Trinidad and Tobago's utility sector (electricity, post and telecommunications) is modern, customer oriented and technologically enabled to provide effective, cost efficient quality services to all citizens;
- The provision of a framework within the Ministry for promoting employee well-being and ensuring that all employees are treated with dignity, fairness and respect;
- Collaboration with the agencies to ensure that they practice prudent financial management with a view to becoming financially viable.

Water is one of the basic necessities to sustain human life. It is also a vital component in the operation of an industrialised society. As such, Government is faced with the challenge of satisfying the needs of its citizenry on one hand while catering for the increasingly sophisticated demands of a dynamic and expanding economy on the other.

The Ministry of Public Utilities is mandated to manage the nation's resources in such a manner as to satisfy its diverse customer base while respecting the constraints and carrying capacity of the environment. The state enterprise responsible for the delivery of water and wastewater services to the population of Trinidad and Tobago is the Water and Sewerage Authority (WASA) (Ministry of Public Utilities, 2013).

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<sup>5</sup> Within 5-10 years

## 7.6 Regulated Industries Commission

The Regulated Industries Commission (RIC) is an independent, statutory body established to ensure the promotion of the highest quality of utility services at fair and reasonable rates while building a credible regulatory regime that responds adequately to stakeholders concerns and also to ensure fairness, transparency and equity in the provision of utility services throughout the country. The RIC regulates the delivery of services by the Water and Sewerage Authority and the Trinidad and Tobago Electricity Commission.

Services provided by the RIC include:

- Making recommendations on the award of licences
- Monitoring and enforcing compliance with licence conditions
- Establishing the principles upon which tariffs will be based and monitoring rates charged to ensure compliance
- Prescribing standards for services and monitoring compliance of those standards
- Carrying out studies of efficiency and economy of operation and performance
- Facilitating competition between service providers where competition is possible and desirable
- Investigating complaints by consumers, of their failure to obtain redress from service providers
- Imposing and collecting fees for licences
- Ensuring that service providers earn sufficient return to finance necessary investment (Ministry of Public Utilities, 2013)

## 7.7 Environmental Management Authority

The Environmental Management Authority (EMA) is established by the Environmental Management Act, 2000 to carry out the objectives of the Act. The Environmental Management Authority has a Strategic Plan for the period 2010 to 2014. The EMA's strategic goals for this period are summarised as follows:

- To protect and improve air quality, inland and coastal water quality.
- To prevent negative health consequences from chemicals spills and the unsafe handling and disposal of solid and hazardous wastes.
- To protect, conserve, and/or restore selected ecosystems and species
- To develop an innovative programme to balance environmental protection and economic development and facilitate the expeditious processing of CEC applications.
- To protect human health and the natural environment from the effects of noise while allowing for reasonable social, cultural and economic activity.
- To mitigate and adapt to climate change.
- To protect human health and the natural environment through the timely enforcement of statutes, ensuring compliance with permit and license conditions and the promotion of environmental stewardship

WASA would need to make an application for a CEC for any activity that will likely result in significant environmental pollution.

## **7.8 Office of the Procurement Regulator**

The Office of Procurement Regulation is a body corporate established pursuant to an Act of Parliament, namely the Public Procurement and Disposal of Public Property Act, 2015. The Act aims to provide for public procurement, and for the retention and disposal of public property in accordance with the principles of good governance, namely accountability, integrity, transparency, and value for money and to promote local industry development, sustainable procurement and sustainable development (Office of Procurement Regulation, 2020).

Though the Act was assented to on January 14, 2015, it comes into operation on a date to be fixed by the President by proclamation. However, to allow for the establishment of the Office of the Procurement Regulator (OPR), the appointment of the Members of the Board, the performance of certain key functions of the OPR, and the drafting of Regulations, the Act was partially proclaimed by way of Legal Notice 150 of 2015 (Office of Procurement Regulation, 2020).

## **7.9 Occupational Safety and Health Authority and Agency**

The Occupational Safety and Health (OSH) Authority and Agency was established under the Occupational Safety and Health Act (OSH Act) (2006). It is a multi-stakeholder advisory body to the Ministry of Labour and Small Enterprise Development (MOLSED). The Authority comprises 17 members and is led by a Chairman. The core task of the Authority is to encourage the enforcement of the OSH Act, to promote training and research, provide information and to develop Regulations and Approved Codes of Practice (A.C.O.P.). The OSH Agency is the enforcement arm of the OSH Authority. The Agency is led by an Executive Director.

There are operational units within the Inspectorate comprised of Safety and Health Inspector Is, Safety and Health Inspectors IIs, Senior Inspectors and the Chief Inspector who is the head of the Inspectorate. Inspectors are empowered under the OSH Act to access all industrial establishments, acquire any information needed to carry out investigations and to use its legal powers.

As an enforcement body, the main objective of the OSH Agency is to ensure compliance with the OSH Act. Its enforcement policy promotes voluntary compliance in the first instance. Therefore, public awareness, the involvement and sensitization of tripartite partners and other stakeholders are considered critical in promoting a preventative safety and health culture in Trinidad and Tobago. Close co-operation with other ministries and institutions, as well as supporting OSH training structures and the provision of accessible OSH information are also essential to OSHA's mandate. However, OSHA is also actively pursuing prosecution of safety and health infractions as another arm of enforcement under the OSH Act (Occupational Safety and Health Authority and Agency, 2020).

## **7.10 Municipal Corporations of Trinidad and Tobago**

Local government is single-tiered system in both Trinidad and Tobago, with Trinidad divided into 14 municipalities governed city/borough or regional corporations. The Municipal Corporations Act No. 21 of 1990 provides for the establishment and operation of the Municipal Corporations in Trinidad, is the principal legislation governing the country's local government system. . . Over the years, the Act has been amended several times, the last amendment being in 2013. This Act, which granted corporate municipal status to all Local Government bodies in Trinidad, and as amended in 1992 (the Municipal Corporations (Amendment) Act No. 8 of 1992), provided for the two City Corporations, three Borough Corporations and



nine Municipal Corporations. Each Municipal Corporation is accountable to the Ministry of Local Government which provides oversight and policy directives.

Under Section 269 of the Municipal Corporations Act 1990, the Minister of Local Government can give general or specific directions to Municipal Councils in relation to government policy on any matter. The Minister can also promote effective and equitable partnership between Central and Local Government in the development of socioeconomic growth, balanced sustainable development and social welfare, and acts as adjudicator in cases of disputes between Municipal Corporations.

The Act gives powers to the 14 Municipal Councils, which acts through the Chief Executive Officer (CEO), Senior Officers and Staff of the Corporations. Each Municipal Council, which comprise a mix of councillors and aldermen, is responsible for a range of key functions within its municipal jurisdiction, from regional and local planning, the development and maintenance of selected roads, bridges, footways, drains, public buildings and structures, the maintenance of markets, slaughterhouses, pastures, commons, recreation grounds or public cemeteries and recreational grounds; solid waste collection; public health, municipal policing to the distribution of truck-borne water in areas where there is no supply.

The Ministry of Rural Development and Local Government's key functions as it relates to the Corporations include the oversight of finances from Central Government; monitoring and evaluation, adjudication; technical services in regard to engineering and project management; drafting legislation that impacts on local government; and developing policy directives. Each year, the Corporation prepares and submits capital expenditure estimates and an income and expenditure budget to the Ministry of Local Government and the Ministry of Finance for approval. Local Government Reform is underway to transform the local government system by devolving significant autonomy, power and authority to Municipal Corporations for their respective jurisdictions.

The Tobago House of Assembly Act 37 of 1980 and its Amendments provide for the establishment and functioning of the Tobago House of Assembly and sets out 33 areas of responsibility for the THA. However, all aspects of water provisioning in Tobago remain the responsibility of WASA.

### **7.11 The Town and Country Planning Division**

The Town and Country Planning Division (TCPD) was established as part of the Town and Country Planning Act. The mandate of the TCPD was to administer the use and development of all lands in Trinidad and Tobago through development planning and development control. The specific functions are:

- Establish a national physical development planning framework for regional and local area plans that would be utilized for decision-making purposes and to guide development accordingly.
- Review applications for planning permission.
- Review applications for display of advertisements.
- Enforce planning control.
- Assist in the preparation and review of planning legislation.
- Compile a database of land use planning data in Trinidad and Tobago.
- Compile a register of all planning applications.

The TCPD is responsible for granting planning permission for proposed developments on both privately and state-owned lands. There are two forms of planning permission: outline and full developments. The purpose of outline planning approval is to ensure consistency between the type of development and the

land use policy for the proposed site. Full planning approval is sought by specific types of activities, this includes:

- Building operations (erection and renovation).
- Land or building use change.
- Retention of an existing building.
- Land subdivision.
- Cutting, clearing, grading or filling activities.
- Road and drain construction.

The TCPD also has oversight of any land acquisition and resettlement activities.

## 8 APPROACH AND METHODOLOGY

### 8.3 General Approach

The multi-disciplinary team of experienced scientists and environmental professionals conducted data gathering and analysis together to determine the dominant environmental issues relevant to the proposed project and to identify the potential impacts and mitigation measures. Detailed review of secondary data was used to inform the assessment. Among the key activities were:

- Desktop research
- Analysis of maps and plans
- Review of reports and background documents
- Stakeholder consultations

Other proposed developments and surrounding land use were also reviewed in the context of compatibility with the proposed project including potential positive, negative and cumulative impacts.

The following subsections describe the approach for assessing the physical, biological and socio-economic environment.

### 8.4 Physical Assessment

This section describes the methods associated with conducting the topographical, climate, hydrological, natural hazard assessments of Trinidad and Tobago.

#### 8.4.1 Topography, Geology and Soils

Assessing the topography, geology and soils of the site included literature review and analysis of 1:50,000 topographic maps and Google Earth images.

#### 8.4.2 Climate

The climate of the area was determined through review of data from the Trinidad and Tobago Meteorological Services and other published literature. Climate change projections from the Draft State of the Caribbean Climate, 2020 prepared by the Climate Studies Group at UWI were also reviewed and referenced.

#### 8.4.3 Natural Hazards

Desktop review of past events were used to inform the section on natural hazards. This included literature on droughts, flooding, landslides, earthquakes, hurricanes and climate change.

#### 8.4.4 Hydrology

Hydrology and drainage were assessed via the review of literature, data and maps from the Water and Sewerage Authority Resources Authority (WASA), the Environmental Management Authority, and the Ministry of Planning and Development. Available water quality data received from WASA were also analysed within the context of the project.

#### 8.4.5 Air and Noise

This project did not involve the collection of air and noise samples. Information presented is based on available ambient air quality data and noise baseline data received from the Environmental Management Authority (EMA) via published literature were also analysed within the context of the project.

Particulate matter was primarily examined since it's effects from exposure of PM<sub>10</sub> on human health include but are not limited to: deleterious effects on the respiratory systems, damage to lung tissue, cancer, and premature death; the age, gender and health of the individual will determine the extent of these effects. This was considered a significant concern based on the proposed activities.

### 8.5 Ecological Assessment

The Ecological Assessment is based primarily on the review of secondary data available from the Trinidad and Tobago State of the Environment Report and the Environmental Management Authority along with information identification for locations of likely ecological significance. This is used to inform the country evaluation and identify the likely types of impacts from the project activities.

### 8.6 Socioeconomic Assessment

The activities of the proposed Water Supply Improvement Program will likely affect the people of Trinidad and Tobago, WASA, and more specifically surrounding communities where construction activities and vice versa. As such, the main purpose of the socioeconomic analysis was to place the proposed project within the context of the local human environment so as to understand the existing socioeconomic setting and determine the potential impacts discerning negative and positive influences.

The project was examined within the geographic setting of Trinidad and Tobago and, where possible the country's municipal administrative areas. The methodological approach to this assessment was in keeping with the databases available and needed to support proper analysis and useful findings and included the following main methods.

- Desk Research
- Field Investigations
- Stakeholder Consultations via Key Informants Interviews.

#### **Desk Research:**

Desktop research and review of earlier environmental studies for Trinidad and Tobago and for different local sites or similar areas in other jurisdictions helped to put the development project into its local

context. Demographic and housing information from the Central Statistical Office (CSO) were also acquired largely via their online published data as the offices were not open during the study period due to the COVID-19 regulations resulting in the closure of non-essential services. The following are secondary documentation that were reviewed:

- IDB Environment and Safeguards Compliance Policy (OP 703) and Environment and Safeguards Compliance Policy (OP 761), IFC Standards on Environmental and Social Sustainability (2012) and relevant local legislation like the Environmental Management Act of 2000; the CEC Rules (2001)
- National policies, plans and programmes that are relevant to the socio-economic development of the affected areas including Vision 2030 National Strategic Plan; the National Spatial Development Strategy – A Planning Framework for the Metropolitan area which includes, the Municipalities of Diego Martin, San Juan Laventille and Tunapuna/ Piarco; and the City of Port-of-Spain.
- Secondary information relating to the Municipalities and affected communities – these include the baseline reports to Municipal Local Area Economic Profiles.
- Mapped data from the Ministries of Works and Transport, Agriculture, Land and Fisheries, Education, Health, Community Development, Rural Development and Local Government, National Security, and Office of Disaster Preparedness and Management (ODPM).
- CSOs 2011 population statistics for the affected communities, the sub-regions and municipalities within which the communities are located including statistics on:
  - a. Population and demography - total population by sex, age group, ethnic composition, religion and disability.
  - b. Household composition – number of households and sex of head of household.
  - c. Housing conditions and services – water sources, sanitation facilities, lightning assets, and environmental problems experienced.
  - d. Using the information collected (secondary and primary data), compile profiles of the affected municipalities and communities – identify the socio-economic characteristics of the communities.
  - e. Income levels and sources; poverty rates and vulnerable groups.
- In cases where limited information is available, official quotes from relevant institutions were used to express or highlight specific issues.
- Cultural heritage sites within the project's areas of influence.
- The ESA Report for the Trinidad and Tobago Water Supply Improvement Project.

### **Field Investigations:**

Rapid appraisal windscreen surveys for selected urban and rural Municipalities were conducted. The purpose was to verify secondary information reviewed and to determine changes that have taken place in recent times, and to understand the socioeconomic and cultural context of the different Municipalities.

### **Stakeholder Consultations:**

As previously indicated in subsection 1.5 It is important to note that this Consultancy took place during the COVID-19 pandemic which impacted the nature of stakeholder engagements held. As a result, community Key Informant interviews administered electronically or via telephone were utilized in place

of face-to-face meetings and a household survey. This would mean that the number of responses were less, but the Consultants believe that the community Key Informants consulted were knowledgeable representatives from key communities.

## 8.7 Impact Assessment and Mitigation Measures

Following the assessments of the existing environment, the team identified various environmental and social aspects and possible impacts associated with the various project components. The construction and operation phases of the proposed activities were also analysed. These impacts were assessed with respect to their direction, duration, magnitude and type.

- Direction defines whether the impact is positive or negative
- Duration defines whether an impact is a short-term, long term, intermittent or continuous
- Magnitude defines an impact as minor, moderate, major or significant
- Type defines an impact as reversible or irreversible

Impacts were identified based on the factors in Table 8-1.

**Table 8-1 Impact Assessment Criteria**

IMPACT ASSESSMENT CHARACTERISTIC	
<b>Direction of impact</b>	
Rank	<b>Definition</b>
Positive	<ul style="list-style-type: none"> <li>• Impacts of the project on the environment and vice versa are likely to be good</li> </ul>
Negative	<ul style="list-style-type: none"> <li>• Impacts of the project on the environment and vice versa are likely to be bad</li> </ul>
<b>Magnitude of impact</b>	
Rank	<b>Definition – one/the combination of</b>
Minor	<ul style="list-style-type: none"> <li>• Little or negligible action and/or control are useful, but not required in the short term, review in the future is useful</li> <li>• Exceeding of threshold value in case of operating problems (abnormal conditions) and low effect and low probability of occurrence and/or high probability of detection.</li> <li>• Minimal effect</li> <li>• Limited probability of occurrence</li> <li>• “Aspect” controlled under normal conditions</li> <li>• High knowledge of “Aspect”</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>• Action and/or control are required in the near future</li> <li>• Exceeding of threshold values in case of operating problems (abnormal conditions) and above</li> <li>• average high probability of occurrence and/or low probability of detection.</li> <li>• Financial threat</li> <li>• Effect likely to increase under planned activities</li> <li>• Rising concern of shareholders</li> <li>• Emergency situation would cause a large environmental impact</li> </ul>

IMPACT ASSESSMENT CHARACTERISTIC	
	<ul style="list-style-type: none"> <li>Complaint likely to be received</li> <li>“Aspect” not fully controlled under normal conditions</li> </ul>
Major	<ul style="list-style-type: none"> <li>Immediate Action and/or control is mandatory</li> <li>Aspect” is currently not controlled under normal operations.</li> <li>Could break legal or policy documents.</li> <li>In breach of legislation</li> <li>Sensitive environment (groundwater proximity, conservation area, residential area)</li> <li>Repeated complaints</li> </ul>
<b>Impact Duration</b>	
Short term	Occurring infrequently or during one project phase
Medium term	Occurring frequently during a few project phases
Long term	Occurring frequently during most or all project phases
<b>Types of Impacts</b>	
Reversible	Effects which are reversible and diminish when activities cease or over time.
Irreversible	Effects which are not reversible and do not diminish even if the activity ceases to occur, and do not diminish with time.
Cumulative	Effects of an action are added to or interact with other effects in a particular place and within a particular time
<b>Probability of Impacts</b>	
Low	Impact which is unlikely to occur
Moderate	Impact which may occur
High	Impact which is very likely to occur

Appropriate development guidelines were then prepared to address all the potential negative impacts identified in the Programmatic Environmental and Social Guidelines. This is presented in Section III of this document.

## 9 THE EXISTING ENVIRONMENT

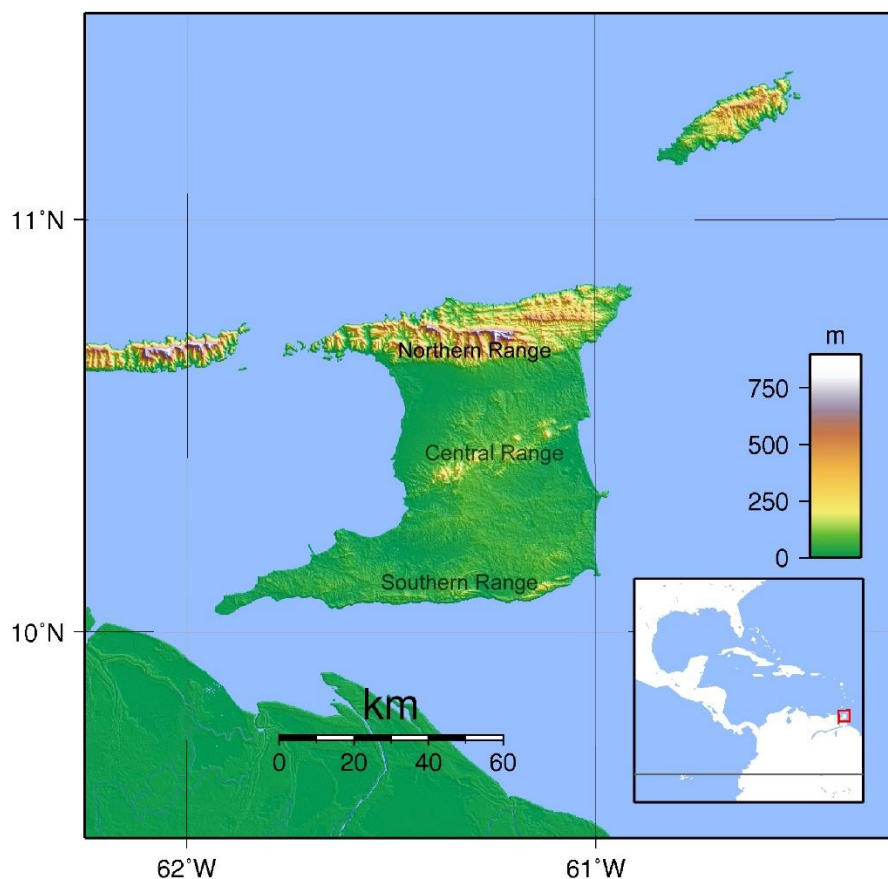
The physical, ecological and social environment for Trinidad and Tobago are presented in Sections 5.1 to 5.3 below. Specifically, the Caparo River Basin has also been highlighted in specific sections based on the possibility of the planned activity to develop the Ravine Sable Sand Pit (RSSP) into a reservoir during the CCLIP.

### 9.3 Overview of Physical Environment in Trinidad and Tobago

#### 9.3.1 Topography

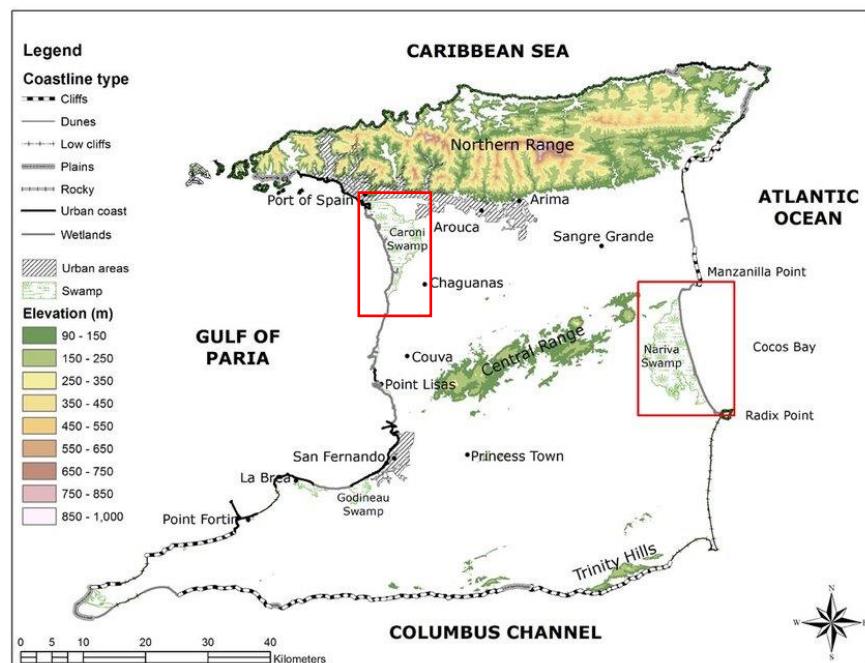
The topography across Trinidad is characterized by three distinct east-west trending mountain ranges, The Northern Range, The Central Range and the Southern Range, separated gently rolling flatlands (Figure 9-1). The Northern Range is the highest set of mountains on the island with a peak reaching 940 m above sea level (EL Cerro Dele Aripo). The gentle topography of the range decreases eastward. The range is said to be a continuation of the mountains of the Paria Peninsular in Venezuela. The Central Range reaches a maximum height of 300 m and the hills of the Southern Range are much lower.

The gently rolling flatlands located between the mountain ranges are generally low lying with extensive drainage features (most originating from the mountain ranges) and extensive swamps areas along the east, west and south coast (Figure 9-2: Location of Swamp Areas across Trinidad).



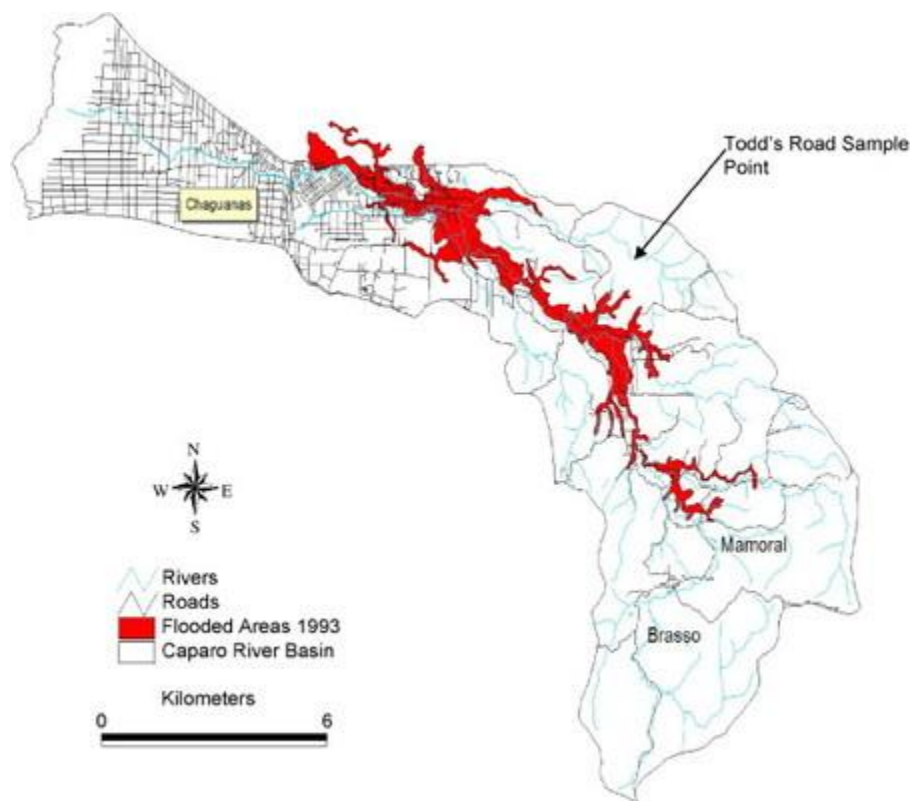
**Figure 9-1: Digital Elevation Model of Trinidad and Tobago (Source: Mapsland, 2020)**





**Figure 9-2: Location of Swamp Areas across Trinidad (Modified from Darsan et al., 2020)**

The Caparo River Basin is a low-lying watershed in Central Trinidad as illustrated above in Figure 5-4. This site has been chosen due to historical issues associated with the flooding of the River Basin. A study was conducted on the utilization of the Ravine Sable Sand Pit to develop a multi-purpose reservoir for flood control irrigation and water supply (Haskoning...). However, the water supply initiative will be pursued as one of the initiatives to be implemented to meet the deficit in Central Trinidad.



**Figure 9-3: Flooding and the Caparo River Basin (Source: Alpha Engineering and Design (2012) Ltd.)**

### 9.3.2 Geology

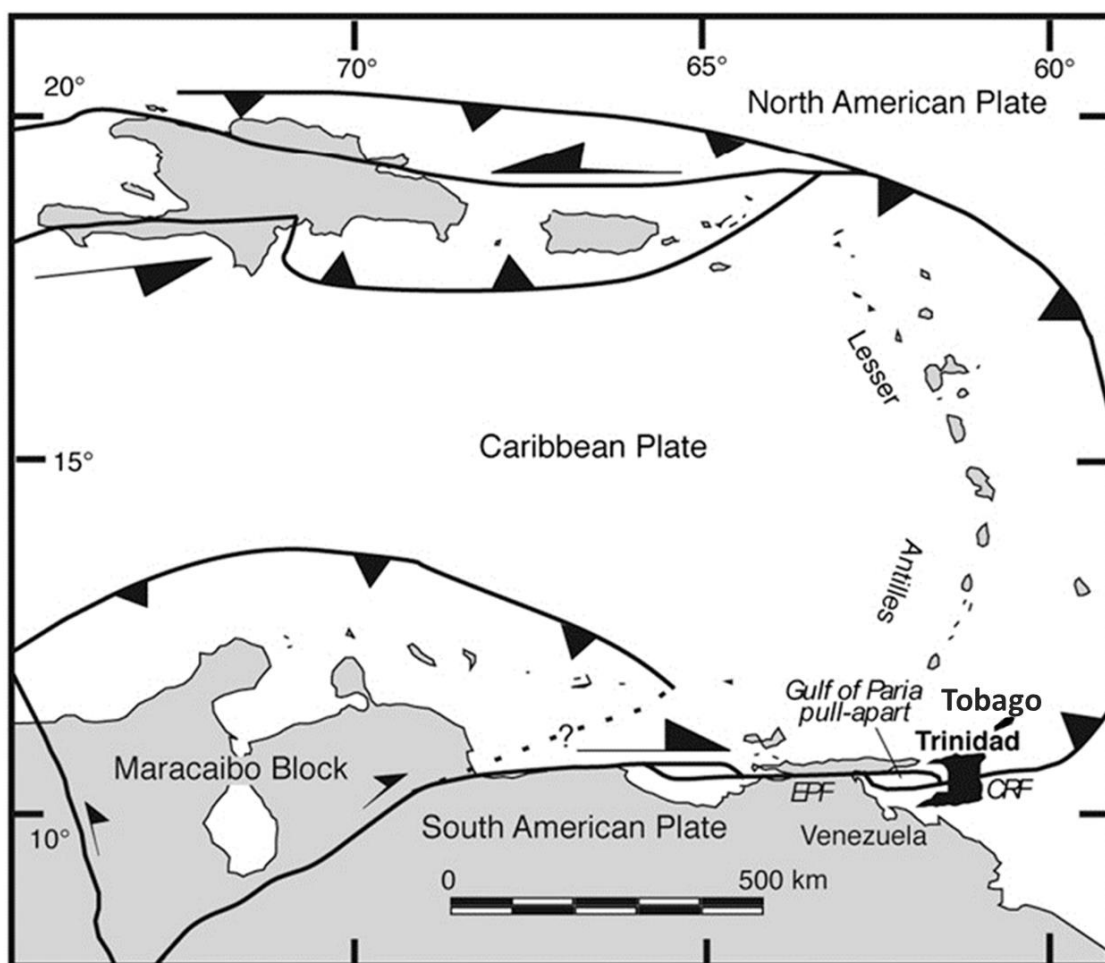
Trinidad and Tobago is located on the South-eastern edge of the Caribbean Plate and the South American Plate margins (Weber, et al., 2011). This plate boundary zone represents an area of significant Neogene structural deformation. Several east-west strike-slip faults which cut across Trinidad are associated with this plate-boundary margin (Figure 9-4 and Figure 9-5). While in Tobago, the Central Fault System consists of normal faults with crosscutting north-northwest striking, oblique-slip faults (Snoke and Wadge, 2001). The South Fault system in Tobago does not show any surface expression however movement is captured in offshore seismic reflection profiles. These islands, therefore, sit within an active earthquake zone.

The geology of Trinidad can be described as three areas of uplifted ranges separated by a flat-lying basin filled areas which were produced by the erosion of uplifted ranges (Figure 9-6 **Error! Reference source not found.**) (Garcia-Caro, Mann & Escalona, 2011). The three uplifted ranges are known as the Northern Range, Central Range, and the Southern Range. The Northern Range has some of the oldest rocks (Late Jurassic – Cretaceous) in Trinidad (**Error! Reference source not found.**). These consist of clastic sedimentary rocks, recrystallized limestones, and low-grade metamorphic rock facies including sericitic phyllites, sericitic quartzites and massive-ortho-quartzites, which sometimes show relic structures (GSTT,2020). The Central Range consists of Pre-Middle Miocene clastic and carbonate sedimentary rocks that underwent deformation and displacement. The right lateral shearing of these rocks along the Central Range fault zone creates an angular unconformity (Garcia-Caro, et al., 2011). The Southern Range contains

clastic sedimentary rocks ranging in age from Late Cretaceous to Pleistocene. This area represents the uplifted and eroded section of the Southern Basin (Garcia et al., 2011).

Surrounding the uplifted ranges, are low lying areas known as the Northern Basin/GOP Pull Apart Basin/Caroni Plains and the Southern Basin. The Northern Basin is infilled with consists of young alluvial fan deposit. These sediments were derived from the erosion of the rocks from the Northern range, transported and deposited by major rivers on the southern flanks of the mountains. The phyllitic rocks of the Northern Range make it very are susceptible to mass movements (landslides). The Southern Basin is characterized as an intensely deformed basin consisting of Oligocene to Pliocene clastic rocks. This basin has been the main site of petroleum exploration with abstraction from the clastic deep water and paralic formations.

Tobago's geology is subdivided into four main groups: the North Coast Schist, the Plutonic Suite, the Tobago Volcanic Group and Pleistocene coralline limestone rocks (Figure 9-7). The North Coast Schists are Cretaceous low grade metamorphosed volcanic rocks. The plutonic suite consists of Albian age (Cretaceous) deformed volcanic plutonic complexes, ultramafic rocks, gabbro-diorite, and biotite ± hornblende tonalite (Snoke, et al., 2013). Parts of the plutonic suite intruded and contact metamorphosed the Tobago Volcanic Group (Snoke, et al., 2013). This group is predominantly Albian lithic-clast volcanoclastic breccias (Snoke, et al., 2013). The youngest rocks are located in the southern section of Tobago. These sedimentary rocks are predominately coralline limestones.



**Figure 9-4: Location of Trinidad and Tobago on the south-eastern margin of the Caribbean Plate Margin (Weber, et al., 2011)**

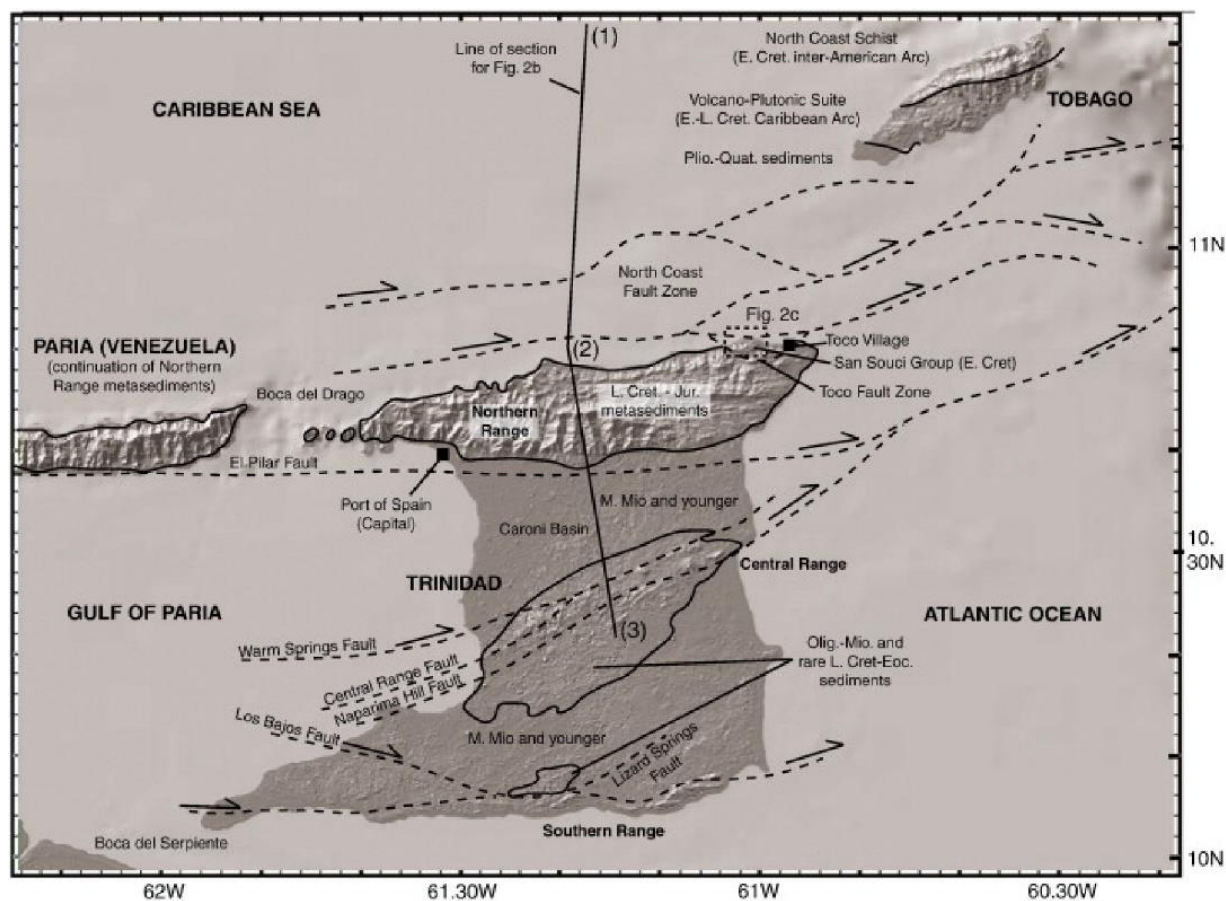
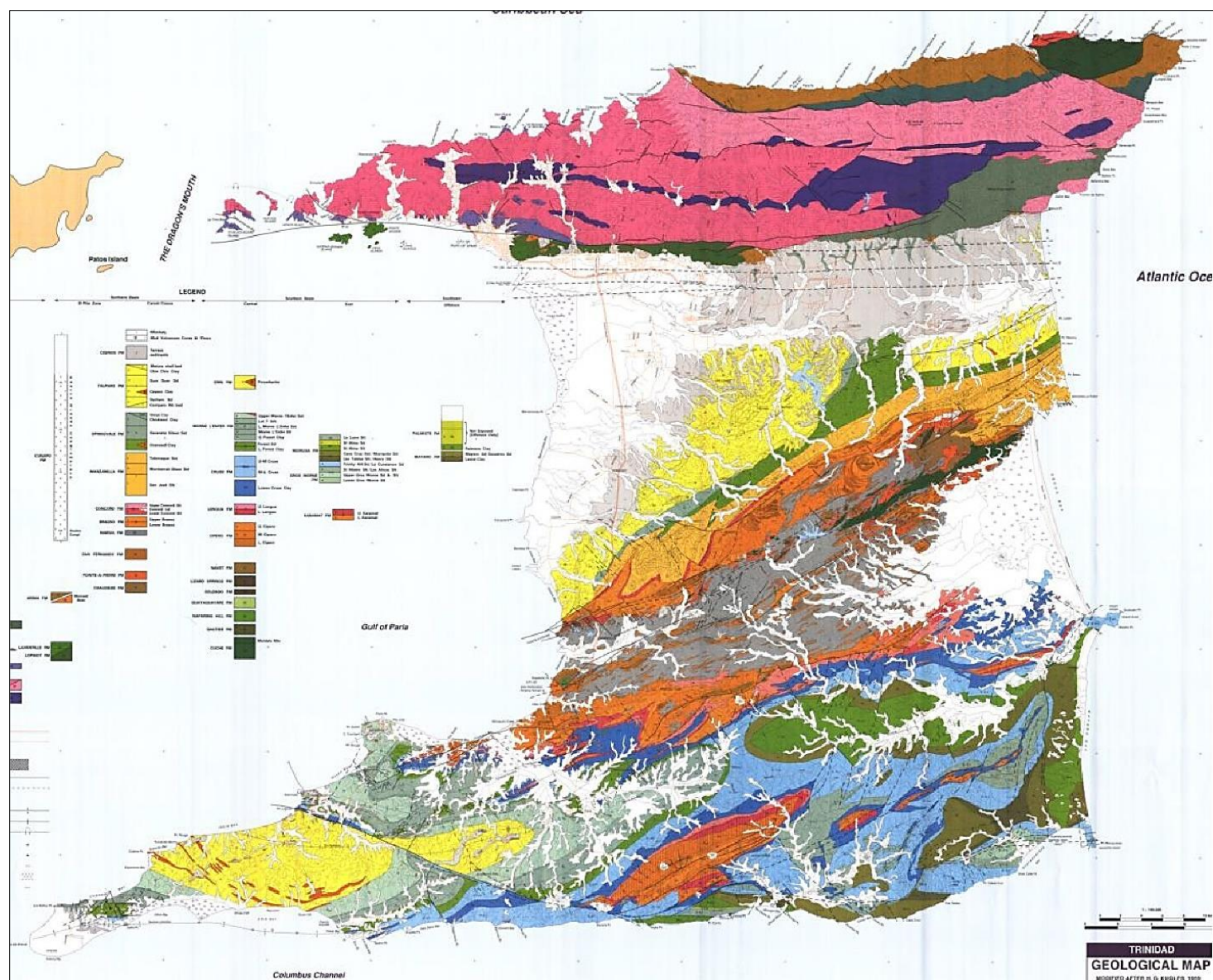


Figure 9-5: Major east-west trending faults which cut across Trinidad Roberson (Roberson & Burke, 1989)





**Figure 9-6: Geology map of Trinidad (Saunders, 1998)**

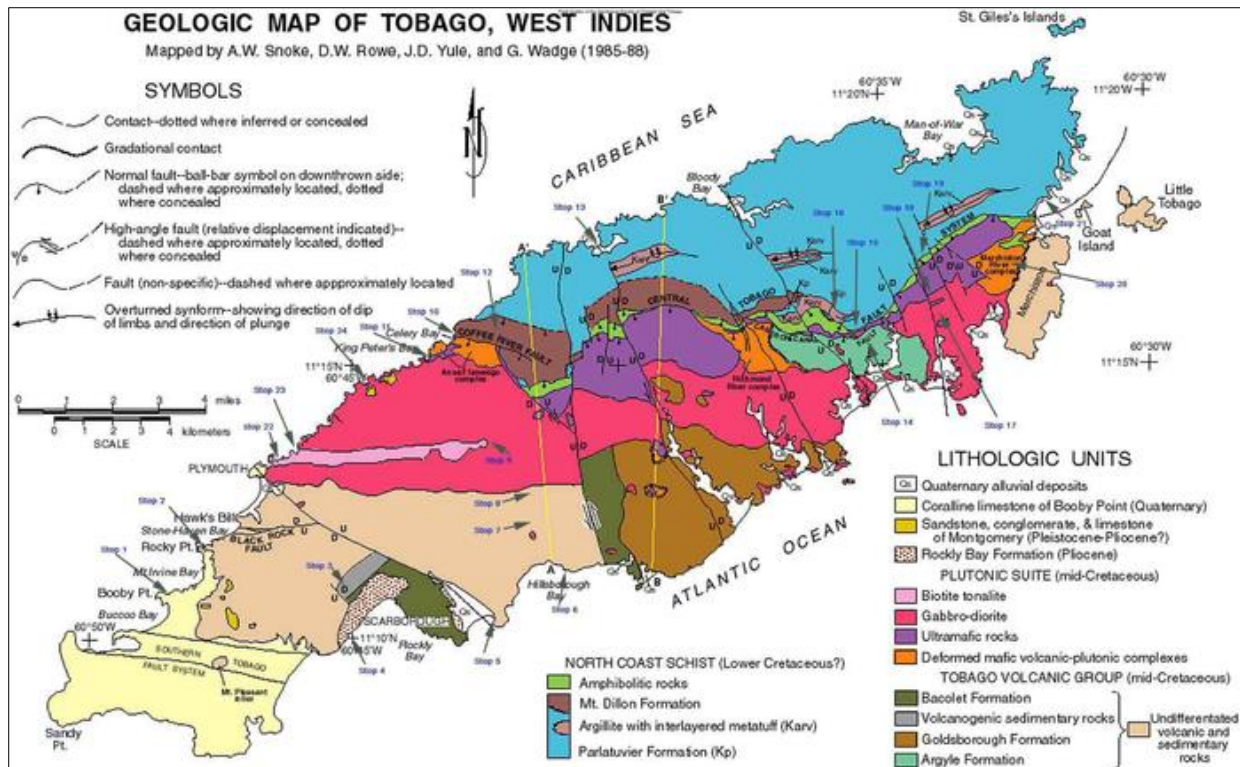
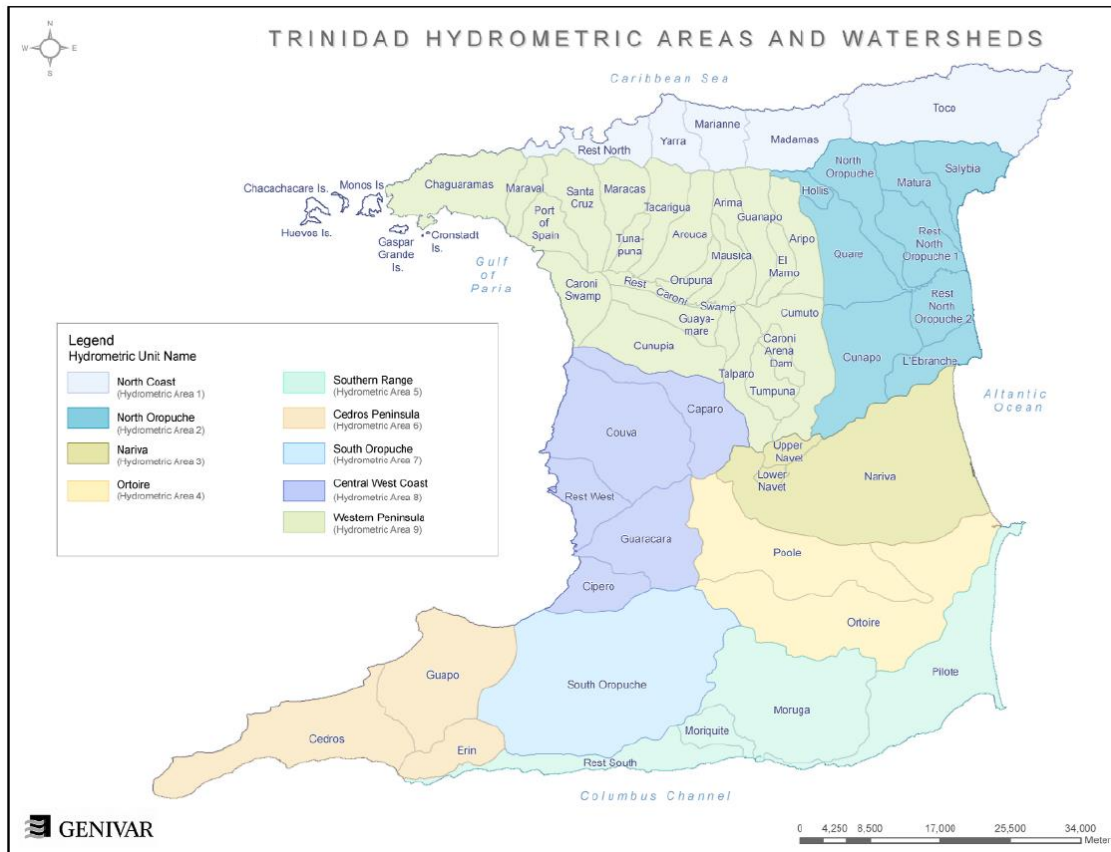


Figure 9-7: Geology map of Tobago (Snoke, Yule and Wadge, 1988)

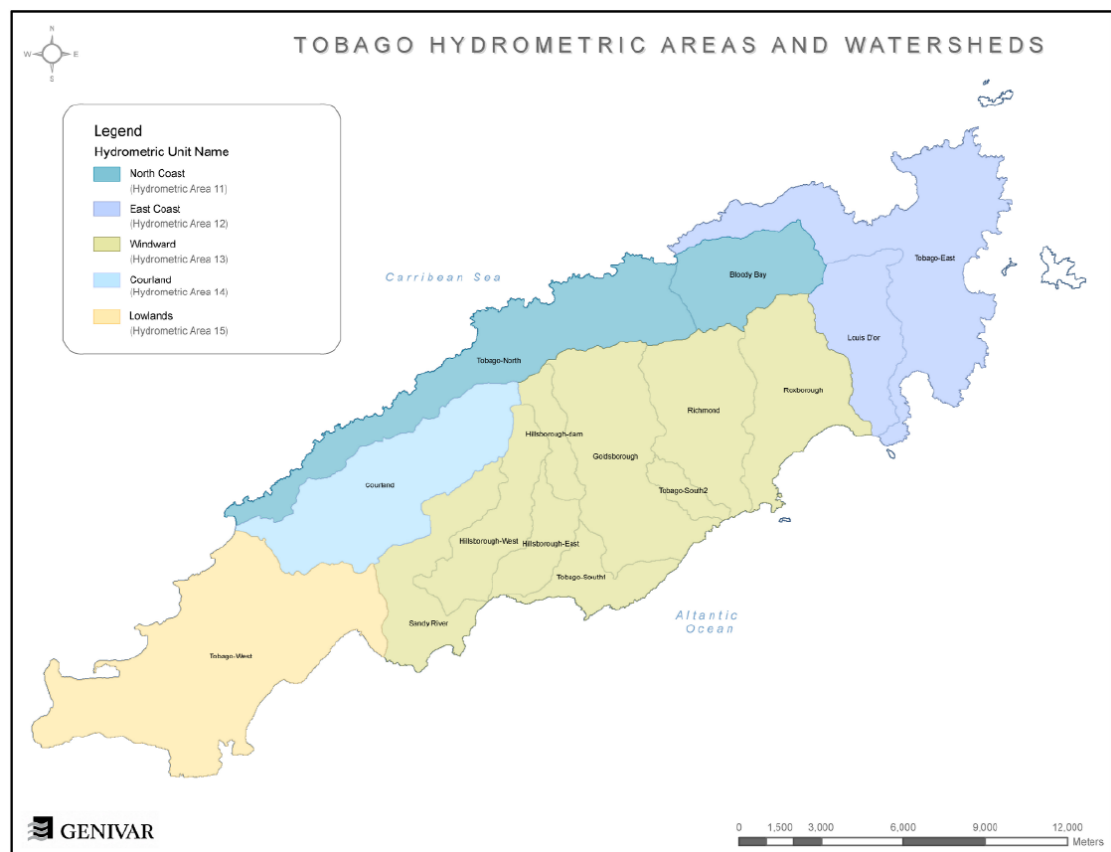
### 9.3.3 Water Resources and Land Use

The Water Resources Agency has divided the country into Water Resource Management Units (WRMUs), each comprising a group of Hydrometric Regions. Each hydrometric area contains a number of watersheds/sub-watersheds as illustrated in Figure 9-8 and Figure 9-9. There are fourteen (14) hydrometric units established for Trinidad and Tobago, nine (9) located in Trinidad and five (5) in Tobago. Trinidad is further sub-divided into 54 watersheds and Tobago sub-divided into 15 watersheds.



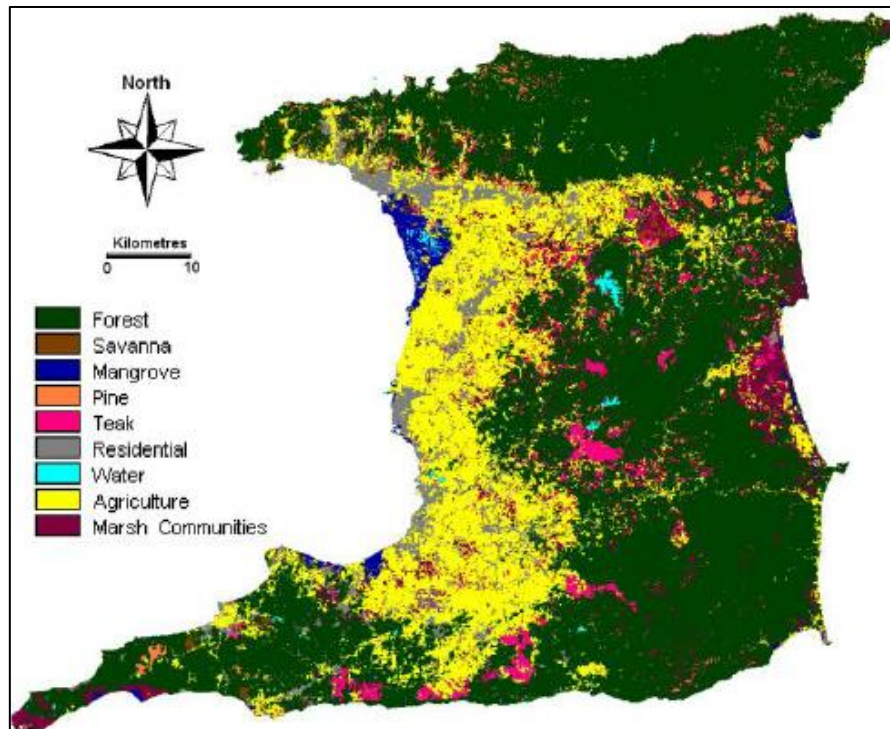


**Figure 9-8: Trinidad Hydrometric Areas and Watersheds (Genivar, n.d.)**



**Figure 9-9: Tobago Hydrometric Areas and Watershed (Genivar, n.d.)**

Residential settlements and commercial centres in Trinidad are concentrated largely along the west coast, and the foothills of the Northern Range. The western and central areas of Trinidad also have highly concentrated agricultural activity (Figure 9-10). The northern range, particularly the eastern section, the smaller central range and southern range are areas of low development and retain much of their forests. There are two key wetland areas, the Caroni Swamp to the west and the Nariva Swamp to the east. Encroachment from agricultural and residential expansions, threaten for example: the degradation of northern range and the Nariva Swamp (Figure 9-11). The management of development, runoff from urban areas and agricultural lands, and wastewater effluent from industries are existing issues that result from the various land uses. These all have negative impacts on the water resources in Trinidad.



**Figure 9-10: Generalised Land Use Map of Trinidad (Chinchamee et al., 2006)**

One of the major problems in managing the water resources in Trinidad and Tobago is the continuing watershed degradation due to encroachment and conflicting land uses which threatens water supply production both in terms of its quantity and quality.

Soil erosion and water degradation have been increasing in Trinidad and Tobago. The main reasons for the degradation are the indiscriminate clearing of forests for housing and urban development, shifting cultivation and squatting, the loss of forest and protective vegetation cover by forest and bush fires, quarrying operations, and road construction and cultivation on steep slopes, without the application of appropriate soil conservation measures (DHV Consultants, 1999).

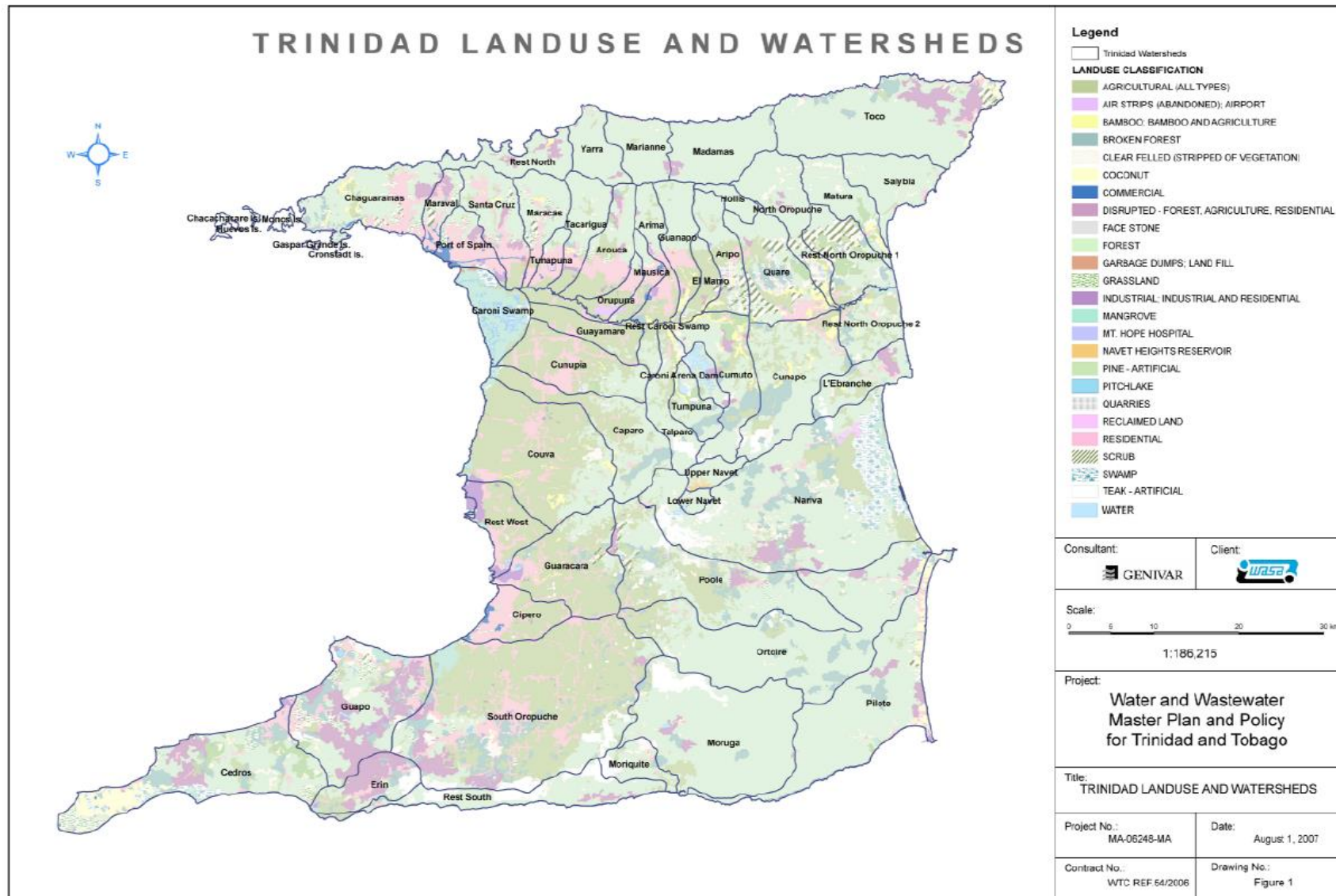
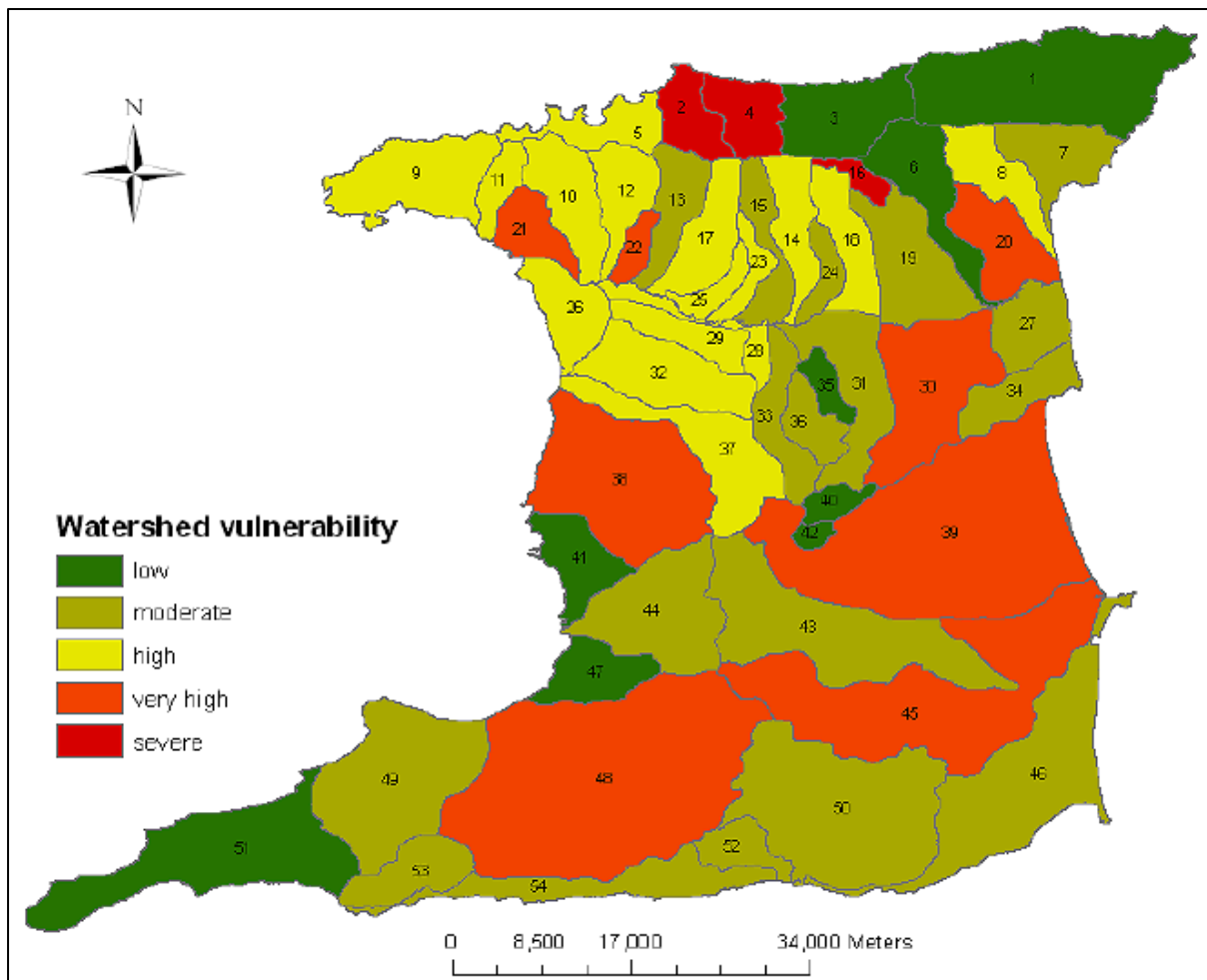


Figure 9-11: Trinidad Land Use and Watersheds (Genivar, n.d.)

Among the highest priority watersheds requiring attention as a result of soil erosion and watershed degradation are the foothills of the Northern Range, and in the Northwest – the Maraval, St. Anns and Diego Martin watersheds (DHV Consultants, 1999). Figure 9-12 illustrates the most severely degraded watersheds in Trinidad.



**Figure 9-12: Vulnerability of Watersheds to Land Degradation (Mahabir and Al-Tahir, 2008)**

Soil erosion and watershed degradation are the main causes of many problems. Impacts on the water resources sector are related to increased sediment yields in rivers, and canals and changes in the distribution of the catchment runoff with respect to peak flows and baseflows. Sedimentation decreases the discharge capacity of surface water channels and therefore increases the risk of flooding. With increased runoff, low flows have also decreased resulting in lower baseflows and more water shortages in the dry season. However, a proper assessment of these impacts of soil erosion and watershed degradation is most unlikely at this time, as the data and information on erosion and soil characteristics are lacking (DHV Consultants, 1999).

Urbanization and housing have increased considerably in Trinidad and Tobago. Again, the southern foothills of the Northern Range have been particularly impacted. It appears that expansion of urban areas has been at the expense of forests and agricultural lands. An example is the Santa Cruz catchment where it has been reported that urban development increased significantly (as much as 30%), (DHV Consultants, 1999). Increased development, together with limited attention being paid to mitigating negative impacts from site preparation and construction methods, further degrades the



watershed and results in high erosion rates and sediment yields. National regulations and guidelines are not followed in some instances.

With respect to shifting cultivation, it has been reported that 75% of the bush fires are caused by slash and burn agriculture (DHV Consultants, 1999). Squatting is also highly damaging to the land as the land is kept clear by fires. In Trinidad, squatting is concentrated on the foothills of the Northern Range where it has led to the destruction of forest vegetation between Port of Spain and Arima. In Tobago, residential squatting is almost non-existent whereas squatting for agricultural purposes is limited.

Quarrying activities have turned large acres of land into wasteland because operators have failed to restore the land after abandoning the quarries. As a result of the removal of the protective vegetation, runoff and soil erosion increase. Additionally, large amounts of sediment may be washed from spoil heaps and steep slopes, while water laden with silt from the wash plants is sometimes discharged directly into the water courses. Streams are frequently diverted for abstracting wash water and sometimes quarrying is done directly in riverbeds. At times, quarries are located upstream of water intake points and water treatment plants and the high sediment loads can cause challenges with the operation of the facilities.

Water quality monitoring is an important aspect of overall water quality management and water resources development. However, water quality and water quantity are strongly interrelated and should not be considered separately in any effective water quality management programme. Hence attention must be given to the discharge of waste loads in the watersheds (WRA, 2019).

Basically, the surface water quality is directly dictated by the pollutant loads from point and non-point sources. The main cause of the deterioration of surface water quality is uncontrolled point wastewater discharge, in particular by industries and by domestic sources. There are a number of manufacturing Industries (around 27) discharging effluent into tributaries of the Caroni Basin. These industries produce a range of items including paints, processed chicken, soaps, oils, beer, batteries, rum, sand and gravel, juices, etc. (WRA, 2019).

With respect to domestic waste, approximately ninety percent (90%) of households is connected to either a sewer or septic system, while nine percent (9%) utilise the pit latrines (CSO 2011). Septic tanks or pit latrines will not have a significant effect on the water quality of the surface water systems if properly installed. The public sewer system continues to improve with the recent construction of new treatment plants and the upgrading of existing plants. However, wastewater collected by several private sewer systems is subsequently treated in wastewater treatment plants which quite often are not operating as effective as they should.

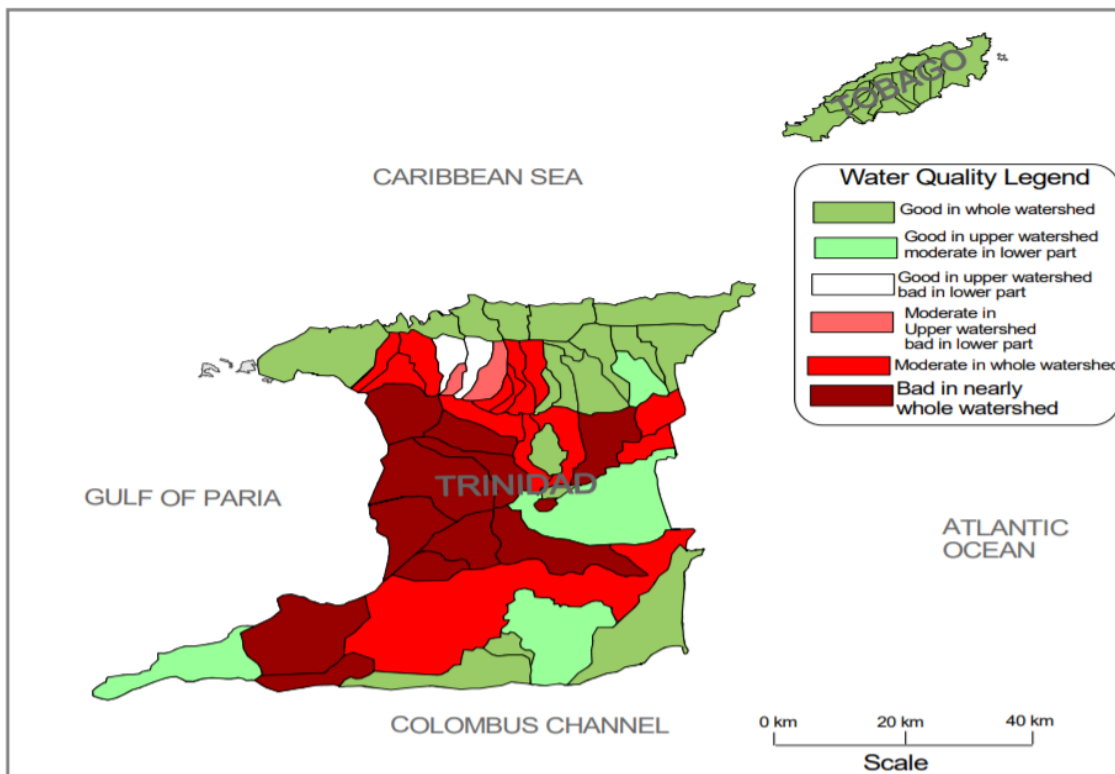
With respect to livestock and agriculture, information on the waste load is lacking. However, the waste load that may reach the surface or ground water system may be significant for specific areas, particularly if significant amounts of fertilizer or pesticides are used. There are a number of cattle, pigs and poultry farms in both Trinidad and Tobago. Livestock is concentrated in the northern and western part of Trinidad.

#### **9.3.3.1.1 Water Quality**

According to an assessment by the Water Resources Agency, the watersheds of the Northeastern section of Trinidad have good water quality, whereas the watersheds in the Central and South Western regions experience poor water quality (Figure 9-13). Watersheds contributing to the Caroni Arena system show steadily decreasing quality throughout the watershed with the lower reaches being more polluted than the upper reaches (WRA, 2019)..

Most of the watersheds in Tobago experience good water quality except the Courland and Sandy river watersheds where the water quality is good in the upper watershed and poor downstream. The lower section of the watershed is negatively impacted by agricultural runoff, urbanization, grey water and seepage from cesspit and pit latrines (WRA, 2019).

Most of the damage caused in the watersheds is based on activities in the watershed. In order to address these issues proper land use planning and implementation of integrated watershed management would be needed. Additionally, effective public education and awareness is critical to enhance understanding of the problems and obtain commitment by everyone.



**Figure 9-13: Surface Water Quality in Trinidad and Tobago (DHV Consultants in GORTT, 2016b.)**

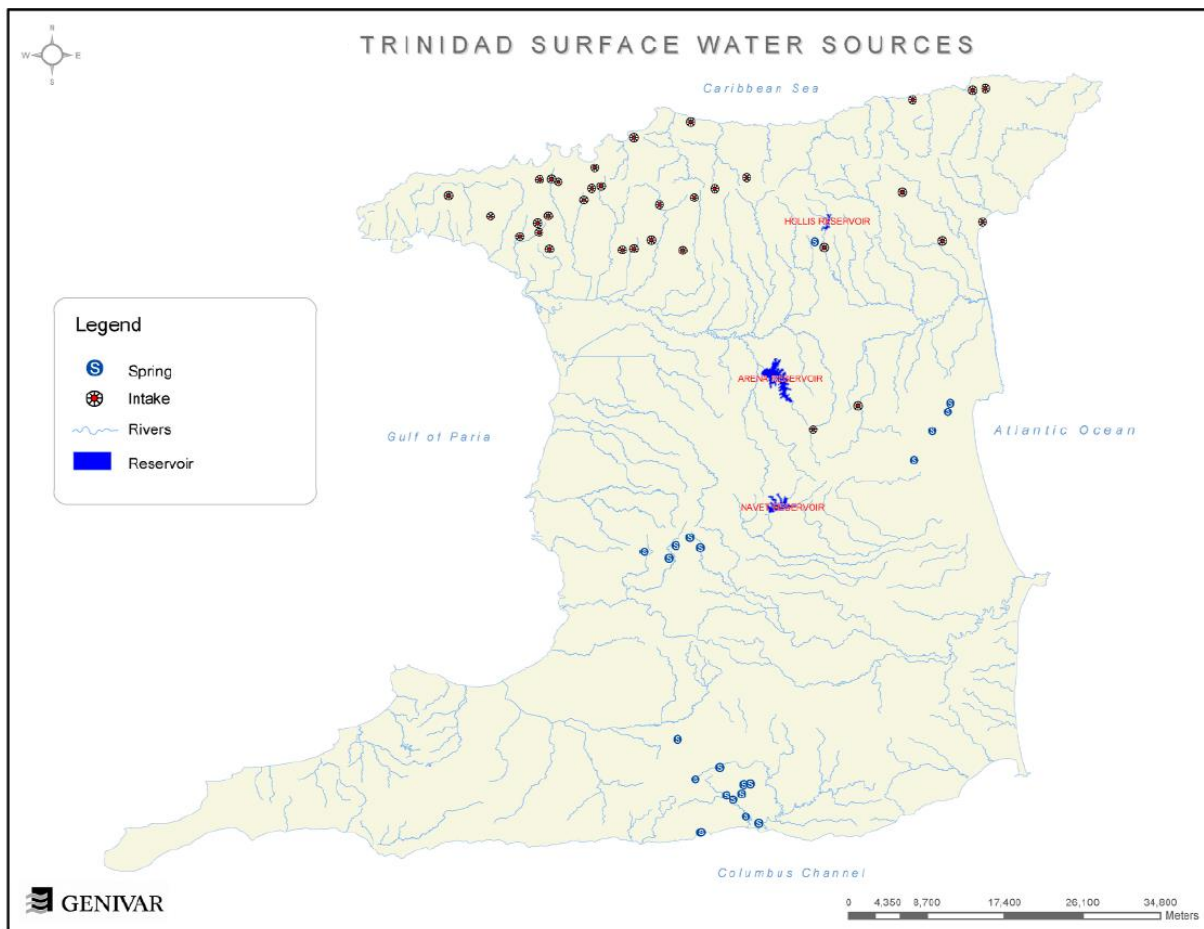
#### 9.3.4 Hydrology

For water resources management purposes, Trinidad and Tobago has been subdivided into fourteen (14) hydrometric areas which was elaborate on in Section 5.1.3 above and illustrated in Figure 9-8 and Figure 9-9. The hydrometric areas in Trinidad are the North Coast, North Oropouche, Nariva, Ortoire, Southern Range, Cedros Peninsula, South Oropouche, Central West Coast and Western Peninsula/Caroni. The hydrometric areas in Tobago are the North Coast, East Coast, Winward, Courland and Lowlands. The hydrologic boundaries of the basins (or watersheds) and hydrometric areas correspond to surface water divides. The unit for water management is a hydrologic basin or watershed.

Water supply in Trinidad and Tobago is from a combination of surface water sources (including reservoirs and rural intakes), groundwater sources and desalination.

#### **Surface water sources**

The major river systems in Trinidad drain the Northern and Southern basins and discharge either to the east or the west. Minor river systems that drain the northern slopes of the Northern Range discharge to the north while other river systems draining the southern slope flow to the south (Figure 9-14).



**Figure 9-14: Surface Water Resources in Trinidad (Genivar, n.d.)**

Five (5) minor river systems which drain Tobago have their headwaters in the Main Ridge. Three (3) river systems drain south into the Atlantic Ocean, and the other two (2) discharge to the south west and north. On the coral plain in the south west of the island, there is an absence of surface drainage which reflects the high infiltration capacity of the underlying limestone.

The largest river basin in Trinidad is the Caroni Basin and it is about 40km in length. The Caroni River drains the western two-thirds of the Northern Basin west through the Caroni Swamp and into the Gulf of Paria. The Arena Reservoir regulates part of the flow of the Caroni Basin. Other major impounding reservoirs in Trinidad are the Hollis Reservoir which is on the Quare river in the north east and the Navet Reservoir which comprises two (2) reservoirs (Upper and Lower Navet reservoirs) on the Navet river (Haskoning Caribbean Ltd., et al., 2013). In Tobago, the Hillsborough river is the most important river in Tobago and has the Hillsborough Reservoir.

An important feature of the water resources system is the coastal swamps which cover approximately 7.6% of the land area in Trinidad. The larger river systems in Trinidad tend to discharge into or through coastal swamps. Given their size, special attention from a water management point of view needs to be given to the Caroni Swamp (5,600 ha), the Nariva Swamp (6,200 ha), the North Oropouche swamp (1,900 ha) and the South Oropouche (Godineau) swamp (Haskoning Caribbean Ltd., et al., 2013).



The North Oropouche River drains the eastern third of the Northern Basin east through the North Oropouche Swamp into the Atlantic Ocean. Within the Southern basin, the Navet River system flows east through the Nariva swamp into the Atlantic Ocean and the South Oropouche River west through the South Oropouche lagoon into the Gulf of Paria.

In Tobago, the Mangroves of Tobago must be given attention as part of the water resources system. These mangrove ecosystems are located in the south west of Tobago and are developed on former reefs. The three locations are the Petit Trou, the Kilgwyn and the Bon Accord Lagoon.

### **Ground water**

The major aquifers in Trinidad are the Northwest Peninsula Gravels, the Northern Gravels, the Central Sands and the Southern Sands. The Northwest Peninsula Gravels, the Northern Gravels and Central Sands are the major producing aquifers. Some minor aquifers in the east of Trinidad are the Mayaro sandstone and Guayaguayare Sandstone.

The Northwest Peninsula gravels consist of alluvial and piedmont deposits in valleys (with a north-south orientation) in the western part of the Northern Range, extending from Chaguaramas in the west to Port of Spain in the east. The main aquifers in the Northwest Peninsula Gravels and Limestones are the Tucker Valley gravels, Diego Martin Valley gravels, the Maraval-Port of Spain Gravels which include the Cascade, St. Anns and Savannah. There are also some water bearing limestone areas such as St. Anns, Dorrington Gardens and Paramin. Rivers flowing through these valleys are the Chaguaramas, Cuesa, Diego Martin, St. Anns, Cascade and Maraval rivers.

The aquifers of the Northwest Peninsula Gravels are unconfined and recharged through direct infiltration by rainfall into the pervious valley soils and streambed infiltration. The aquifers consist of interbedded sands, gravels, boulders and clay, derived from erosion of the Northern Range rocks. There are wellfields in all the aquifers of the Northwest Peninsula Gravels. The upper section of the Northwest Peninsula Gravels and Northern Gravel aquifers, within the valleys are likely to be perennially recharged by surface flows. The Northern Gravels derived from erosion of the Northern Range rocks extend from Port of Spain to approximately three kilometres east of Arima and southward onto the Caroni Plain.

The rivers which emerge from the south side of the Northern Range (from west to east) are the San Juan, St. Joseph, Tacarigua, Arouca and Arima rivers. Their related aquifers are the El Socorro gravels, Valsayn gravels, Tacarigua gravels, Arouca gravels and Arima gravels respectively. The rivers flow to the Caroni River and recharge the gravel-fan aquifers as they flow over them. There are wellfields in all the aquifers of the Northern gravels.

The aquifers of the Northern Gravels are unconfined and consist of stratified beds of sand, gravel, silt and clay. The major source of recharge is through direct infiltration of rainfall into the soils overlying the gravel fans, streambed infiltration from the rivers crossing the gravel fans, and subsurface flow from the Northern Range.

For the coastal aquifers between Chaguaramas and El Socorro, the abstraction rates must not exceed the balanced yields, to keep a hydrodynamic balance and prevent seawater intrusion.

The Central Sands are located on the southern limb of the Caroni Syncline. These sands outcrop at irregular intervals in a band extending diagonally from Claxton bay in a north-easterly trend towards the Cumuto area and dip in a north-westerly direction towards the Gulf of Paria. The entire region is heavily faulted. The main aquifers of the Central Sands are the Sum Sum Sand, the Mahaica Sand and the Durham sand which consist of blanket sands. There are wellfields in all the aquifers of the Central

sands. The aquifers of the Central Sands are confined and consist of fine to very fine marine sands. The Sum Sum-Mahaica Sands and Durham sands are separated by the Caparo clay. The major source of recharge is direct infiltration of rainfall into the pervious valley soils and streambed infiltration.

The water quality in the Sum Sum, Mahaica and Durham wellfields have a high iron content.

The Southern Sands are multiple-sand aquifers and consist of the aquifers of the Erin Formation (sands of Pleistocene age) and the Morne L'Enfer Formation (sandstones of Pliocene-Pleistocene Age). The area is heavily faulted, dividing the Morne L'Enfer and the Erin Formations into a series of hydraulically discontinuous basins. There are wellfields in all the aquifers of the Southern sands.

The aquifers of both the Erin Sand and the Morne L'Enfer Formation are confined. The former consists of fine and very fine sands while the latter consists of sands with thin layers of silt and silty clay with lignite and is divided by the Lot Seven Silts. The major source of recharge is direct infiltration of rainfall into the pervious soils. Comparing the total yield for each aquifer with the data available on safe yields, it was concluded that groundwater production might be increased for both the Morne L'Enfer Sand and the Erin Sand aquifers. The water quality in the Southern aquifers are generally good but may have a high iron content.

The Specific Capacities of the wells in the aquifers of the Northwest Peninsula Gravels and the Northern gravels are much higher than those of the wellfields in Central and South therefore production is generally greater.

In Tobago, the potential for groundwater production is low. Groundwater is extracted in the south-western part of the island which consists of Quaternary sedimentary deposits of coral limestone underlain by impermeable Tertiary sedimentary clays.

The aquifers in Tobago are alluvial deposits in Richmond, clastics (volcanic/sedimentary) in Government Farm, Coral limestone and alluvial deposits in Bloody Bay. These aquifers are all unconfined. The related wells are in Bon Accord, Government Farm, Golden Grove, Scarborough and Bloody Bay.

#### **9.3.4.1 Water Supply and Demand**

Water supply in Trinidad and Tobago is from surface water sources (including reservoirs and rural intakes), groundwater sources and desalination which each contribute 54%, 26% and 20% respectively to water supply (Report of Cabinet-Appointed Sub-Committee on WASA 2020). The surface water availability of Trinidad is estimated at 3,600 MCM/year which is more than ten (10) times the present public water supply demand while the surface water availability for Tobago is estimated at 136 MCM/year. Expressed per capita the water availability in Trinidad and Tobago is more than 2,000 cubic metres per year. According to the World Bank's criterion (i.e. 1000 cubic metres/year), Trinidad and Tobago is not a water scarce country. However, the surface availability is strongly influenced by seasonal and regional variation.

Surface water availability is enhanced by the four (4) surface water impounding reservoirs. The combined surface water storage capacity of the impounding reservoirs in Trinidad is 71 million m<sup>3</sup> with Hollis, Arena, and Navet having capacities of 4.75 million m<sup>3</sup>, 46.6 million m<sup>3</sup> and 19.1 million m<sup>3</sup> while the capacity of the impounding reservoir, Hillsborough, in Tobago is 1.02 million m<sup>3</sup> (MPU, 2020).

- 9.3.5 In 2019-2020, WASA's production averaged 218 IMGD of water, while domestic and non-domestic demand is estimated at 155.4 IMGD. Non-Revenue Water (NRW) consisting of water lost through leaks and thefts is estimated within the range of 40-50% (87.2-109 IMGD). The supply deficit in the dry season is estimated at 79 IMGD, and the annual average deficit is 24 IMGD (Report of Cabinet-Appointed Sub Committee on WASA 2020).Climate

The climate of Trinidad and Tobago is tropical, warm and humid with two major seasons: a dry season from January to May and a wet season from June to December. Both islands display a similar seasonal rainfall pattern. A short dry spell, 'Petite Careme,' typically occurs in the middle of the wet season in September or October. The average annual daily temperature in Trinidad and Tobago is approximately 26° C with minor diurnal variations. Temperatures peak in May and are at a minimum in January. The average annual rainfall for Trinidad (75-year mean) is approximately 2,200 mm with over 78% of the mean annual rainfall occurring during the wet season. The average annual rainfall (30-year mean) for Tobago is 1900 mm (DHV Consultants, 1999).

In general, the eastern half of Trinidad receives more rainfall than the western half. Maximum amounts of precipitation occur in the northeast of Trinidad where orographic effects dominate. The mean annual rainfall for Trinidad varies with maximum values as high as 3,800 mm on the eastern peaks of the Northern Range, slightly north-east of the Caroni basin, in response to the orographic effects of the North-East Trade winds; and minimum values of 1,200 mm in the north-western Peninsula and southwest of the island. For Tobago, the average annual rainfall ranges from 1200 to 2,800 mm. In Tobago, similar orographic effects result in most of the rainfall being concentrated on the north slopes of the Main Ridge and average annual rainfall depths as high as 2800 mm on the highest peaks of the Main Ridge. Rainfall on the south plains have an average annual rainfall of less than 1800 mm and decreases to 1400 mm on the south western coast (DHV Consultants, 1999).

Evapotranspiration in Trinidad and Tobago is significant and averages from 34% of the total precipitation in the wet season to 70% in the dry season (DHV Consultants, 1999). Evapotranspiration also varies considerably with physiography and with rainfall event quantities. Annual mean wind speed is approximately 5km/hr as measured at Piarco Airport in Trinidad and 4km/hr as measured at Crown Point Airport in Tobago (DHV Consultants, 1999).

Relative humidity ranges from 65-70% at the end of the dry season to 80- 85% in the wet season. In coastal areas, the range is less with relative humidity between 70% and 80% (DHV Consultants, 1999).

#### **9.3.5.1 Climate Change**

With respect to climate change, predicted impacts and the effects include:

- Reduced rainfall in the dry season and increased rainfall which has the effect of reduced available water, a decline in surface runoff, reduced groundwater and increased risk of droughts.
- Increased rainfall intensity which has the effect of increased surface water runoff and increased risk of flooding and flash floods. Flooding could contribute to higher turbidity and sediment load in rivers.
- Increased temperature would have the effect on the availability of water resources as evaporation rates would increase and water consumption per capita would increase. Warmer

temperatures would also cause sea level rise and increased salinity in coastal aquifers and streams which will reduce fresh water supplies.

- Sea level rise and more frequent storms which will have the effect of increased risk on coastal areas. Sea level rise will also decelerate wetland renewal and change the salinity distribution and productivity of mangroves.

*(Crichlow, 2008 and Asian Development Bank, 2016)*

### 9.3.6 Natural Hazards

The project area is typically affected by natural hazards such as floods, drought, landslides, earthquakes, hurricanes and climate change. Each of these are further elaborated below.

#### 9.3.6.1 Hydrometeorological Hazards

##### 9.3.6.1.1 Extended Dry Periods/ Drought

Trinidad and Tobago's climate is divided into two yearly seasons, the dry and wet seasons. The dry season typically occurs between the months of January and May, and the wet season from June to December. During the dry season it is common to have 14 to 20 consecutive days with below average rainfall and this is considered a feature of the local dry season (TTWC, 2020). These are considered dry spells or short-period droughts. During the dry season, the average temperature ranges from 20°C to 33°C with monthly precipitation ranging between 30 mm to 110 mm.

Impacts during the dry season include: -

- High temperatures with frequent hot days (temperature >34°C) occurring in Trinidad. These can sometimes persist for several consecutive days. This raises the risk of heat-stress on persons and livestock.
- Increased number of bush fires due to the lack of moisture and the drying of weeds, grass, bushes and plants.
- Reduced air quality due to dry periods causing increased dust and fumes from bush fires.
- Increased water scarcity due to the lack of rainfall and high rates of evapotranspiration.
- Increased losses of crops and livestock due to dry conditions and heat stress.

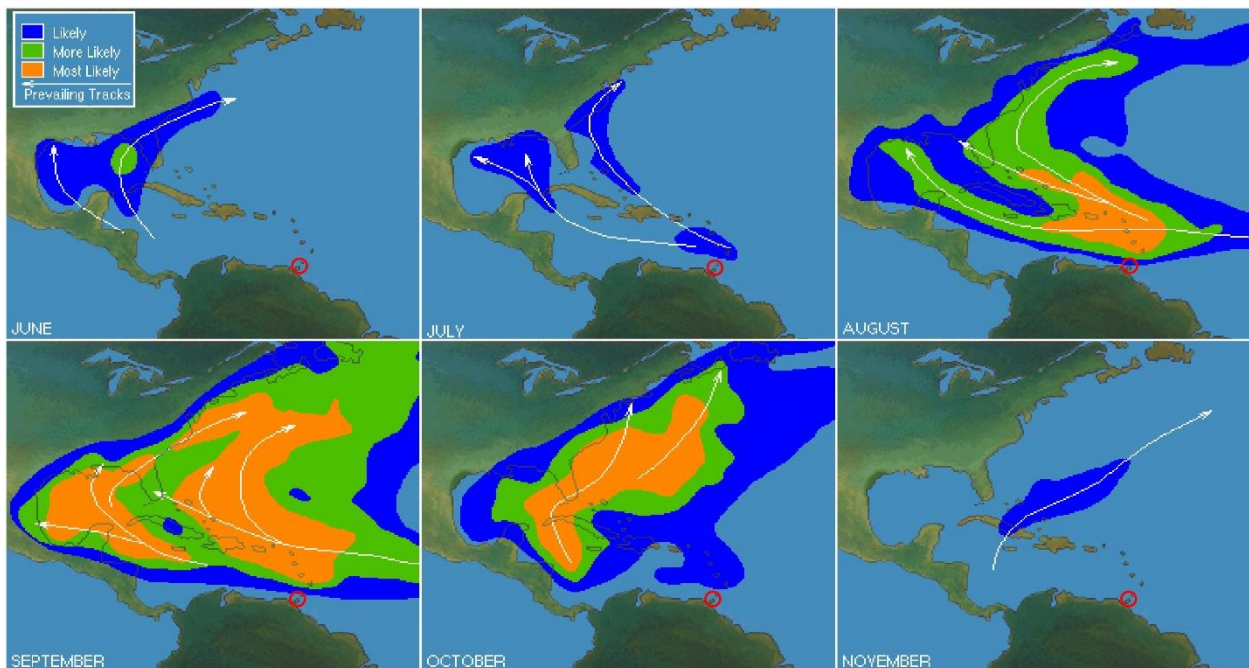
WASA prepared a Water Supply Management Plan for the Dry Season. This plan presents a schedule with shorter durations of piped water and truck borne water. The Operational Implementation Plan tends to focus on the critical areas for water supply in the dry season (called Hot Spots). Crichlow, M. (2007) elaborates on actions such as:

- Water scheduling and water trucking
- Redistribution of water
- Provision of additional storage
- Diversification of water supply
- Purchase of additional water from Desalcott
- Minimization of Plant Disruption
- Optimization of production levels from Caroni Arena Treatment Plant
- Enhance ground water production to safe yield and possibly more, and
- Aggressive pipeline repair or replacement

- Implementation of a Water Conservation Public Education Programme
- Promotion of the installation of water efficient fixtures and repair of internal leaks by customers
- Promotion of water use efficiency for industries and agriculture

#### 9.3.6.1.2 Heavy Rains, Tropical Storms and Hurricanes

The hurricane season in the Caribbean is from June 1 to November 30. Trinidad and Tobago is situated in the southern Caribbean and therefore has a susceptibility to tropical storms and hurricanes compared to the rest of the Caribbean (Figure 9-15) (RMS, 2020). However, in the past the country has been impacted by several hurricanes and tropical storms which have deviated from the normal route or have passed close to the islands (Table 5-8).



**Figure 9-15: Location of Trinidad and Tobago (red circle) and the typical hurricane tracks and likelihood of experiencing a hurricane by month (NOAA, n.d.).**

The country, however, is mostly impacted by rains associated with the Inter-tropical Convergence Zone (ITCZ) and tropical waves moving across the Atlantic Ocean into the Caribbean Sea. These lead to periods of heavy rainfall, particularly during the wet season (June to December). These systems impact the island frequently and have caused flooding, heavy winds and increased lightening.

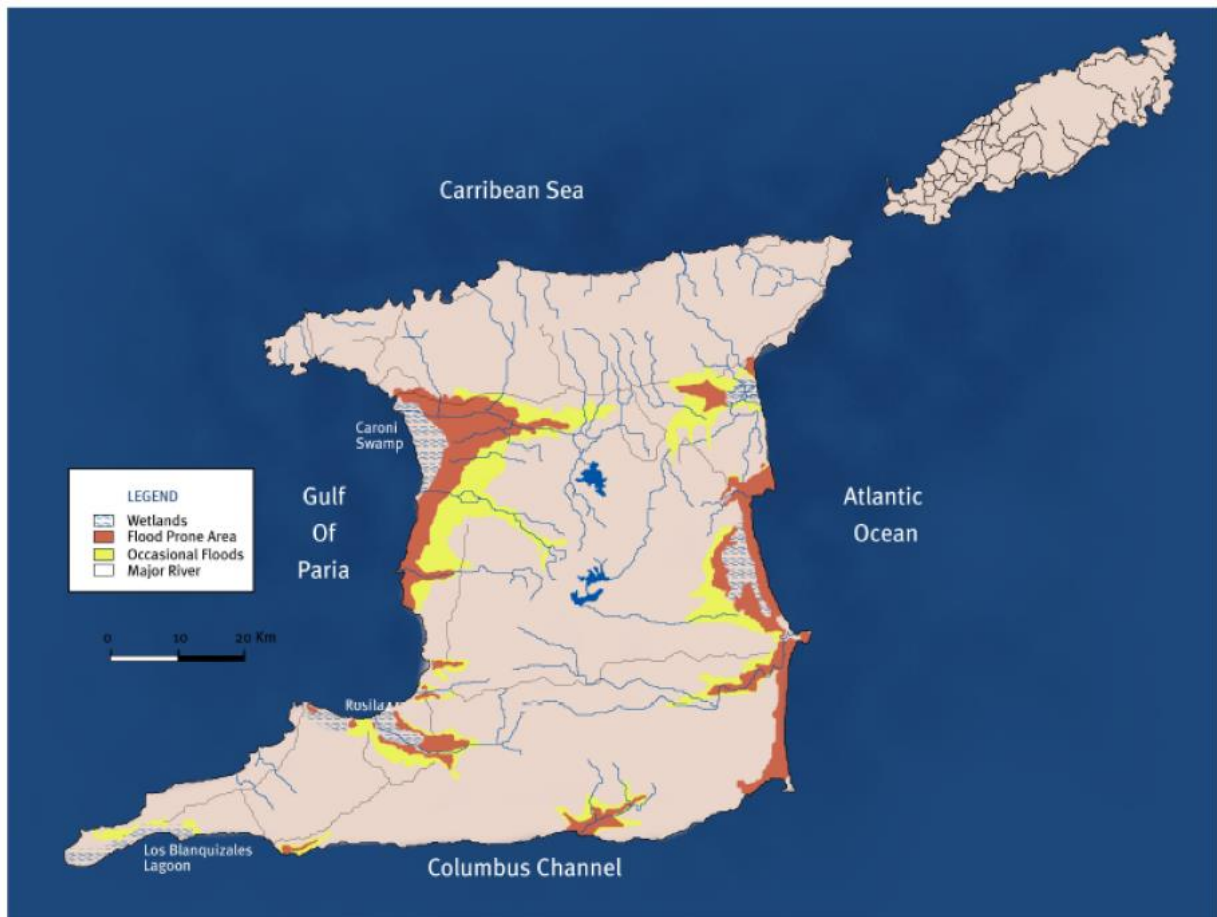
**Table 9-1: Tropical Storms and Hurricanes which have impacts Trinidad and Tobago (ODPM, n.d.)**

Hurricanes and Tropical Storms that have made landfall in Trinidad and Tobago		
Hurricane Flora	30 September 1963	Category 3 Hurricane making landfall causing the deaths of 20 persons across the two islands, destroying 50% of cash crops. Overall estimated damage was TT\$30 million.
Tropical Storm Alma	14 August 1974	Made landfall causing the deaths of two persons.
Tropical Storm Arthur	25 July 1990	Made landfall over Tobago.
Tropical Storm Fran	14 August 1990	Made landfall over south Trinidad.
Tropical Storm Bret	7 September 1993	Made landfall causing severe flooding and high winds causing trees to fall.
Tropical Storm Joyce	1 October 2000	Made landfall and caused significant wind damage in Tobago.
Hurricanes and Tropical Storms that have not made landfall in Trinidad and Tobago but has affected the islands.		
Hurricane Felix	31 August 2007	Caused flooding in Central and South Trinidad
Hurricane Emily	13 July 2005	Induced landslides in the Northern Range of Trinidad and widespread flooding across the island with 1 home being washed away.
Hurricane Ivan	6 September 2004	Category 4 Hurricane not making landfall but causing severe flooding in Tobago and high winds caused over 45 houses to lose roofs. Over 305 of the island was left without electricity and the estimated damage was US\$4.9 million.

#### 9.3.6.1.3 Flooding

Floods are caused by nature or by man-made (anthropogenic) actions and can cause huge losses to life and property. Climatological factors when combined with global warming can result in flooding being more severe. Two of the main man-made causes of floods that result in disastrous effects are deforestation and global warming. Flood prone areas in Trinidad and Tobago is illustrated in Figure 9-16.





**Figure 9-16: Flood Prone Areas in Trinidad and Tobago (Genivar, n.d.)**

The main types of floods that occur are:

- River (or fluvial) floods which are overbank flooding that occur when water rises and overflows the edges of a river or stream. They are usually caused by excessive precipitation and are climatologically driven.
- Flash floods which are intense, high velocity torrents of water that occur in a river channel. In addition to excessive rainfall and/or intense rainfall over a short duration. They are usually caused by urbanization and poor land use practices in the watersheds which create more impervious surface areas resulting in reduced infiltration and more runoff.
- Coastal Floods which occur in areas on the coast and are typically the result of extreme tidal conditions caused by severe weather.

Flood monitoring and early warning are undertaken by the Water Resources Agency (WRA), the following are key measures currently being employed:

- WRA has installed a number of crest gauges placed in specific locations in the flood-prone basins throughout Trinidad. These gauges are flood level monitoring stations.
- WRA is in the process of upgrading its hydrological network including the flood monitoring network. At present, the WRA has partnered with the Ministry of Local Government and Rural Development, and the Trinidad and Tobago Red Cross to undertake a Community Flood Early Warning System. This system includes the installation/modernization of real-time gauges

(streamflow) in every Regional Corporation and a mechanism to allow for monitoring of flood levels, notification of flood risk to specific affected communities, flood response and collection of flood data.

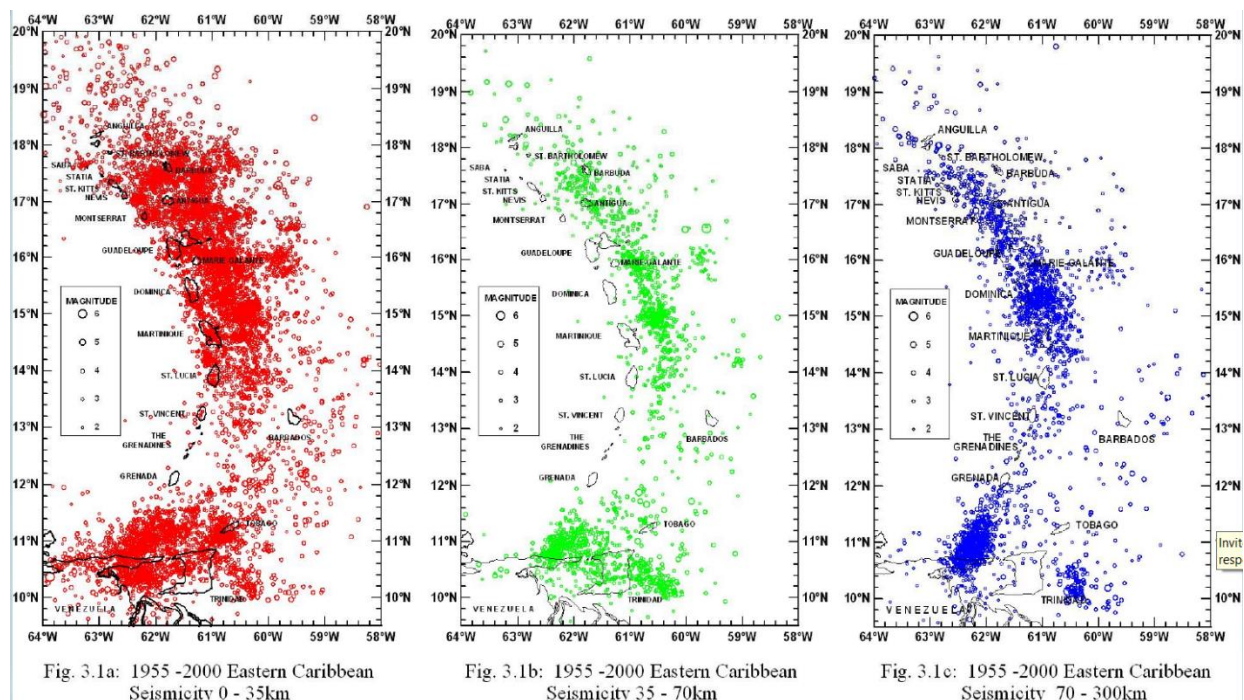
- The system also includes flood mapping and preparation of flood inundation maps using updated Digital Elevation Models by organized teams.
- The Community Flood Early Warning System is being enhanced with support from UNDP Brussels and funded by ECHO Focal Point. The enhancement include the installation of additional monitoring stations, flood forecasting and mapping, a gender study, public awareness, and data/information dissemination through a web site.

The Drainage Division of the Ministry of Works has responsibility for rivers, maintenance of the channels and providing approvals for the use of rivers (this is not allocation of water). However, some attention must be paid to the paving of river channels which is currently being done. These areas serve as points for recharge to the aquifers and this practice can eventually have a serious negative impact on the recharge to aquifers.

### 9.3.6.2 Geological Hazards

#### 9.3.6.2.1 Earthquakes

Trinidad is located along the south-eastern margin of the Caribbean Plate along the southern strike-slip boundary with the South American Plate (**Error! Reference source not found.**) and several major faults through the island (**Error! Reference source not found.**). The region is therefore tectonically active with both shallow and deep earthquakes (Figure 9-17). Locally in Trinidad, earthquakes mainly occur in five main zones with the North Paria Peninsular being the most significant source of earthquakes and several significant earthquakes with magnitudes greater than 5 on the Richter Scale have been recording around Trinidad between 1955 and 2008 (Figure 9-18). Trinidad has also experienced local earthquake swarms with magnitudes up to 5.8 and depths ranging from 0-70 km.



**Figure 9-17: Earthquake Caribbean Seismicity showing Trinidad at the bottom of the map (UWI SRC, 2010)**

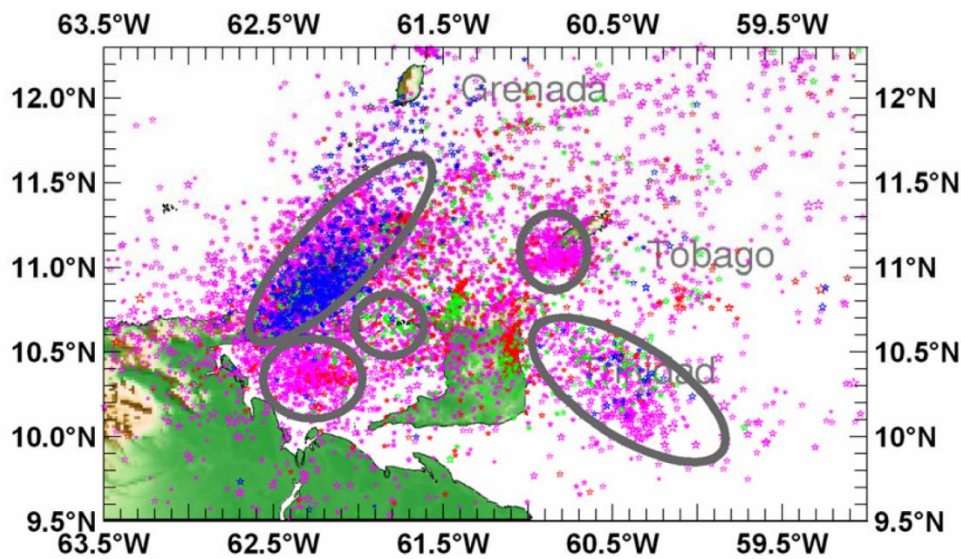


Figure 9-18: Earthquake zones around Trinidad and Tobago (UWI SRC, 2010)

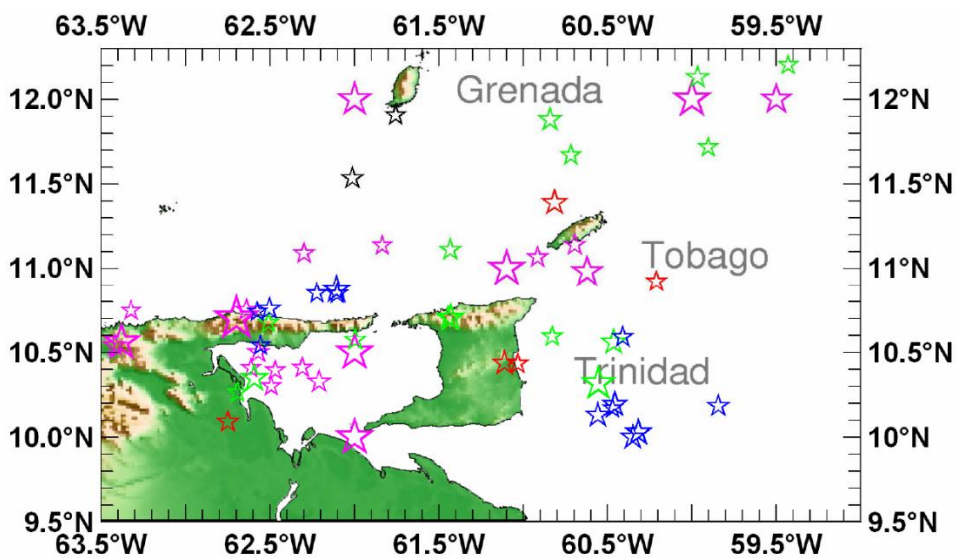


Figure 9-19: Earthquakes with magnitude greater than 5 occurring around Trinidad and Tobago between 1955 – 2008 (UWI SRC, 2010)

#### 9.3.6.2.2 Landslides

Landslides in Trinidad are largely controlled by the island's topography and geology and have been categorized within two distinct groups (Kanithi & Kanhai, 2006):

1. Landslides associated with metamorphic rocks within the Northern Range (Figure 9-20 )and
2. Landslides associated with unconsolidated sedimentary rocks which occur mostly within the Central and Southern Ranges.

Within the Northern Range, most of the landslides occur where there are layers of weathered debris on steep slopes, usually after rainfall events. The occasional translational or rotational landslide may occur in areas where the rocks dip towards the roads. In the Central and Southern Ranges, landslides occur in unconsolidated sands, soils, and muds/clays. These slides occur when clays become over



saturated, swell, and begin to slip on gentle slopes (sometimes with gradients less than 5 degrees). Slips have been known to occur from over saturation or have been triggered by heavy vehicular traffic and earthquakes.

Most of the project area is in the Northern Range which generally has highly susceptible to landslides. These have a high potential to damage or block access roads to communities, affect utilities and water supply and distribution infrastructure.



**Figure 9-20: Landslide occurred on September 13, 2017 along the North Coast Road in the Northern Range, Trinidad (Photo From: Trinidad and Tobago Weather Center) (TTWC, 2020).**

### **9.3.7 Air Quality**

In 2017, Trinidad was ranked the 10th most toxic country in the world (Cadogan, 2019). Trinidad and Tobago has continued its focus on industrialization and is considered to be one of the most industrialized countries in the Commonwealth Caribbean. Some of the major industries in the country are energy, agriculture, and manufacturing. The main sources of pollution in Trinidad and Tobago are caused by manufacturing, transportation, fuel trade, construction, electrical power generation, and oil refineries. Major pollutants that are of great concern to air quality in Trinidad and Tobago include:

1. Suspended Particulate Matter: Total suspended particulates (TSP); Particulate matter of aerodynamic diameter of maximum 10  $\mu\text{m}$  (PM<sub>10</sub>)
2. Sulphur dioxide (SO<sub>2</sub>)
3. Nitrogen dioxide (NO<sub>2</sub>)
4. Carbon monoxide (CO)
5. Ozone (O<sub>3</sub>)
6. Lead (Pb)
7. Volatile Organic Compounds (VOCs) Includes some hydrocarbons (HC)

In the case of CCLIP, construction activities resulting in particulate matter would be of the greatest concern to negatively impact air pollution.

## **9.4 Overview of Ecological Environment in Trinidad and TOBAGO**

### **9.4.1 Ecosystems in Trinidad and Tobago**

Trinidad and Tobago are the two main islands of an archipelagic state situated at the southern end of the Windward Islands. Both islands lie on the South American Continental Shelf and are directly influenced by the Orinoco and the South Equatorial Current. The biota and terrestrial habitats of Trinidad therefore reflect the ecology of equatorial South America unlike the other Windward islands which have ecosystems dominated by island endemic species (GORTT, 2012).

It is well evidenced that due to its small size, location, and geological relationship shared with the South American continent, the country has a high species diversity to surface area ratio. The main ecosystems in Trinidad and Tobago are terrestrial forests, coastal ecosystems, marine ecosystems and freshwater ecosystems.

The range of terrestrial ecosystems include evergreen seasonal, semi-evergreen seasonal, deciduous seasonal, littoral woodlands, lower montane rainforests, seasonal montane forests, montane rainforests, elfin woodlands and savannahs (Figure 9-22 and Figure 9-21). In 2015, forested areas on both islands accounted for approximately 234,000 hectares of land, this represented an increase in forested areas compared to 2010 and includes the regeneration of secondary forest on abandoned sugar cane lands, abandoned cocoa and coffee plantations, and the increase in the cultivation of timber (GORTT, 2016b.).

Coastal ecosystems include swamp forests (including mangrove woodlands), palm swamps and marshes. These support approximately 2160 species of flowering plants, 110 of which are endemic; 433 species of birds (411 Trinidad and 210 Tobago); 100 mammals; 37 amphibians and 93 reptiles including 47 snakes (44 Trinidad and 21 Tobago) (GORTT, 2012).

Marine systems include the water masses; mud bottoms; coral reefs and communities; sandy bottoms; rocky shores, sea grass beds and mud flats. These support a range of macro and microbiota including a large array of commercially important fish species and 36 species of reef building corals (GORTT, 2012).

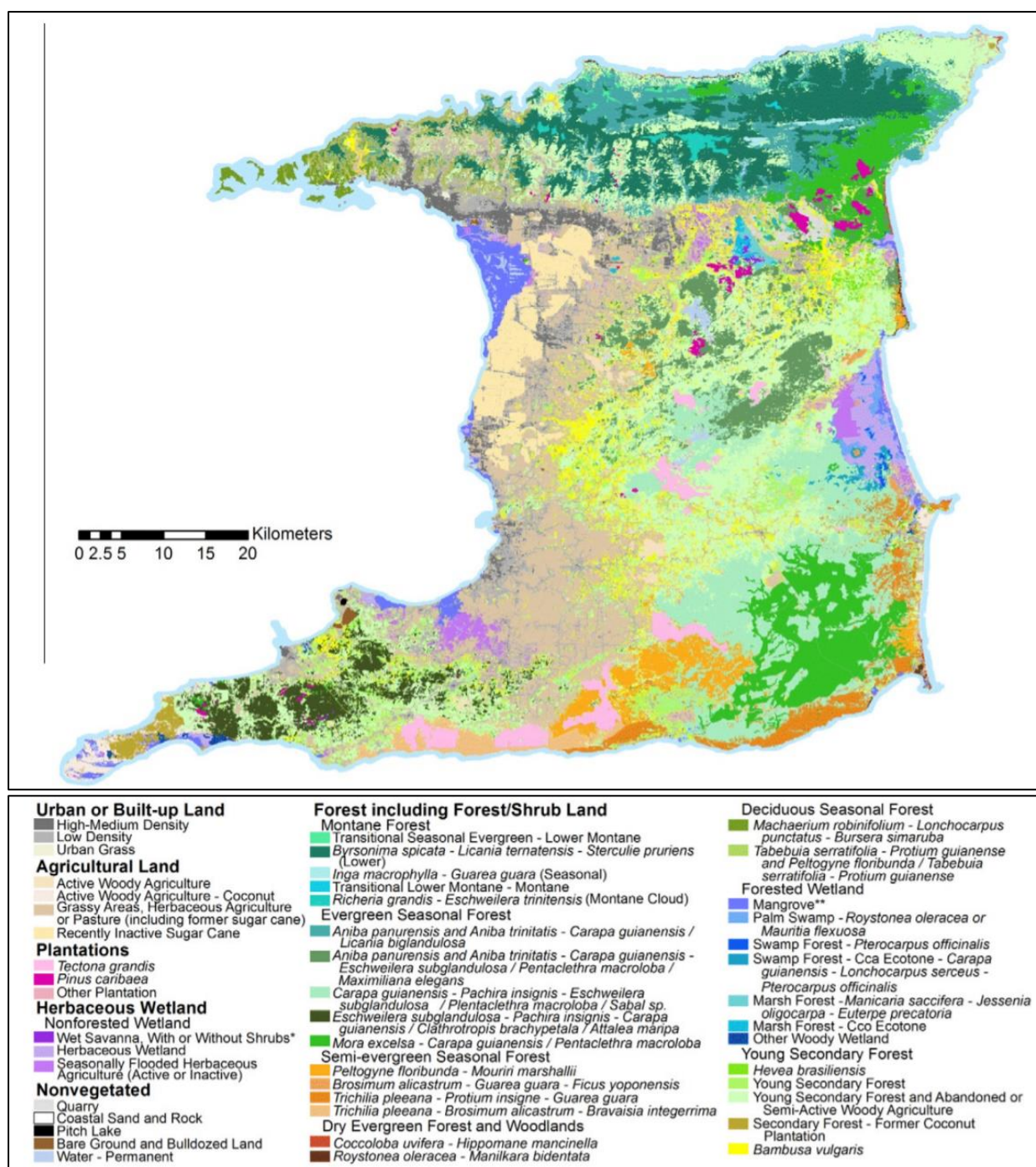


Figure 9-21: Forest Association and Land Cover Map for Tobago (Helmer, et al.2012)



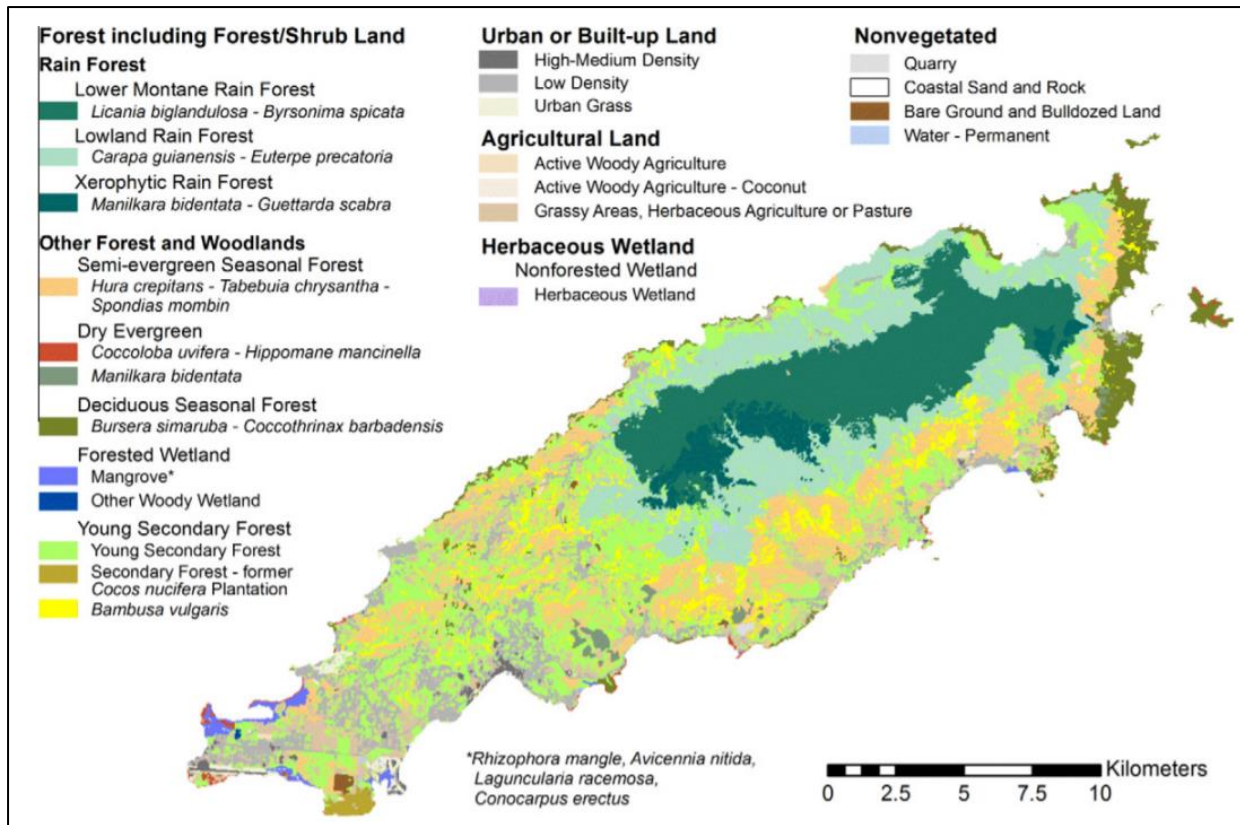


Figure 9-22: Forest Association and Land Cover Map for Tobago (Helmer, et al.2012)

Freshwater ecosystems are not well monitored in Trinidad and Tobago although this should be a key role of the Water Resources Agency. Of note are the results of a river-monitoring programme undertaken between 2001 and 2006, which focused on selected heavy metals and a number of other physio-chemical parameters, indicating that the water quality and sediments in most rivers across T&T are of poor quality. While Cadmium, Chromium and Nickel levels were generally found to be in moderate concentrations at river sampling sites, Zinc, Lead and Copper concentrations were often well above acceptable limits (GORTT, 2016b). Concentrations of heavy metals also appeared to increase along the length of many rivers due to pollution loading (Figure 9-13). This has negative implications for aquatic life being consumed from rivers as well as the coastal environment.

The pollutants in rivers are derived from a range of land use activities, including agriculture, industrial activity, transportation, and domestic runoff. As such it is very important that as WASA undertakes this project, measures should be put in place so that the planned activities, such as excavating and changing pipelines etc. do not further contribute to negatively impacting these freshwater resources.

#### 9.4.2 Flora

GoRTT (2012) indicates that the flora of Trinidad and Tobago consists of approximately 2,500 species in about 175 families. In terms of numbers of species, the largest families are the ferns and their allies with approximately 310 species; the grasses, legumes and orchids each with about 200 species; and the sedges, madders, melastomes, composites and euphorbs each with about 90 species. Table 9-2 below presents a summary of some of the larger plant families.

**Table 9-2: Flora of Trinidad and Tobago (GORTT, 2012)**

<b>Family</b>	<b>Genera</b>	<b>Species</b>
Ferns & allies	66 (51)	310 (214)
Grasses	74	214
Legumes	75	202
Orchids	68	190
Sedges	22	111
'Rubes' (Rubiaceae)	48	97
Melastomes	22	95
Composites	45	86
Euphorbs	27	82

In the marine environment, main plant communities are the phytoplankton, seagrass beds and marine algal communities. Sea grass communities are usually found in shallow sheltered waters on firm sandy bottoms. Sessile algal communities are found mainly on hard substratum often in exposed high energy conditions, and many species are adapted to depths greater than those associated with sea grasses. Sessile algal communities often include sponges and corals.

Important flora relevant to CCLIP would be riparian vegetation associated with river systems, those aquatic species that live in rivers, swamp vegetation that act as natural flood retention and water purification areas, and tree cover in areas that naturally facilitate aquifer recharge within watersheds. It is important that with the extraction of water resources from rivers, non-consuming demand is retained, which is the minimum flows required to maintain healthy ecosystems in rivers and swamps. This minimum flow should be determined on a basin-by-basin basis.

Further with development activities at RSSP under CCLIP these do not negatively impact aquatic life in the Caparo River.

#### **9.4.3 Fauna**

Key faunal species associated with watersheds are those that relate closely to CCLIP. Faunal species important for protection flourish in protected areas. Protected Areas in Trinidad and Tobago are shown in Figure 9-23. Important faunal species are discussed below.

##### **Fish life (approximately 45 species and excluding sea run and peripheral species)**

There are 21 families of freshwater fish to be found in Trinidad, in few orders, and of these four are marine families with freshwater representatives. Tobago in contrast only has seven families of which four are marine families with freshwater representatives (GORTT, 2012).

It is believed that there are between 400 and 500 species in several dozens of orders and families in marine fish (GORTT, 2012).

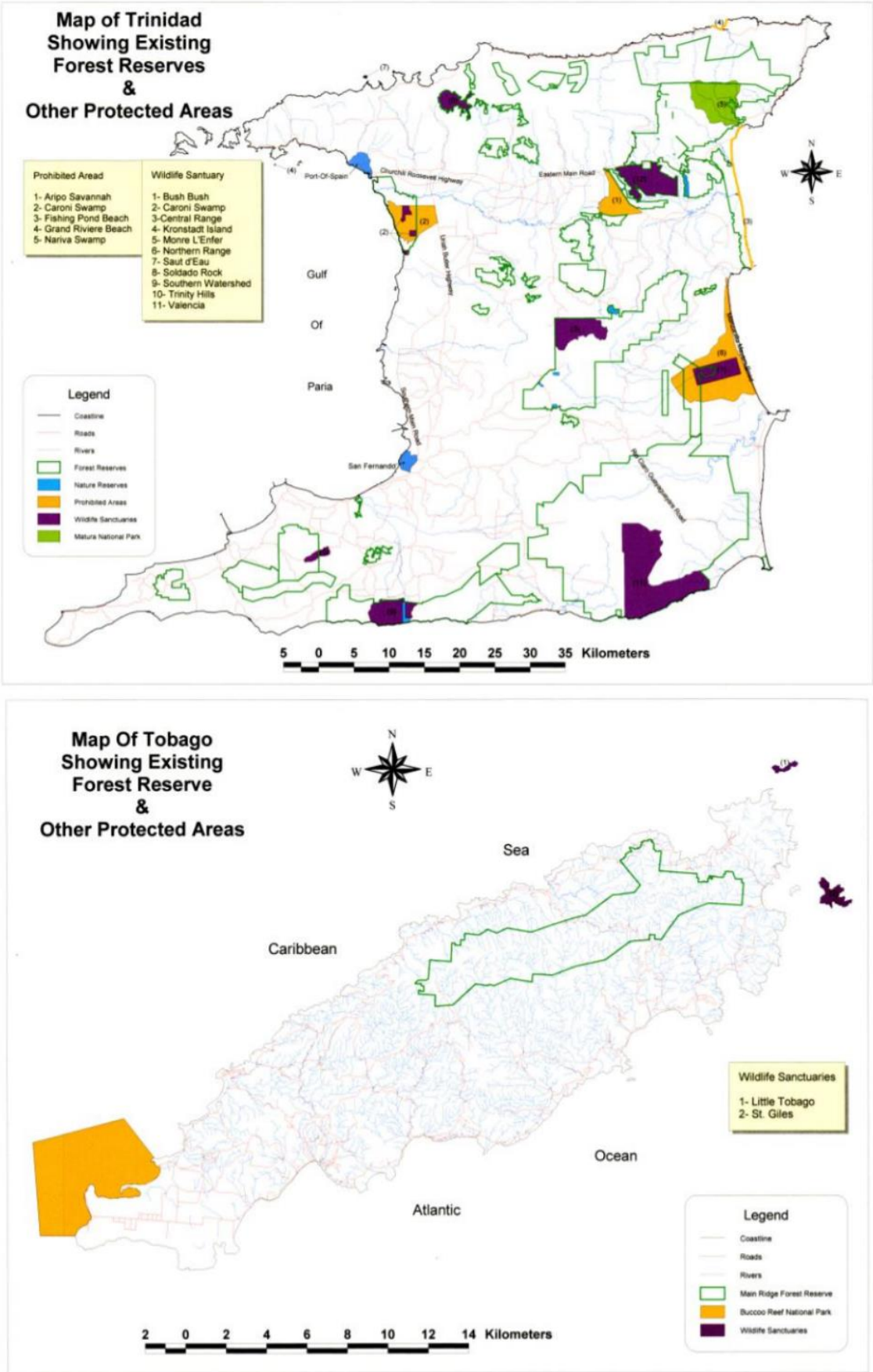


Figure 9-23: Protected Areas in Trinidad and Tobago (GORTT, 2011)

### **Amphibia**

GORTT (2012) indicates that in Trinidad there are 37 species in ten families, in a single order, while as may be expected, Tobago has only about one third the number in fewer families. All are of the anuran order, frogs or toads, there being no salamanders or caecilians (legless amphibians). One frog species bears the strong possibility of being endemic (*Phyllodytes auratus* – Golden tree frog).

### **Reptiles**

There are seven families of snakes, and about 44 species to be found in Trinidad. In Tobago there are fewer families represented by 21 species three of which are found only in Tobago. There are five families of lizards and about 25 species in Trinidad and Tobago. They vary considerably in size, habitats and distribution. Some are arboreal, a few terrestrial, and a few burrowing. The rest of the reptilian fauna includes the turtles, terrapins and tortoises, and a single crocodilian, the spectacled caiman. Only the tortoise is terrestrial. There are two species of tortoise listed, one native and one introduced, but both are extremely rare in the wild (GORTT, 2012).

### **Birds**

The avifauna of Trinidad and Tobago is extremely well. Birds constitute the largest groups of vertebrates. Sixty-six (66) families in twenty orders are represented in Trinidad and Tobago. The dominant order, as it is in many other parts of the globe, is the Passeriformes or perching birds, accounting for almost a third of the families represented. Four hundred and eleven (411) species have been recorded in Trinidad. Again, as with other vertebrate groups, there are substantially fewer species in Tobago than in Trinidad. Two hundred and ten (210) species have been recorded for Tobago.

Certain general features of the avifauna may be noted. A substantial proportion of the total number of species is resident and breeding but there are also migrants from North America, a few from South America and sea birds typical of the Caribbean biogeographic province, as well as oceanic species. There are also occasional visitors and strays.

### **Mammals**

The mammals constitute the final vertebrate group of the terrestrial biota and it too is well documented. Nine orders and about 27 families are represented, and all are typical of the adjacent mainland and the wider neotropics. There are approximately 100 indigenous species, but the bats and rodents predominate. Bats for example account for over half of the mammalian fauna. The rest of the mammalian group includes the marsupials, edentates, a single armadillo, several rodents, primates, a few carnivores, deer and manatee.

### **Other groups**

As noted above the insects and arachnids dominate the terrestrial fauna. Unfortunately, knowledge of the various groups is very uneven. Orders such as the Coleoptera, (beetles), Lepidoptera (butterflies and moths) and the Diptera (flies) are relatively large, and while much has been recorded there are immense gaps. The single volume on lepidopterans lists 617 species of butterflies. Most of the hesperiidae (doctord butterflies) are however not included, nor are moths, except for the hawk moths. The total number of lepidopterans is therefore likely to be much higher. Some of the flies, for example mosquitoes and sandflies, are particularly well known, owing to their importance as pests and vectors of disease. Pests are generally better known as an amorphous grouping rather than as members of one or another insect order (GORTT, 2012).

#### **9.4.4 Ecosystem Functions and Linkages**

The island of Trinidad and Tobago has areas that are significantly disturbed due to development. As indicated above there are several areas that are considered to be ecologically significant.

The wetlands support a vibrant ecosystem of mangroves, seabirds and other species. The wetlands also assist in improving water quality by filtering water on its way to the sea by providing sediment trapping/reduction functions. It also functions as a natural flood control mechanism.

The terrestrial forested areas support significant endemic bird populations that are both nesting and foraging. These forested areas are surrounded or interspersed by rivers which are freshwater ecosystems as well as the developed urban areas. The trees in the forested areas and along waterways provide erosion and sediment control and as a result of flood prevention, climate regulation, water purification, and sustainable timber.

Whilst there are no plan to remove sensitive ecosystems under CCLIP, project activities would need to be actively managed so as to not disturb these areas through improper waste management, improper storage of construction or excavated material and improper sediments control management measures.

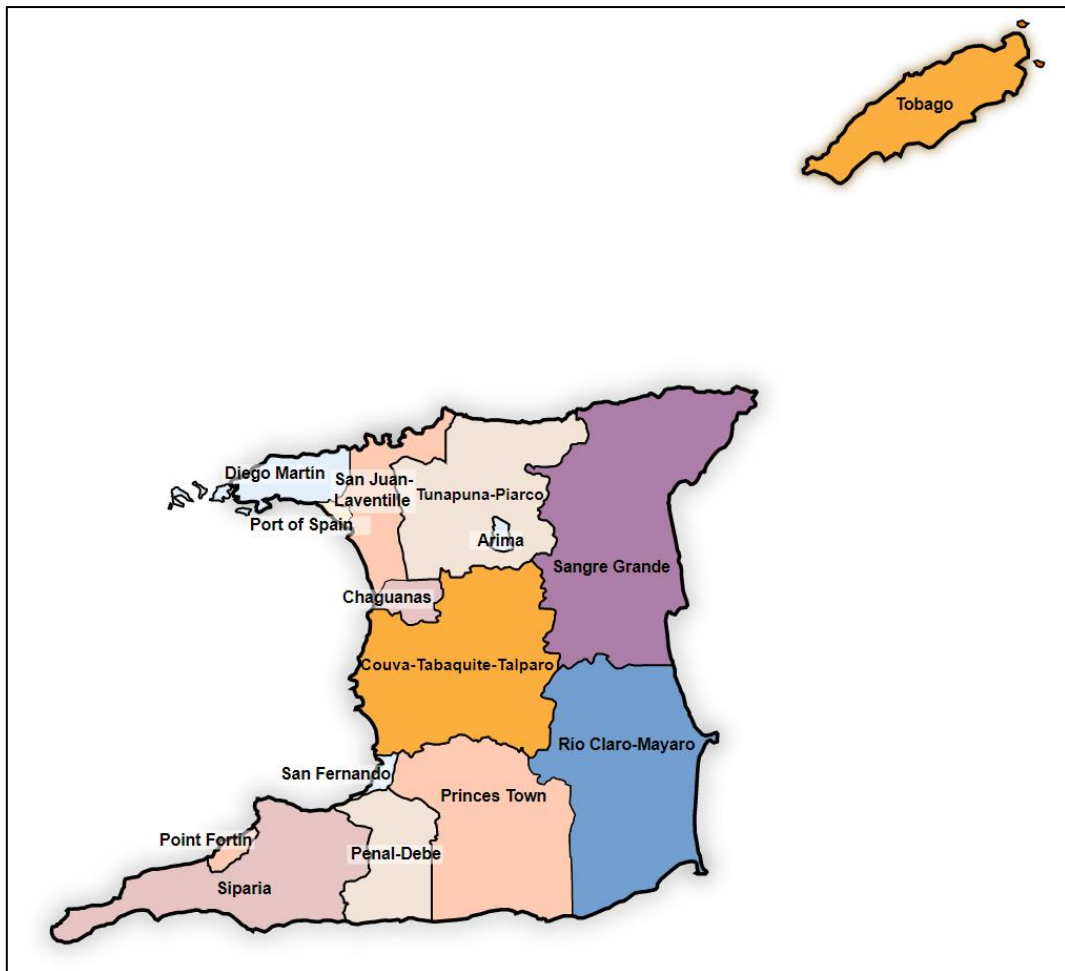
### **9.5 Overview of Socio-Economic Environment in Trinidad and Tobago**

#### **9.5.1 The Locational Setting**

The Trinidad and Tobago Water Supply Improvement Project aims to improve the efficiency and quality of potable water and services in Trinidad and Tobago by upgrading the national physical and institutional water infrastructure. As such the area of influence of the CCLIP project is the entire country.

The local government jurisdictions comprise 14 local government administrative regions (2 cities, 3 boroughs and 9 regional municipalities) of Trinidad (under the Municipal Corporation Act – Act 21 of 1990). Tobago comes under the Tobago House of Assembly Act – Act 37 of 1980 and comprises of over 594 communities. A large proportion of Trinidad's population is concentrated in the highly urbanised regions of the East - West and North - South Corridors. By contrast, a much lower proportion of the national population lives in eastern Trinidad, the deep southwest peninsula, and the north-east region of Tobago - all of which are relatively sparsely populated.





**Figure 9-24: Map of Trinidad (including municipal boundaries) and Tobago**

## 9.5.2 Socio-Economic Description of Trinidad and Tobago

### 9.5.2.1 Population and Demography

#### 9.5.2.1.1 Population distribution

Mid-year population estimates by the CSO put the 2019 population of Trinidad and Tobago at 1,363,985 persons of which 679,635 were females and 684,350 were males (Figure 9-25). These figures are up from the 2011 count of 1,328,019 persons, made up of 661,714 females and 666,305 males.



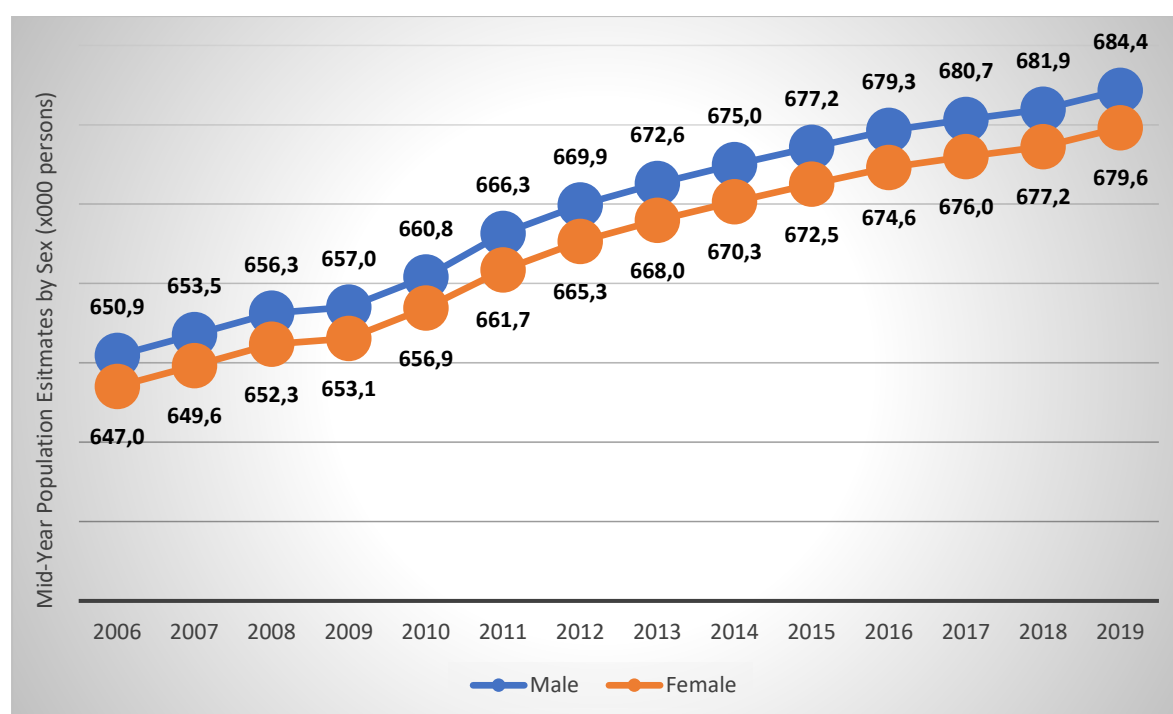


Figure 9-25: Mid-year Population Estimates by Sex, 2006-2019

Source: Central Statistical Office Population Database

The 2011 Population and Housing Census provides the most recent comprehensive break down of population statistics in Trinidad and Tobago. According to this Census, 95.4 percent of the country's population resided in Trinidad and 4.6 percent in Tobago (Table 9-3).

The rate of urbanisation of Trinidad and Tobago has increased over the years, with an estimated 72 percent of the national population living in urban areas,<sup>6</sup> the majority of which is located along the East-West Corridor and North-South Corridor. The cities and boroughs remain the densest parts of the country (Table 9-3). Population changes between the 2000 and 2011 censuses showed a clear movement of people away from the populated northwest urban areas to central and east Trinidad.

Table 9-3: Total population by Sex and Municipality, Land Area and Population Density, 2000 and 2011

Administrative Regions	Number of Communities	Land Area (km <sup>2</sup> )	Density (Persons per km <sup>2</sup> )		Population	
			2011	2000	2011	2000
<b>Trinidad and Tobago</b>		<b>5,127</b>	<b>259</b>	<b>246</b>	<b>1,328,019</b>	<b>1,262,366</b>
<b>Tobago</b>		<b>300</b>	<b>203</b>	<b>180</b>	<b>60,874</b>	<b>54,084</b>
St. Andrew		21	835	754	17,536	15,830
St. David		38	230	197	8,733	7,504
St. George		43	160	125	6,875	5,364
St. John		55	51	55	2,825	2,998
St. Mary		56	59	53	3,297	2,965
St. Patrick		38	409	369	15,560	14,011
St. Paul		49	123	110	6,048	5,412
<b>Trinidad</b>		<b>4,827</b>	<b>263</b>	<b>250</b>	<b>1,267,145</b>	<b>1,208,282</b>
City of Port-of-Spain		12	3,090	4,086	37,074	49,031

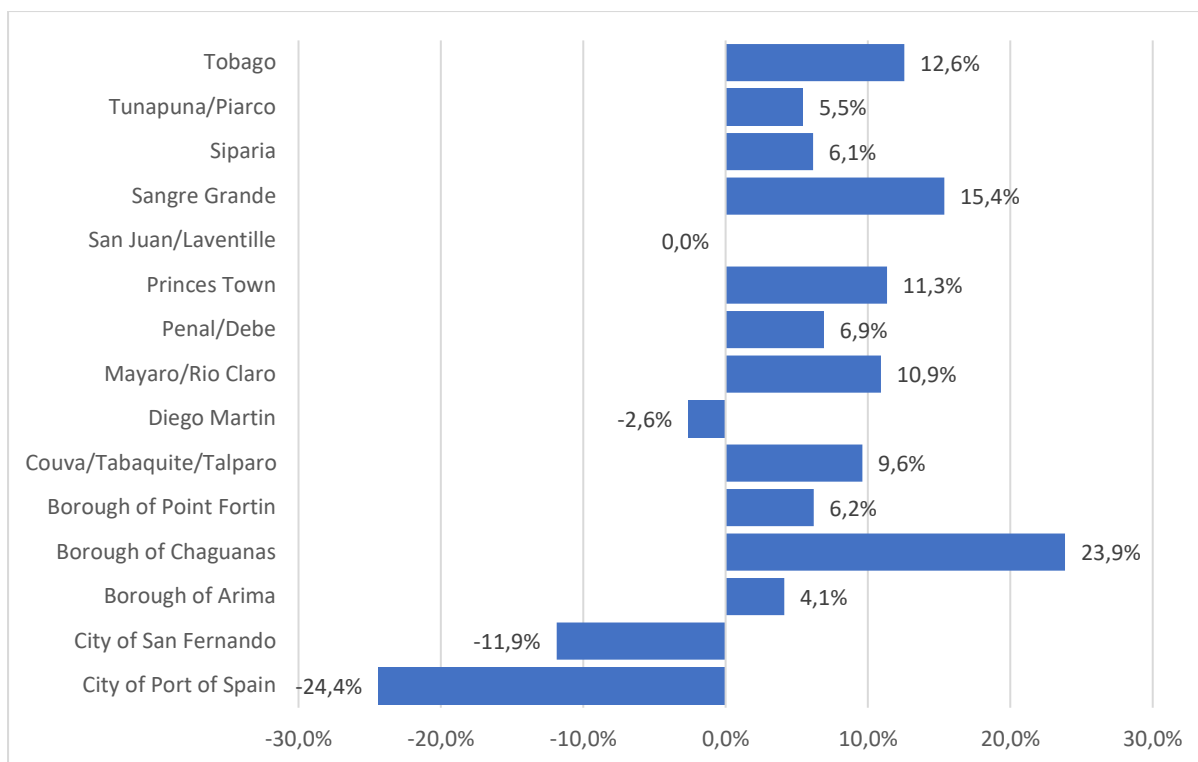
<sup>6</sup> Leontine Alkema, Gavin W. Jones, Cynthia U. R. Lai, 2012. Levels of Urbanization in the World's Countries: Alternative Estimates. Available [online]: <https://paa2012.princeton.edu/papers/121285>.

Administrative Regions	Number of Communities	Land Area (km <sup>2</sup> )	Density (Persons per km <sup>2</sup> )		Population	
			2011	2000	2011	2000
City of San Fernando		19	2,570	2,917	48,838	55,419
Borough of Arima		12	2,801	2,690	33,606	32,278
Borough of Chaguanas		59	1,416	1,143	83,516	67,433
Borough of Point Fortin		25	809	762	20,235	19,056
Couva/Tabaquite/Talparo		723	247	225	178,410	162,779
Diego Martin		126	817	839	102,957	105,720
Mayaro/Rio Claro		814	44	41	35,650	33,480
Penal/ Debe		246	363	340	89,392	83,609
Princes Town		620	165	148	102,375	91,947
San Juan/Laventille		239	658	658	157,258	157,295
Sangre Grande		927	82	69	75,766	64,343
Siparia		495	176	165	86,949	81,917
Tunapuna/Piarco		510	422	400	215,119	203,975

*Source: CSO 2000 and 2011 Population and Housing Censuses*

In 2000, 30.5 percent of Trinidad's population lived in four core urban municipalities on the western end of the East-West Corridor – the City of Port-of-Spain, City of San Fernando, and the Regions of Diego Martin and San Juan/Laventille. Altogether, the populations of these municipalities declined between 2000 and 2011 by 5.8 percent, with the City of Port-of-Spain losing one quarter of its population (24.4%), the City of San Fernando down by 11.9 percent, Diego Martin by 2.6 percent, and San Juan/Laventille by less than 1 percent. On the other hand, the populations in the municipalities in central Trinidad, along the North-South Corridor, noted significant increases during the period. Similar population expansion was noted eastward, in the Tunapuna-Arima-Sangre Grande area, with the municipality of Sangre Grande having the largest population increase. The population of Chaguanas rose by 23.9 percent, Sangre Grande by 15.4 percent, and Couva/Tabaquite/Talparo by 9.6 percent. Taken together, the proportion of people in those three regions increased by some 14.1 percent (Figure 9-26).

The decline in the City of San Fernando was met with the growth in adjacent parts of its metropolitan areas within the regions of Penal/Debe (6.9%) and Princes Town (11.3%). Between 2000 and 2011, Tobago's population increased by 12.6 percent, from 54,084 to 60,874. The highest population increase (226.9%) was noted in the Parish of St. George. This parish, along with the three other western parishes of St. Patrick, St. Andrew and St. David, remained the most populated areas in Tobago, accommodating 50.2 percent of the island's population.



**Figure 9-26: Population Change by Municipalities in Trinidad and in Tobago, 2000-2011**

Source: CSO 2000 and 2011 Population and Housing Censuses

#### 9.5.2.1.2 Household Size

Nationally, an average of 3.3 persons lives in the 401,382 households recorded, down from 3.6 in 2000. The average household size declined both in Trinidad (from 3.7 in 2000 to 3.3 in 2011) and in Tobago (from 3.5 in 2000 to 3.0 in 2011). In the case of the administrative regions of Trinidad, the average household sizes range from 2.9 persons per household to 3.5 persons per household.

Although twice as many household heads were men, at 33 percent, the proportion of households headed by females was substantial. There was a greater prevalence of female-headed households in the core urban areas, in the City of Port-of-Spain, San Juan/Laventille, the City of San Fernando, Diego Martin and Arima. On the other hand, in the other municipalities – Penal/Debe, Mayaro/Rio Claro and Couva/Tabaquite/Talparo, male-headed households were markedly more predominant. It is noteworthy that the prevalence of female-headed households in the City of Port-of-Spain was nearly twice that of Penal/Debe.

**Table 9-4: Household Heads by Administered Area for Trinidad and Tobago and Sex 2011**

Municipality	Total	Male Headed	% Male Headed	Female Headed	% Female Headed
<b>Trinidad and Tobago</b>	<b>401,384</b>	<b>269,865</b>	<b>67.2%</b>	<b>131,519</b>	<b>32.8%</b>
<b>Tobago</b>	<b>20,125</b>	<b>12,865</b>	<b>63.9%</b>	<b>7,260</b>	<b>36.1%</b>
<b>Trinidad</b>	<b>381,259</b>	<b>257,000</b>	<b>67.4%</b>	<b>124,259</b>	<b>32.6%</b>
City of Port-of-Spain	12,333	6,756	54.8%	5,577	45.2%
City of San Fernando	15,111	9,437	62.5%	5,674	37.5%
Borough of Arima	9,780	6,235	63.8%	3,545	36.2%
Borough of Chaguanas	24,644	17,078	69.3%	7,565	30.7%
Borough of Point Fortin	6,679	4,323	64.7%	2,356	35.3%
Couva/Tabaquite/Talparo	51,818	38,308	73.9%	13,510	26.1%

<b>Municipality</b>	<b>Total</b>	<b>Male Headed</b>	<b>% Male Headed</b>	<b>Female Headed</b>	<b>% Female Headed</b>
Diego Martin	32,404	20,449	63.1%	11,955	36.9%
Mayaro/Rio Claro	10,351	7,726	74.6%	2,625	25.4%
Penal/Debe	26,067	19,682	75.5%	6,385	24.5%
Princes Town	29,661	21,729	73.3%	7,932	26.7%
San Juan/Laventille	49,404	29,835	60.4%	19,569	39.6%
Sangre Grande	22,706	15,755	69.4%	6,952	30.6%
Siparia	26,125	18,315	70.1%	7,810	29.9%
Tunapuna/Piarco	64,176	41,372	64.5%	22,804	35.5%

*Source: CSO 2011 Population and Housing Census*

#### **9.5.2.1.3 Population structure (by sex and age)**

In 2011, male to female ratio of the total population for Trinidad and Tobago was 100.7 males per 100 females. The sex ratio has increased from 99.8 males per 100 females in 1990 to 100.7 males per 100 females in 2011.

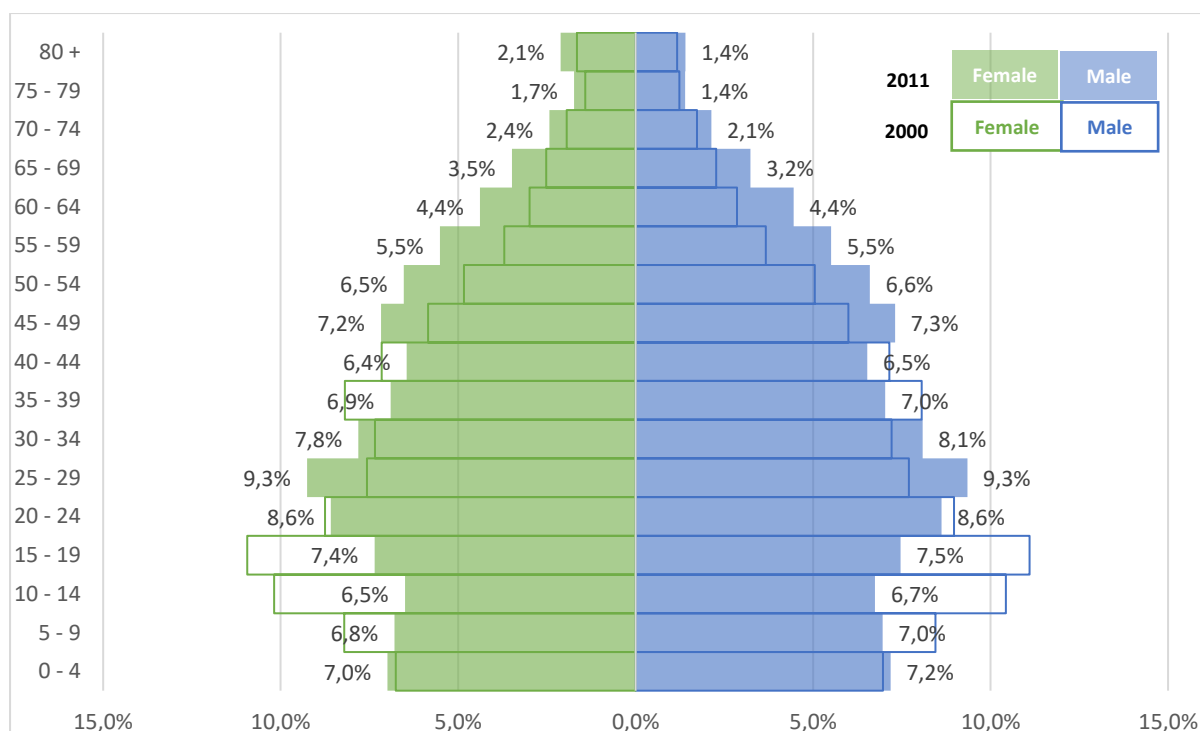
In all the age groups from 20-24 years to 55-59 years, the ratio of male-headed to female-headed households was above the national average. The 80 years or older groups is the only instance where the proportion of female-headed households outnumbered male-headed households. Most of the male-headed households were between the ages of 45 and 49 years, while the majority of female heads were between 50 and 54 years.

A comparison of the age-sex pyramid of the Trinidad and Tobago for 2000 and 2011 shows that is the population's age structure changing (Figure 9-27). In the youngest age group (0-4 years), there was growth in the percentage distribution of both the male and female populations. The widening of the top of the pyramid in 2011 indicates the aging of the national population.

The 2011 census shows that the population of Trinidad and Tobago was relatively young, with more than half of the population, both females and males, under 35 years and 20.6 percent younger than 15 years old (Figure 9-27). The age group between 5 and 19 years, most of whom make up the primary and secondary school age population, accounted for 20.9 percent of the population. The working age population between 15 and 65 years, accounted for 70.4 percent of the national population. An examination of the age composition showed that the population in age groups classified as the dependent group (all persons aged 0-14 years and 65+ years) stood at 29.6 percent of the population in 2011.

This age dependency ratio looks at the proportion of dependents less than 15 years and the older adult population of 65 and older in relation to the working-age population (15-64 age groups). In 2011, the average age dependency ratio for Trinidad and Tobago was 41.9. The ratio for Trinidad was 41.8 and 45.9 for Tobago. The national child dependency ratio was calculated as 29.2, while the ratio for older adults was 12.7.

When the age dependency ratio is examined by Municipality, 5 municipalities showed ratios below the national average – Tunapuna/Piarco, Princes Town, Couva/Tabaquite/Talparo, Penal/Debe, and Chaguanas. Regions with ratios above the national average were Port-of-Spain, Diego Martin, San Juan/Laventille, San Fernando, Sangre Grande, Point Fortin, Arima and Tobago. The other areas had age dependency ratios which were similar to the national average.



**Figure 9-27: Age and Sex Pyramid, 2000 and 2011**

Source: CSO 2000 and 2011 Population and Housing Censuses

**Table 9-5: Female and male age structure of Trinidad and Tobago, 2000 and 2011**

Age Group	2000			2011		
	Female	Male	Both Sexes	Female	Male	Both Sexes
0-4	629,315	633,051	1,262,366	46,274	47,847	94,121
5-9	42,431	43,595	86,026	44,952	46,379	91,331
10-14	51,594	52,913	104,507	43,010	44,953	87,963
15-19	64,037	65,367	129,404	48,670	49,709	98,379
20-24	68,703	69,774	138,477	56,833	57,407	114,240
25-29	55,099	56,881	111,980	61,250	62,268	123,518
30-34	47,648	48,957	96,605	51,683	53,897	105,580
35-39	46,126	46,067	92,193	45,677	46,862	92,539
40-44	51,270	51,303	102,573	42,672	43,491	86,163
45-49	44,889	45,482	90,371	47,429	48,685	96,114
50-54	36,785	38,037	74,822	43,203	43,981	87,184
55-59	30,533	31,900	62,433	36,496	36,719	73,215
60-64	23,268	23,230	46,498	29,002	29,645	58,647
65-69	18,902	18,207	37,109	23,055	21,583	44,638
70-74	15,868	14,553	30,421	16,079	14,209	30,288
75-79	12,289	11,110	23,399	11,463	9,286	20,749
80+	9,062	7,938	17,000	13,966	9,384	23,350
Total	10,811	7,737	18,548	661,714	666,305	1,328,019

Source: CSO 2000 and 2011 Population and Housing Censuses

#### 9.5.2.1.4 Ethnic composition

In 2011, East Indians and Africans were the two largest ethnic groups in Trinidad and Tobago. East Indians accounted for 35.4 percent of the total population while Africans accounted for 34.2 percent. The next largest group was described as 'Mixed' representing 22.8 percent of the population and disaggregated into the 'African/East Indian' 7.7 percent and 'Mixed Other' 15.1 percent. All other ethnic groups totalled 1.4 percent, with a relatively large 'not stated' category consisting of 6.2 percent. Comparison of ethnic composition across the two main islands showed a different composition for Tobago as compared to Trinidad. Some 85.2 percent of the population was African followed by the 'Mixed' group comprising 8.5 percent.

#### 9.5.2.1.5 Religious composition

In 2011, the Trinidad and Tobago population were mainly Christians, made up mostly of people of Roman Catholic (21.6%), Pentecostal/Evangelical/Full Gospel (12.0%), Anglican (5.7%), Spiritual Shouter Baptist (5.7%) and Seventh Day Adventist (4.1%) denominations. Hinduism (18.2%) and Islam (5.0%) were the other main two religions to which the national population were affiliated. The religious affiliations of 7.5 percent of the population were listed under the 'Others', while 2.2 percent of the population indicated they had to no religious affiliation.

#### 9.5.2.2 Persons with Disabilities

The 2011 census showed that 3.9 percent of the national population had some form of disability (Table 9-6). The most prevalent form of difficulty in functioning reported by persons with disabilities (PWDs) was walking and climbing stairs (31.8%), followed by seeing (27.8%), speaking and understanding (13.6%), and remembering and concentrating (10.8%).

**Table 9-6: Persons of disabilities and prevalence of disabilities by Administrative Area, 2011**

Municipality	Persons with Disabilities		Type of Disabilities (some, lots of difficulty, or cannot do at all)					
	Number	%	Seeing	Hearing	Walking or Climbing Steps	Remembering or Concentrating	Gripping	Speaking and Understanding
<b>Trinidad and Tobago</b>	<b>52,243</b>	<b>3.9%</b>	<b>19,540</b>	<b>6,217</b>	<b>22,374</b>	<b>7,569</b>	<b>5,018</b>	<b>9,586</b>
<b>Tobago</b>	<b>1,858</b>	<b>3.1%</b>	<b>658</b>	<b>220</b>	<b>827</b>	<b>249</b>	<b>117</b>	<b>330</b>
<b>Trinidad</b>								
City of Port-of-Spain	2,055	5.5%	982	256	809	231	128	248
City of San Fernando	1,923	3.9%	649	271	914	295	171	363
Borough of Arima	1,155	3.4%	388	123	494	180	117	224
Borough of Chaguanas	3,294	3.9%	1,293	359	1,379	474	293	583
Borough of Point Fortin	834	4.1%	281	77	377	126	60	172
Couva/Tabaquite/Talparo	6,569	3.7%	2,015	949	3,155	1,114	811	1,317
Diego Martin	3,609	3.5%	1,383	425	1,468	535	313	647
Mayaro/Rio Claro	1,637	4.6%	601	186	571	285	150	382
Penal/Debe	4,100	4.6%	1,438	501	1,891	615	433	754
Princes Town	3,938	3.8%	1,089	492	1,844	655	458	886
San Juan/Laventille	6,564	4.2%	2,725	747	2,657	788	545	1,114
Sangre Grande	3,072	4.1%	1,079	370	1,325	466	318	604
Siparia	4,199	4.8%	1,817	466	1,630	578	430	698
Tunapuna/Piarco	7,436	3.5%	3,141	776	3,031	979	675	1,264



*Source: Central Statistical Office 2011 Population and Housing Census*

### **9.5.2.3 Education Attainment and Qualification**

The 2011 Population and Housing Census shows that 29.8 percent of the population had attained primary-level education, 43.5 percent attained secondary and post-secondary, with 14.6 percent 6.2% attaining tertiary level education (6.2% attained non-university level and 8.4% university-level). Males outnumbered females up to the primary and secondary levels education. However, at the tertiary level females outnumbered males. Most of the population that had attained tertiary level education can be found in the core urban areas. A higher proportion of the municipal population had attained tertiary level education in the City of Port-of-Spain (15.9%), City of San Fernando (20.4%), the Boroughs of Arima (19.9%), Chaguanas (17.4%) and Point Fortin (16.3%), and the Municipalities of Diego Martin (19.3%) and Tunapuna/Piarco (18.1%) than the national average.

Close to 40 percent of the national population (38.7%) 15 years or older had no academic qualifications. Up to 4.3 percent reported school leaving as the highest qualification attained and 2.1 percent indicated that CXC Basic was their highest educational qualification. Some 25.1 percent achieved GCE 'O' level/CXC General or 'A' Levels as their highest educational qualification, 9.3 percent were granted Diplomas, while 5.2 percent achieved either first or post-graduate degrees.

**Table 9-7: Educational Attainment of Population by Municipality**

Country/Island/ Municipality	Total	None/ Nursery/ Kinder- garten	Primary	Secondary	Post Secondary	Tertiary Non- University	Tertiary/ University	Other	Not applicable	Not stated
<b>Trinidad and Tobago</b>	<b>1,322,546</b>	<b>4.6%</b>	<b>29.8%</b>	<b>41.3%</b>	<b>2.3%</b>	<b>6.2%</b>	<b>8.4%</b>	<b>1.0%</b>	<b>4.8%</b>	<b>1.6%</b>
<b>Tobago</b>	<b>60,735</b>	<b>3.7%</b>	<b>35.0%</b>	<b>39.0%</b>	<b>2.0%</b>	<b>4.5%</b>	<b>8.6%</b>	<b>1.5%</b>	<b>5.1%</b>	<b>0.6%</b>
<b>Trinidad</b>	<b>1,261,811</b>	<b>4.6%</b>	<b>29.5%</b>	<b>41.4%</b>	<b>2.3%</b>	<b>6.2%</b>	<b>8.4%</b>	<b>1.0%</b>	<b>4.8%</b>	<b>1.7%</b>
City of Port-of-Spain	35,914	3.5%	23.5%	45.2%	2.3%	5.4%	10.5%	1.5%	4.4%	3.5%
City of San Fernando	48,635	3.9%	23.9%	40.4%	3.1%	8.7%	11.7%	1.2%	4.3%	2.8%
Borough of Arima	33,404	3.9%	25.1%	39.9%	3.5%	8.1%	11.8%	1.4%	4.7%	1.7%
Borough of Chaguanas	83,489	4.5%	27.3%	40.8%	2.1%	6.9%	10.5%	0.8%	4.7%	2.3%
Borough of Point Fortin	20,161	5.1%	27.6%	37.9%	4.2%	9.2%	7.1%	1.6%	5.1%	2.1%
Couva/Tabaquite/Talparo	178,160	4.5%	32.3%	41.0%	2.6%	5.8%	7.1%	0.8%	4.7%	1.0%
Diego Martin	102,340	4.1%	24.1%	42.7%	2.3%	7.0%	12.3%	1.1%	4.4%	2.1%
Mayaro/Rio Claro	35,649	6.1%	39.7%	36.6%	2.0%	3.7%	4.1%	0.7%	5.5%	1.7%
Penal/Debe	89,342	4.7%	30.9%	42.3%	1.9%	6.1%	7.9%	0.5%	4.5%	1.1%
Princes Town	102,369	5.1%	33.4%	41.4%	2.1%	5.3%	5.5%	0.7%	5.2%	1.3%
San Juan/ Laventille	157,021	4.6%	28.9%	43.1%	2.1%	5.8%	7.2%	1.3%	5.2%	1.8%
Sangre Grande	75,605	4.4%	36.7%	40.7%	1.2%	4.7%	5.3%	0.6%	5.4%	1.0%
Siparia	86,898	5.0%	31.1%	43.1%	2.7%	5.7%	5.4%	0.8%	5.0%	1.2%
Tunapuna/Piarco	212,825	4.8%	27.0%	40.3%	2.2%	7.0%	11.1%	1.1%	4.6%	1.9%

#### 9.5.2.4 Health

The 2011, Trinidad and Tobago Population and Housing Census reports that 2 in every 10 persons were living with chronic disease. Hypertension (6.5%), diabetes (5.9%), asthma (3.6%), arthritis (2.6%), and heart disease (1.6%) were the five most common chronic health condition observed. Heart disease is ranked as the leading cause of death in Trinidad and Tobago, accounting for 25 percent of all deaths annually. Diabetes and hypertension (each accounting for approximately 12% of deaths) are contributing factors, along with overweight/obesity and lack of regular exercise. At 16 percent, cancers (neoplasms) are also cause of death.

The leading mental health problems are schizophrenia, mood disorders, mental and behavioural disorders, and substance abuse. Domestic violence is also regarded a major health concern. During the period 2010-2012, there were 5,909 reported cases of domestic violence. The victims were under the age of 19 in 6.6% of cases, aged 20-29 in 29.2%, and aged 30-39 in 44.2% of cases.

Large flows of people into the country have facilitated the introduction of new viral diseases - chikungunya in 2014 and Zika in 2016. By the end of 2016, 243 confirmed cases of chikungunya infection and 498 cases of Zika virus disease, which included the infection of 294 pregnant women. The most recent virus introduced into the country is the severe acute respiratory syndrome coronavirus 2 which so far has accounted for 123 COVID-19 infections.

Country/Island/ Municipality	Persons suffering from chronic illness (%)	Prevalence Rate (%)						Persons not suffering from any chronic illness (%)
		Hyper- tension	Diabetes Mellitus	Asthma	Arthritis	Heart Disease	Other chronic Illness	
<b>Trinidad and Tobago</b>	<b>20.3</b>	<b>6.5</b>	<b>5.9</b>	<b>3.6</b>	<b>2.6</b>	<b>1.6</b>	<b>3</b>	<b>79.7</b>
<b>Tobago</b>	<b>17</b>	<b>6.9</b>	<b>4.5</b>	<b>3.4</b>	<b>1.8</b>	<b>0.6</b>	<b>2.5</b>	<b>83.0</b>
<b>Trinidad</b>								
City of Port of Spain	24.2	8	5.4	4.1	3.3	1.6	3.7	75.9
City of San Fernando	22.1	6.1	5.7	2.9	2.5	1.6	2.8	77.9
Borough of Arima	20.8	6.2	5.1	4.1	2.1	1.1	3	79.2
Borough of Chaguanas	20.4	6.3	6.7	3.9	2.6	1.7	2.9	79.7
Borough of Point Fortin	20.9	5.3	4.5	3	1.9	1.2	3.1	79.1
Couva/Tabaquite/Talparo	21.6	7	7.1	3.9	2.9	1.9	3.1	78.5
Diego Martin	20.5	6.7	4.7	3.5	2.6	1.2	3.3	79.5
Mayaro/Rio Claro	19.2	7.3	6.6	2.7	2.7	1.8	3.2	80.8
Penal/Debe	21.3	7	7.5	3.5	3.5	2.6	2.7	78.7
Princes Town	19.7	5.9	6.2	3.2	2.7	2.1	2.7	80.4
San Juan/Laventille	20.1	6.2	5.3	4	2.5	1.2	3.1	79.9
Sangre Grande	18.3	6.5	5.8	3.9	2.3	1.5	3.1	81.7
Siparia	18.9	6.7	6.4	3	2.8	2	2.9	81.1
Tunapuna/Piarco	20.4	6	5.7	3.8	2.2	1.4	2.9	79.6

#### 9.5.2.5 Economic Activity

Due to weak global trade and heightened investment trade policy uncertainty emanating mainly from trade frictions between the United States and China and lower commodity prices, the global economy lost momentum in 2019 with world output growth slowing to 2.9 percent in 2019 according to the International Monetary Fund January 2020 World Economic Outlook Update. Against this backdrop, Trinidad and Tobago's economy rebounded during the first quarter of the 2019 calendar, fuelled by the recovery of both the Energy and Non-Energy sectors and leading to the real GDP expanding to 1.7 percent (Table 9-8). The main contributors to this recovery were Manufacturing (4.9%), Mining and Quarrying (1.9%), Trade and Repairs (1.7%), Public Administration (1.5%), Financial and Insurance Activities (1.7%), Electricity and Gas (3.2%) and Transport and Storage (5.6%) sectors, which altogether accounted for 80.8 percent of the real GDP at Basic Prices during the first three months of 2019. A 19.2 percent upsurge in the economic activity of the Agriculture, Forestry and Fishing sector, due to a sharply higher output of root crops and vegetables in the first three months of calendar 2019 following the recovery from the widespread flooding that occurred towards the end of 2018, notably contributed to this recovery as well.

**Table 9-8: Trinidad and Tobago Selected Economic Indicators**

Economic Indicators	2015	2016	2017	2018	2019 (Jan -Mar)
Real GDP Growth (%) (2000 = 100) <sup>7</sup>	1.8	-6.3	-2.3	-0.2	1.7
Energy Sector	-0.8	-9.8	0.7	-3.2	3.9
Non-Energy Sector	2.1	-3.1	-3.4	0.4	0.6
Agriculture, Forestry and Fishing	35.9	-7.3	7.9	-9.6	19.2
Trade and Repairs	5.4	-7.0	-10.7	-1.5	1.7
Construction	-2.7	-4.2	-1.8	-0.1	-8.2
Financial and Insurance Activities	3.4	2.5	4.6	0.0	1.7
Manufacturing	2.2	-2.4	-2.4	0.3	4.9
Mining and Quarrying	-3.2	-13.2	0.2	-4.4	1.9
Public Administration	1.4	2.1	0.6	-1.2	1.5
Electricity and Gas	1.8	-8.1	8.6	2.4	3.2
Transport and Storage	-4.5	-17.6	2.0	3.5	5.6
Inflation Rate (%) <sup>8</sup>					
(period average)	4.7	3.1	1.9	1.0	1.0
(end of period)	1.5	3.1	1.3	1.0	0.4
Unemployment Rate (%) <sup>9</sup>	3.4	4.0	4.8	4.1*	n.a.

Source: CSO, Ministry of Finance and Central Bank of Trinidad and Tobago

A soft labour market and muted wage growth contributed to a generally low inflation in 2019 (Table 9-9). Unchanged from the previous year, headline inflation was recorded at 1.0 percent in 2019 with core inflation held steady by the increases in prescription medication and medical services offset by slower

<sup>7</sup> Real GDP growth rates are sourced from the CSO

<sup>8</sup> Changes in the Index of Retail Prices (RPI), January 2015 = 100

<sup>9</sup> This represents the average of the four quarters.

\* For the period January to September 2018

transportation inflation. Additionally, food inflation decreased from 1.1 percent in 2018 to 0.6 percent in 2019 as a result of price decreases in fresh fruits and vegetables.

**Table 9-9: Labour Statistics from Jan 2017 to Sep 2018**

Labour Indicators	Jan – Sep 2017	Jan – Sep 2018
Working age population (15 years and over)/Thousands	1,071.2	1072.1
Labour Force/Thousands	637.0	631.1
Persons with Jobs/Thousands	605.4	605.4
Persons without jobs/Thousands	31.7	25.7
Participation Rate (%)	59.2	58.9
Male	69.0	68.2
Female	50.0	49.6
Unemployment Rate (%)	5.0	4.1
Male	4.4	3.4
Female	5.8	5.0

Source: Central Statistics Office

Trinidad and Tobago's unemployment rate for the first 9 months of 2018 decreased from 5.0 percent in the corresponding period in 2017 to 4.1 percent (Table 9-10). The decrease in the unemployment rate despite little variation in the number of employed persons, indicates that discouraged workers have left the labour force and is evidenced by the corresponding decline in the participation rate between the reporting periods. Notably, women fared worse than men with higher unemployment rates and lower rates of participation in the labour force.

The 2019 Review of the Economy report produced by the Ministry of Finance reported that individuals between the ages of 15 and 29 years represented the largest proportion of all unemployed persons (46.3%) during the period of April to June 2018 and consequently experienced the highest level of unemployment (8.0%), following a notable growth in the number of young persons in the labour force from 135,300 to 138,600 within the quarter. The unemployment rate for the middle age population (30 – 49 years) for the same reporting period was 3.2 percent while the elderly (65 years and over) recorded the lowest level of unemployment during the quarter of 1.4 percent.

**Table 9-10: Sectoral Distribution of Employment from Jan 2017 to Sep 2018**

Sectors	Jan – Sep 2017		Jan – Sep 2018	
	(000s)	%	(000s)	%
Agriculture	22.9	3.8	23.6	3.9
Petroleum and Gas	14.6	2.4	14.6	2.4
Manufacturing	49.9	8.2	47.7	7.9
Construction	89.5	14.8	88.8	14.7
Transport, Storage and Communications	43.6	7.2	38.7	6.4
Other Services	385.0	63.6	392.0	64.7
Wholesale and Retail	118.4	19.6	119.0	19.7
Community, Social and Personal Services	206.7	34.1	206.4	34.1
Finance, Insurance and Real Estate	58.3	9.6	62.9	10.4

Sectors	Jan – Sep 2017		Jan – Sep 2018	
	(000s)	%	(000s)	%
Not Classified	1.5	0.2	3.6	0.6
Total Employment	605.4	100.0	605.4	100.0

*Source: Central Statistics Office*

The employment gains in some sectors during the first nine months of 2018 were offset by job losses in other sectors (Table 9-10). Growth in the levels of employment was observed in the finance, insurance, and real estate services sector, the agriculture sector, and the wholesale and retail trade sector. Conversely the largest job losses occurred in the transport, storage and communication sector, manufacturing (including mining and quarrying) sector and the construction (including electricity and water) sector.

The highest proportion (19.4%) of all registered businesses in Trinidad is located in the City of Port-of-Spain, followed by Tunapuna/Piarco (11.7%), Couva/Tabaquite/Talparo (11.4%) and San Juan/Laventille (10.8%) (Table 9-11).

**Table 9-11: Registered Businesses in Trinidad by Municipality**

Municipality	Proportion of Registered Businesses
City of Port-of-Spain	19.4%
City of San Fernando	7.5%
Borough of Arima	3.7%
Borough of Chaguanas	5.8%
Borough of Point Fortin	1.6%
Couva/Tabaquite/Talparo	11.4%
Diego Martin	8.1%
Mayaro /Rio Claro	2.4%
Penal/Debe	5.6%
Princes Town	4.3%
San Juan/Laventille	10.8%
Sangre Grande	3.4%
Siparia	4.2%
Tunapuna/Piarco	11.7%

*Source: Central Statistical Office Business Register, 2008*

The types of enterprises were similar among the municipalities, with businesses concentrated largely in the Distribution (i.e. retail) sector, followed by the Finance, Insurance, Real Estate and Business Services sector. There are a number of public industrial parks and estates across Trinidad, encompassing numerous energy and non-energy activities, including food processing, bonded warehouse facilities, the manufacture of plastic, steel, electrical, concrete and wood products, steel fabrication, engineering works, construction and maintenance of marine craft, and production of industrial materials and gases, among others (Table 9-12).



Table 9-12: Tenancy in the Various Municipalities

Municipalities	Parks/Estates	Number of Tenants
<b>Tobago</b>	Milford Industrial Park	5
	Sangster's Hill Mall	19
	Cove Eco-Industrial and Business Park	n.a.
<b>Trinidad</b>		
City of Port-of-Spain	Port-of-Spain Abattoir	4
	East Dry River Industrial Park	12
	Sea Lots Industrial Park	11
	Beetham Industrial Park	2
Borough of Arima	O'Meara Industrial Park	123
Borough of Chaguanas	Biljah Industrial Park	14
	Chase Village Industrial Park	4
Borough of Point Fortin	Point Fortin Industrial Park	3
Couva/Tabaquite/Talparo	Point Lisas Industrial Park	18
	Point Lisas South and East Industrial Estate	n.a.
	Plaisance Park Industrial Park	13
Diego Martin	Diamond Vale Industrial Park	47
	Harmony Hall Industrial Park	14
Penal/Debe	Debe Industrial Park	6
Tunapuna/Piarco	Macoya Industrial Park	12
	Frederick Settlement	64
	Trincity Industrial Park	15
	Piarco Aero Park	n.a.
	Tamana InTech Park	1
San Juan/Laventille	Morvant Industrial Park	15
Siparia	<i>La Brea Industrial Estate</i>	n.a.

#### 9.5.2.6 Poverty and Vulnerability

The 2005 Report on Survey of Living Conditions for Trinidad and Tobago showed that relative poverty rate averaged 16.7 percent of the population of which 1.2 percent were food poor (indigent). Another 9.0 percent of the population was vulnerable to poverty<sup>10</sup>. This figure ranged from 4.5 percent (in Arima) to 39.1 percent (in Sangre Grande).

Most of the country's poor can be located in Princes Town (13.8%), Sangre Grande (13.4%), Siparia (10.9%), San Juan/Laventille (10.4%) and Tunapuna/Piarco (10.2%); these regions together accounted for 58.7 percent of the total poor population. In terms of the relative poverty among the municipalities, 39.1 percent of the population of Sangre Grande were deemed to be poor. Other regions of high relative poverty rates included Princes Town (30.0%), the Borough of Point Fortin (24.6%), Mayaro/Rio Claro (26.6%) and Siparia (27.7%), all of which showed rates of above 20 percent. In the areas of the highest concentration of the population, some of the poorest live within less than two miles from the most well-off. Figure 9-28 shows the distribution of poverty, while Figure 9-29 presents a map of poverty by the

<sup>10</sup> Persons who will fall into poverty if face a sudden shock such as an economic downturn, natural disaster, etc.

municipalities of Trinidad and the parishes of Tobago. The areas in the darkest colour reflect the poorest parts of the country.

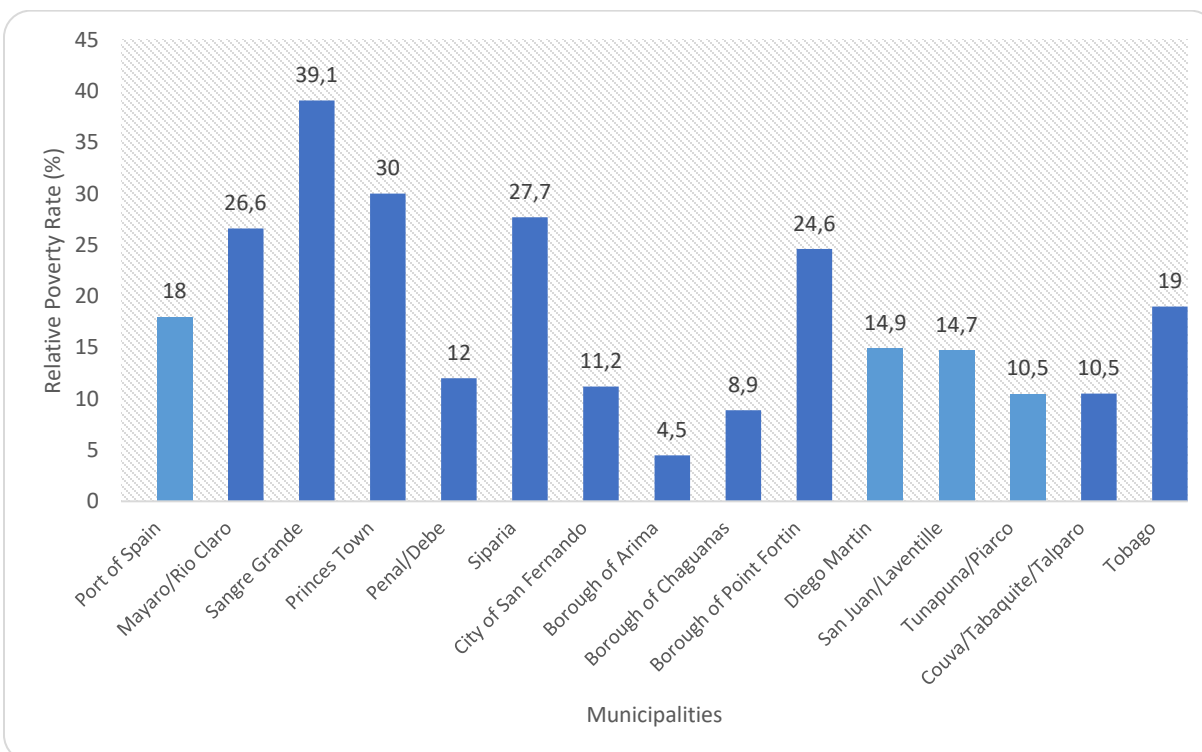


Figure 9-28: Distribution of the Poor as a Percentage of Total Population

Source: Report on Survey of Living Conditions in Trinidad and Tobago, 2005

Table 9-13: Estimated Poor Population in Trinidad and Tobago by Municipality, 2005

Municipality	Relative Poverty per 100 persons	Total Population, 2011	Estimated Poor Population	Proportion of the Poor Population
<b>Trinidad and Tobago</b>	<b>16.7%</b>	<b>1,328,019</b>	<b>221,779</b>	<b>100.0%</b>
<b>Tobago</b>	<b>19.0%</b>	<b>60,874</b>	<b>11,566</b>	<b>5.2%</b>
<b>Trinidad</b>	<b>16.6%</b>	<b>1,267,145</b>	<b>210,346</b>	<b>94.8%</b>
City of Port of Spain	18.0%	37,074	6,673	3.0%
City of San Fernando	11.2%	48,838	5,470	2.5%
Borough of Arima	4.5%	33,606	1,512	0.7%
Borough of Chaguanas	8.9%	83,516	7,433	3.4%
Borough of Point Fortin	24.6%	20,235	4,978	2.2%
Couva/Tabaquite/Talparo	10.5%	178,410	18,733	8.4%
Diego Martin	14.9%	102,957	15,341	6.9%
Mayaro/Rio Claro	26.6%	35,650	9,483	4.3%
Penal/ Debe	12.0%	89,392	10,727	4.8%
Princes Town	30.0%	102,375	30,713	13.8%
San Juan/Laventille	14.7%	157,258	23,117	10.4%
Sangre Grande	39.1%	75,766	29,625	13.4%

Municipality	Relative Poverty per 100 persons	Total Population, 2011	Estimated Poor Population	Proportion of the Poor Population
Siparia	27.7%	86,949	24,085	10.9%
Tunapuna/Piarco	10.5%	215,119	22,587	10.2%

Source: Analysis of the 2005 Trinidad and Tobago Survey of Living. Prepared by Kairi Consultants Limited on behalf of the Poverty Reduction Programme, Ministry of Social Development, Trinidad and Tobago, 2006.

The highest incidence of poverty was among large-sized households and reflected in rural areas such as Sangre Grande in Trinidad and St. Paul in Tobago (Figure 9-29). Female-headed households were more likely to be poor than male-headed households and poor women represented 38.8 percent of the working poor (Table 9-13). The poor tended to have achieved low educational attainment and were heavily concentrated in elementary occupations among men and in low level services and sales among women. Children, youths, older adults (the elderly), and PWDs were also identified among the most vulnerable.

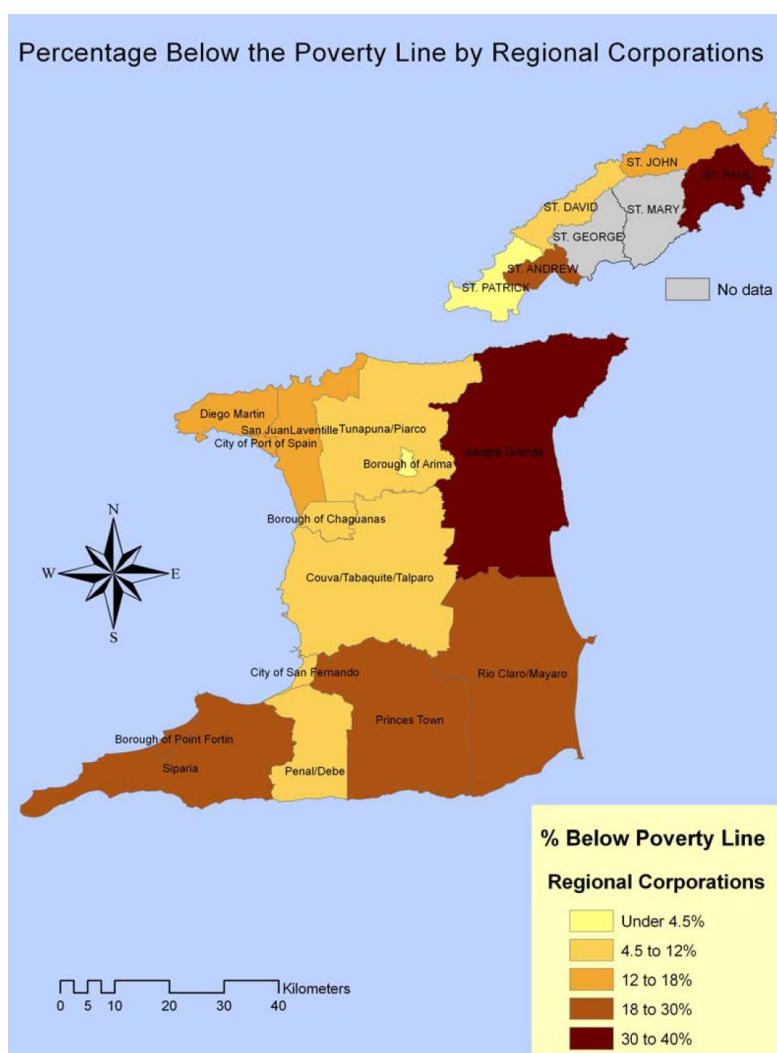


Figure 9-29: Percentage Population Below the Poverty Line by Municipality

Source: Analysis of the 2005 Trinidad and Tobago Survey of Living. Prepared by Kairi Consultants Limited on behalf of the Poverty Reduction Programme, Ministry of Social Development, Trinidad and Tobago, 2006.

### 9.5.2.7 Housing Stock

According to the 2011 Population and Housing Census, the majority of the housing stock (46.1%- 77.6%) was built before 1989. The highest proportion of buildings built before 1989 are located in Port of Spain (77.6%), followed by Diego Martin (69.9%) while close to 30 percent of buildings in Sangre Grande were built after 2000. Across the municipalities, between 50 to 90 percent of buildings were constructed from concrete or concrete and brick. In the more rural municipalities of Point Fortin, Mayaro/ Rio Claro, Princes Town, Sangre Grande and Siparia more than 20 percent of buildings had wooden outer walls.

**Table 9-14: Types of Buildings by Municipality**

Municipality	Type of Building						
	Residential	Residential / Commercial	Residential / Office	Residential / Industrial	Community Service	Other	Not Stated
<b>Tobago</b>	<b>96.7%</b>	<b>2.9%</b>	<b>0.2%</b>	<b>0.0%</b>	<b>0.1%</b>	<b>0.1%</b>	<b>0.0%</b>
<b>Trinidad</b>							
Port of Spain	94.6%	4.5%	0.1%	0.1%	0.3%	0.2%	0.3%
San Fernando	94.4%	5.0%	0.2%	0.0%	0.2%	0.1%	0.2%
Arima	95.7%	3.8%	0.2%	0.1%	0.0%	0.0%	0.2%
Chaguanas	94.4%	5.3%	0.1%	0.0%	0.0%	0.1%	0.1%
Point Fortin	96.0%	3.6%	0.1%	0.0%	0.0%	0.1%	0.0%
Couva/Tabaquite/Talparo	95.6%	4.0%	0.1%	0.1%	0.1%	0.1%	0.0%
Diego Martin	96.6%	2.1%	0.2%	0.0%	0.1%	0.9%	0.1%
Mayaro/Rio Claro	95.1%	4.4%	0.1%	0.1%	0.0%	0.1%	0.2%
Penal/ Debe	96.0%	3.8%	0.0%	0.0%	0.0%	0.1%	0.1%
Princes Town	95.5%	4.1%	0.0%	0.0%	0.0%	0.2%	0.1%
San Juan/Laventille	96.4%	3.1%	0.1%	0.1%	0.1%	0.1%	0.2%
Sangre Grande	96.3%	3.4%	0.0%	0.1%	0.1%	0.1%	0.0%
Siparia	96.3%	3.3%	0.0%	0.0%	0.1%	0.1%	0.1%
Tunapuna/Piarco	96.0%	3.2%	0.1%	0.1%	0.1%	0.2%	0.3%

*Source: Trinidad and Tobago 2011 Population and Housing Census, CSO*

The vast majority (more than 94%) of buildings in each municipality were residential (Table 9-14). Buildings that serve both a residential and commercial function were the next most prominent building type.

### 9.5.2.8 Informal Settlements

Illegal occupation of lands, or squatting as it is known locally, has become a complicated and major issue for the State and private landowners. Squatting could once be considered a solution for the poor to have access to land and housing, has since become a challenge as both low and middle income families take advantage of capturing government land due to the ever-increasing high demand for housing and very high cost on land, for which they would have difficulty getting loans.

In 2005, the Land Settlement Agency (LSA) estimated that 50,000 households were squatting, half of them on private lands and the other half on public lands. The results of a series of social surveys conducted by the LSA between 2009 and 2012 in order to estimate the extent and characteristics of informal

settlements across Trinidad and Tobago indicated that informal settlements on State Lands comprised a total of 60,000 households in 396 informal settlements with another 30,000 households estimated to be located on private lands. This can be interpreted as informal settlements accounted for approximately 1 in 5 households in Trinidad and Tobago. In the 2016 The State of Social Housing in Six Caribbean Countries Study, it is suggested that over 19.0 percent of the population of Trinidad and Tobago or 76,000 households in Trinidad and Tobago live in informal (squatter) settlements.<sup>11</sup>

These settlements are characterised typically by poorly constructed housing, little or no access to basic amenities such as piped water, improper sewage facilities, inadequate drainage, and very limited mechanisms for risk transfer. Oftentimes, existing squatter settlements continue to grow, despite the passing of the Squatter Regularisation Act (Act 25 of 1998).

The passing of the State Land (Regularisation of Tenure) Act provided a path for eligible squatters illegally occupying state lands prior to June 1, 1998 to obtain security of tenure and for the upgrading of infrastructure and services. Under the Act, a squatter who was illegally occupying state lands could only have applied for a certificate of comfort (COC) on or before October 27, 2000. This is the first step in a three-stage regularization process to obtain security of tenure by way of deed of lease. Between 1998 and 2000, approximately 22,500 households have applied for COCs, which implies that more than 1 in every 3 households squatting on state lands are not eligible for COCs based on the deadline for occupation and application. So far, there has not been much success in regularising squatters and regulating the illegal occupation of state lands.

As of 2011 there were approximately 187 squatter settlements, registered with the Trinidad and Tobago Land Settlement Agency, which still does not account for total number, as there are many more communities which remain unregistered, and more have developed in recent years, including in Sangre Grande where the phenomenon has exploded.

#### **9.5.2.9 Water Supply and Demand**

According to the Water Sector Improvement Plan, Trinidad and Tobago has an estimated demand of 135 MIG/day or 83 gallons per capita per day and has a production of 232 MIG/day. Non-Revenue Water is estimated at 99 MIG/ day or 60 percent of demand and 43 percent of production. WASA's service coverage is almost universal for improved water supply services, covering 97 percent of the population.

According to the 2011 Census, there was near universal access to improved water supply with over 90 percent of households in each municipality either having water piped publicly or privately into dwellings, plots or yards and communities (standpipes); or captured with a private catchment (Table 9-15). Households in municipalities with a largely rural character, such as Point Fortin, Mayaro/Rio Claro, Penal/Debe, Princes Town and Siparia, relied to a lesser extent on piped water than more urban municipalities and featured a higher proportion of households who mainly utilise truck borne water or water captured via a private catchment. It is worth noting that although close to 85 percent households in Sangre Grande received piped water into their dwelling, plot or community, roughly 1 In 10 households depended on private catchments as their main water source.

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<sup>11</sup> Donovan, Michael G. and McHardy, Pauline, 2016. The State of Social Housing in Six Caribbean Countries. Inter-American Development Bank (IDB Monograph; 426). Available [online], <https://publications.iadb.org/en/state-social-housing-six-caribbean-countries>.

Most households used water piped into homes as their main source of drinking water (Table 9-16). About 1 in 4 households primarily drank collected rainwater in the eastern Trinidad which comprises the municipalities of Sangre Grande and Mayaro/Rio Claro. Bottled water has become an important source of drinking water nationally, particularly in north west Trinidad (in Diego Martin, Port of Spain and San Juan/Laventille) and the north central (Chaguanas, Tunapuna/Piarco and Arima), as well as in Tobago.



**Table 9-15: Main Water Supply Source to Households by Municipality**

Municipality	Public Piped Dwelling	Public Piped Yard	Public Standpipe	Private Piped Dwelling	Private Catchment	Truck borne	Spring/ River/ Well/ Pond	Other	Not Stated
Port of Spain	84.9%	4.0%	2.9%	5.9%	0.7%	0.0%	0.1%	0.5%	1.1%
San Fernando	92.9%	2.8%	1.5%	1.7%	0.4%	0.0%	0.0%	0.2%	0.5%
Arima	94.8%	1.7%	0.5%	1.6%	0.7%	0.1%	0.0%	0.5%	0.1%
Chaguanas	90.2%	5.1%	0.4%	2.5%	0.6%	0.2%	0.1%	0.7%	0.2%
Point Fortin	47.7%	21.0%	7.1%	10.2%	7.1%	1.7%	0.1%	4.4%	0.6%
Couva/ Tabaquite/ Talparo	74.9%	10.0%	2.7%	3.3%	4.6%	1.5%	0.4%	2.4%	0.3%
Diego Martin	75.3%	7.7%	2.6%	3.0%	3.1%	1.9%	3.4%	2.0%	1.1%
Mayaro/ Rio Claro	47.3%	13.4%	2.5%	5.7%	23.7%	3.8%	0.3%	3.0%	0.3%
Penal/ Debe	58.0%	23.7%	2.1%	3.3%	7.9%	2.2%	0.1%	2.6%	0.2%
Princes Town	64.2%	12.7%	3.3%	4.8%	9.8%	2.1%	0.2%	2.2%	0.6%
San Juan/ Laventille	74.7%	7.7%	4.7%	5.5%	3.5%	0.7%	1.3%	1.6%	0.3%
Sangre Grande	71.0%	6.6%	3.5%	3.7%	9.8%	1.4%	1.1%	2.6%	0.2%
Siparia	58.0%	15.8%	4.0%	9.1%	7.1%	1.4%	0.3%	3.8%	0.5%
Tunapuna/ Piarco	89.6%	3.4%	1.7%	2.2%	1.3%	0.2%	0.7%	0.6%	0.4%
Tobago	83.8%	7.9%	1.8%	2.3%	1.8%	0.2%	0.4%	1.6%	0.1%

Source: Trinidad and Tobago 2011 Population and Housing Census, CSO

**Table 9-16: Main Source of Drinking Water by Region**

Region	Piped into Dwelling	Piped into Yard	Piped to neighbour	Public tap/ standpipe	Protected spring	Rainwater collection	Bottled water
Trinidad and Tobago	76.0%	2.6%	1.6%	1.6%	0.5%	5.3%	11.1%
North West	73.0%	2.8%	2.5%	3.0%	1.6%	5.0%	9.3%
East	63.0%	2.6%	0.7%	1.5%	0.1%	25.6%	5.1%
North Central	79.7%	1.1%	0.8%	0.8%	0.2%	1.0%	16.1%
South West	76.9%	4.8%	2.5%	1.7%	0.0%	6.0%	6.8%
Tobago	77.1%	0.5%	0.3%	0.4%	0.9%	5.4%	13.2%

Source: Trinidad and Tobago 2011 Multiple Indicator Cluster Survey, Ministry of Social Development and Family Services, CSO and UNICEF

The challenge in the provision of water was demonstrated in the frequency of water supply to households. In 2011, more than 68 percent of households in Arima, Chaguanas, Couva/Tabaquite/Talparo, Diego Martin, San Juan/Laventille, Sangre Grande, Tunapuna/Piarco and Tobago had water supplied more than three times or more a week. In contrast, up to 43 percent of households in the rural municipalities of Point Fortin, Mayaro/Rio Claro, Penal/Debe, Princes Town and Siparia received water at most once or twice weekly (Table 9-17).

The frequency of communities receiving water is also seasonal and may depend on a number of factors. In the advent of the Covid-19 pandemic, WASA reported that only 67 percent of the population of Trinidad and Tobago was supplied with water more than 3.5 days per week with 23 percent receiving a supply 2 to 3 days per week and 1 percent receiving a supply less than 2 days per week.<sup>12</sup> Further, a later news article noted the challenges faced by the Authority with maintaining a reliable water supply to communities across the country, particularly those at high points or the extremities of the water distribution network (Trinidad Express, March 28, 2020). Harsh 2019 and 2020 dry seasons and a drier than normal 2019 wet season have led to a significant reduction in water production from 242 MIG to 200 MIG of water per day.

**Table 9-17: Frequency of Water Supply to Households by Municipality**

Municipality	Blank	Every day	Three or more times weekly	Once or twice weekly	Once every 2 or 3 weeks	Not at all	Other	Not Stated
Arima	3.0%	60.2%	29.3%	6.3%	0.3%	0.1%	0.2%	0.6%
Chaguanas	4.3%	84.5%	9.8%	0.9%	0.1%	0.1%	0.1%	0.2%
Point Fortin	24.1%	6.0%	27.0%	40.3%	1.4%	0.6%	0.1%	0.5%
Couva/Tabaquite/Talparo	12.5%	36.5%	31.6%	17.1%	1.5%	0.1%	0.3%	0.4%
Diego Martin	14.4%	44.0%	31.4%	8.4%	0.7%	0.2%	0.2%	0.7%
Mayaro/Rio Claro	36.8%	18.1%	25.4%	16.4%	2.3%	0.5%	0.2%	0.3%
Penal/ Debe	16.3%	10.7%	35.0%	35.4%	2.1%	0.2%	0.1%	0.4%
Princes Town	19.8%	12.6%	32.6%	26.8%	6.3%	0.8%	0.5%	0.7%
Siparia	22.3%	19.4%	28.5%	27.8%	1.3%	0.2%	0.2%	0.3%
Tunapuna/Piarco	5.4%	64.7%	26.0%	2.8%	0.2%	0.2%	0.2%	0.4%
Tobago	6.4%	56.0%	30.6%	6.4%	0.2%	0.0%	0.1%	0.3%

*Source: Trinidad and Tobago 2011 Population and Housing Census, CSO*

The latest published Survey of Living Conditions Report for Trinidad and Tobago in 2005 provides a look at the country's water supply through a poverty lens. The Report revealed that over 70 percent of households had water piped to their dwelling from a public source and another 4.4 percent had water piped to dwelling from a private source. The likelihood of piped water to dwelling increased with household quintile with 51.5 percent of those in the poorest quintile had water piped to the dwelling compared to 90.3 percent of those in the richest quintile. Of the total households surveyed, 7.1 percent had a supply of water piped into the yard in which their dwelling was located. As much as 5.9 percent of

<sup>12</sup> Quoted statement made by WASA's chairman, Mr. Romeny Thomas, in the Trinidad Newspaper Express article, dated April 4, 2020, entitled "WASA's Covid-19 Response."

Quoted using statements made by Mr. Alan Poon King, WASA's Acting Chief Executive Officer, in the LoopTT news article, entitled "Reservoir Levels Low: Water supply to Some Areas Severely Affected." Dated May 29, 2020.

all households sampled still depended on public standpipes, with 11.5 percent of the poorest quintile relying on this source. Within the poorest quintile, 3.9 percent relied on truck borne water supplies, and 11 percent depended on private catchments (non-piped). The second quintile displayed a pattern that was only marginally better. It should be noted that large proportions of the two lowest quintiles used springs/ivers or ‘other’ sources of water supply, 9.0 percent of those in quintile I and 5.3 percent of those in quintile II respectively (Table 9-18).

**Table 9-18: Distribution of Dwellings by Main Source of Water by Quintiles**

Main Source of Water	Household Quintiles					
	Poorest	II	III	IV	Richest	Total
	%	%	%	%	%	%
Public piped into Dwelling	47.8	66	71.7	79.8	87.3	70.7
Public Piped into Yard	11.9	7.8	8.4	6.2	1.6	7.1
Public Standpipe	11.5	6.3	6.1	3.5	2.6	5.9
Private Piped into Dwelling	4.7	5.8	4.7	3.9	3	4.4
Private Catchment not Piped	11	6.6	3.7	3.5	2.1	5.4
Truck Borne	3.9	2	0.9	1	1.7	1.9
Spring/River	2	0.9	1.8	0.6	0.1	1.1
Other	7	4.4	2.5	1.5	1.4	3.3
Not Stated	0.2	0.3	0.1	-	.1	0.2
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Total (n)</b>	<b>834</b>	<b>847</b>	<b>855</b>	<b>854</b>	<b>869</b>	<b>4,258</b>

The challenge in the provision of water was also demonstrated in the frequency of water supply (Table 5-18). Although 95 percent of households received water from public/private piped, public standpipe, private catchment and truck borne sources, further analysis of the data show that only 58.4 percent of households received a continuous supply of water, while 20.1 percent indicated that they received a water supply three or more times weekly. Households receiving a continuous supply of water and three or more times a week increased across quintiles - from the poorest (69.2%) to the richest (85.4%). Of households in the poorest quintile 11 percent of those sampled stated that the frequency of their water supply fell into the category ‘other’ which suggests that, at best, it was not as good as the mentioned delivery mode. If having access to water three or more times weekly is set as the standard, more than 20 percent of the population was under-provided with running water (Table 9-19).

Table 9-19: Frequency of Pipe Borne Water Supply by Quintiles

Frequency of Water Supply	Household Quintiles					Total %
	Poorest %	II %	III %	IV %	Richest %	
Continuous Supply	52.2	53.8	59.1	62.5	64.1	58.4
Three or more Times Weekly	17	20.4	20.6	21.4	21.3	20.1
Twice Weekly	9	9.3	7.6	5.4	5	7.3
Less than Twice a Week	9.8	8.6	7.1	6.5	4.1	7.2
Other	11	6.7	5.3	3.7	4.5	6.2
Not Stated	0.9	1.2	0.3	0.6	0.9	0.8
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Given the problems of securing a continuous supply, many households in Trinidad and Tobago have invested in on-site storage. The 2005 report showed that on average 83 percent of all households used water tank storage facilities: 72.6 percent of the poorest invested in such storage facilities, compared to 91.3 percent of the richest quintile. It is not uncommon for households to invest in more than one source of storage. The use of barrels for water storage decreases, the higher the quintile (Table 9-20).

Table 9-20: Type of Water Storage Facility by Quintile

Type of Water Storage Facility		Household Quintiles					Total
		Poorest	II	III	IV	Richest	
Water Tank	N	524	572	594	624	656	2,969
	%	72.6	79.8	82.8	88.6	91.3	83.0
Barrel	N	290	190	136	91	62	768
	%	40.3	26.5	18.9	12.9	8.6	21.5
Other	N	99	69	71	46	38	324
	%	13.8	9.6	9.9	6.6	5.3	9.1

The water tariff structure is as presented in the Figure 9-30 below. There is no readily available data on the ability of the low-income households in Trinidad and Tobago to pay for their water supply. It should be noted, however, that poor and vulnerable households may have difficulty paying for their water supply. However, an exercise in benchmarking the performance of WASA against water utilities in other Caribbean countries show that 0.6 percent of the average expenditure for the poorest households (in the bottom quintile) was used to pay water utility bill compared to 0.1 percent in Jamaica (Table 9-21).<sup>13</sup>

<sup>13</sup> Quarterly expenditure of TTD15,904 for the bottom income quintile and TTD28,258 for the median income quintile were derived from the 2008-2009 Household Budget Survey Report prepared by the Central Statistical Office (CSO) (Volume II, Table 5.22). Reported household expenditure from the 2008-2009 survey (TTD3,338/month or TTD10,013/quarter for the bottom income quintile and TTD5,930/month or TTD17,792/quarter for the median income quintile) has been adjusted for inflation of 59 percent from 2009 to 2018 (to TTD5,301/month or TTD15,904/quarter for the bottom income quintile and to

**Table 9-21: Benchmarking WASA’s Performance Against Regional Utilities**

Key Performance Indicator	WASA T&T	NWC Jamaica	WSC The Bahamas	GBUC Grand Bahamas	BWSL Belize	Target
Metered Customers	5%			100%	100%	100%
Consumption (1/capita-day)	377	162	101	80	110	<200
Affordability (% of Average Expenditure by Households in the bottom quintile)	0.6%	0.10%				

Sources: Castalia Final Report on the Transformation Process Roadmap, Safege, 2017; Presentation TECHNICAL EXCHANGE National Water Commission, Jamaica 2019; Presentation by Mario Tavera, Project Manager, Miya Bahamas, 2019; WHO/UNICEF Joint Monitoring Program, 2017; Smart Water Analytics, Master Plan for Grand Bahama Utility Company, 2018; CASTALIA (2019); Belize Water Services Ltd., Annual Report (2019).

One of the principles of the National Integrated Water Resources Management Policy guarantees that: *“Potable water of such quality and quantity as to sustain life should be available to all citizens, irrespective of the citizen’s ability to pay. This minimum service is a requirement for reasons of public health and environmental condition.”*

The Regulated Industries Commission (RIC) is responsible for price setting for the water sector and does so within a regulatory framework that is governed by the Regulated Industries Commission Act No. 26, 1998 (RIC Act). The RIC has a responsibility to ensure that its determination of allowed revenues reflect the utility’s efficient costs and that there is maximum efficiency in the management of the utility’s resources, in order to ensure the lowest possible rates to customers and a sustainable utility service. It is noted by the RIC that established tariffs are likely to have a disproportionate impact on different customers’ ability to pay, thereby giving rise to the issue of affordability of the service to particular vulnerable customers. The RIC therefore considers all existing measures of the government and other agencies that affect affordability and develop strategies to manage affordability issues that arise from its price setting activities. The RIC uses affordability instruments to protect low income consumers such as the poverty threshold used to calculate the basic needs utility supply.

In addition, the Ministry of Public Utilities provides a subsidy programme – the Utilities Assistance Programme (UAP) – aimed at ensuring certain citizens have access to the basic utilities of water and electricity. For WASA customers, the subsidy applies to the following:

- A<sub>2</sub> customers, that is, persons with an external water supply, will receive a credit of TT\$140.00 per year; and
- A<sub>3</sub> or A<sub>4</sub> customers, that is, persons with an internal water supply, non-metered and metered, will receive a credit of TT\$200.00 per year.

Eligible customer applicants for this subsidy include persons receiving Senior Citizens’ Pension, Disability or Public Assistance Grant, or Trinidad and Tobago Food Card; low income pensioners over 65 years, who receive a monthly income equal to or less than of TT\$5,000, inclusive of the pension; and low income persons with a certified disability. **There is also a Water Tank Assistance Component, which** provides a one-time assistance of a water tank and fittings to community-based facilities, and eligible low income

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TTD9,419/month or TTD28,258/quarter for the median income quintile). Inflation data was obtained from the International Monetary Fund, World Economic Outlook, accessed 11 October 2018.

households with monthly income equal to or less than TT\$7,000 that are with or without an adequate supply of pipe borne water supply of 72 hours or less per week.

		Water and Sewerage Authority Tariff Book
<b>3.0 SCHEDULE OF RATES AND CHARGES</b>		
<b>3.1 <u>Water Services</u></b>		
<b>3.1.1 Domestic</b>		
A <sub>1</sub> Standpipe	- \$33.75 per quarter	
A <sub>2</sub> Externally Serviced	- \$67.50 per quarter	
A <sub>3</sub> Internally Serviced (Unmetered)		
<u>ATV (\$)</u>	<u>CHARGE</u>	
0 - 500	95% of ATV Minimum \$108/quarter	
501 - 1000	81% of ATV Minimum \$118/quarter	
1001 - 2000	54% of ATV Minimum \$203/quarter	
Over 2000	47% of ATV Minimum \$270/quarter Maximum \$304/quarter	
A <sub>4</sub> Internally Serviced (Metered)		
Up to 150 cubic meters	- \$1.75 per cub. meter/qtr.	
Above 150 cubic meters	- \$3.50 per cub. meter/qtr. Minimum bill - \$30/quarter	
A <sub>5</sub> Charitable Institutions and Places of Worship (Unmetered)	- Minimum Domestic Bill of \$108/quarter	
A <sub>6</sub> Charitable Institutions and Places of Worship (Metered)		
Up to 150 cub/meters	- \$1.75 per cub. meter/qtr.	
Above 150 cub/meters	- \$ 3.50 per cub. meter/qtr. Minimum Bill - \$30/quarter	

		Water and Sewerage Authority Tariff Book
<b>3.1.2 Non Domestic</b>		
<b>B. Industrial</b>		
B <sub>3</sub> - Unmetered	- \$474 per month	
B <sub>4</sub> - Metered	- \$3.50 per cub. meter/mth. Minimum Bill - \$35 per mth.	
<b>C. Commercial</b>		
C <sub>3</sub> - Unmetered	- \$474 per month	
C <sub>4</sub> - Metered	- \$3.50 per cub. meter/mth. Minimum Bill - \$35 per mth.	
<b>D. Cottage</b>		
D <sub>3</sub> - Umetered	- \$300 per month	
D <sub>4</sub> - Metered – Up to 150 cub.m. Above 150 cub.m.	- \$2.50 per cub. meter/mth. - \$3.50 per cub. meter/mth. Minimum Bill - \$25 per month	
<b>E. Agricultural</b>		
E <sub>3</sub> - Unmetered	- 15% of ATV Minimum Bill - \$105 per mth	
E <sub>4</sub> - Metered	- \$2.25 per cubic meter Minimum Bill - \$20 per mth	
<b>F. Unserviced Premises</b>	- \$50 per month	

**Figure 9-30: Water Tariff Structure Extracted from WASA's Tariff Book, 1993 Revised 2008**

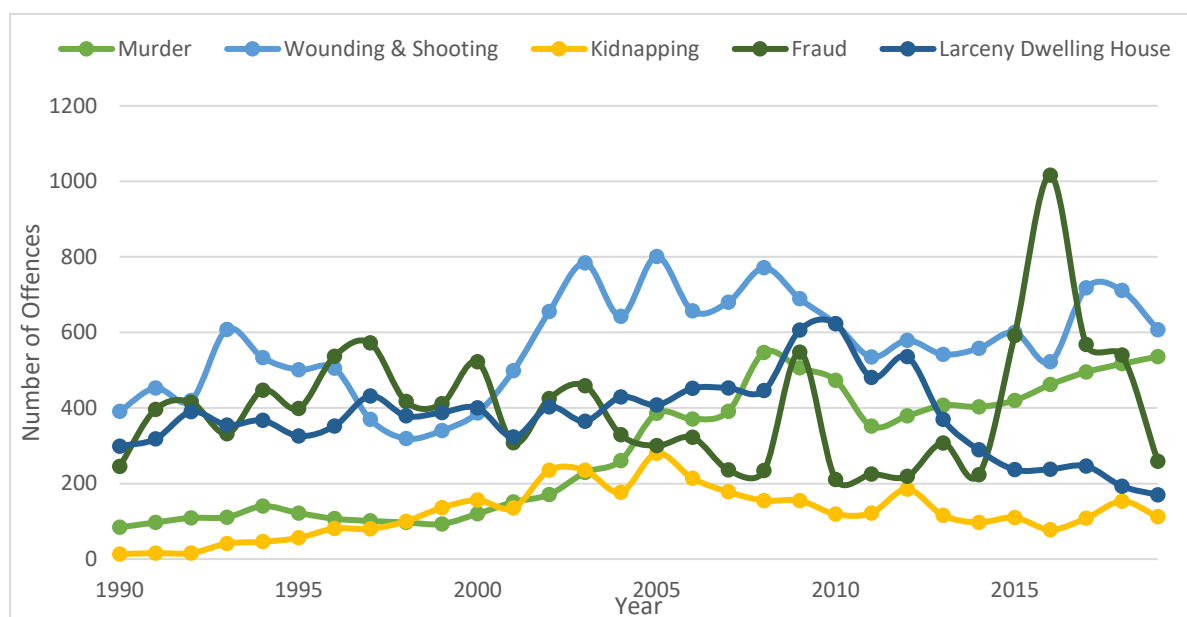


### 9.5.2.10 Crime

Crimes in Trinidad and Tobago are categorized as major crimes<sup>14</sup> and minor crimes<sup>15</sup>. Figure 9-31 and Figure 9-32 show major between 1990 and 2019 and minor crimes in Trinidad and Tobago between 1990 and 2013.

Between 1990 and 2013, there were 5,805 murders in Trinidad and Tobago, the majority of which occurred in the Port of Spain Police Division (25%), the Northern Division (19.3%), North Eastern Division (13.2%), and Western Division (11.3%). A similar trend is associated with the incidence of gangs and gang violence. The majority of reported 10,141 reported domestic violence crimes were assault and beatings (51.1%), followed by threats (28%). Of these, 72.3 per cent of all domestic violence cases, the victims were female and 27.7 per cent were male. Some 8.4 per cent of all murders were because of domestic violence.

From 1990 to 2013 there was an annual average of 553 woundings and shootings, with the average rising to 593.6 per year during the last five years of the period. During 2000 to 2013, the largest proportion of woundings and shootings occurred in the Port of Spain Division (24.4%), Northern Division (17.4%), and Southern Division (11.7%). For the period 1990 to 2013, there was an average of 1,083 malicious woundings per year, with the average decreasing to 559 per year during the last five years of the period. During the last five years of the period, the majority of malicious woundings occurred in the Southern Division (23%), followed by the Central Division (13.7%) and the Northern Division (12.7%).

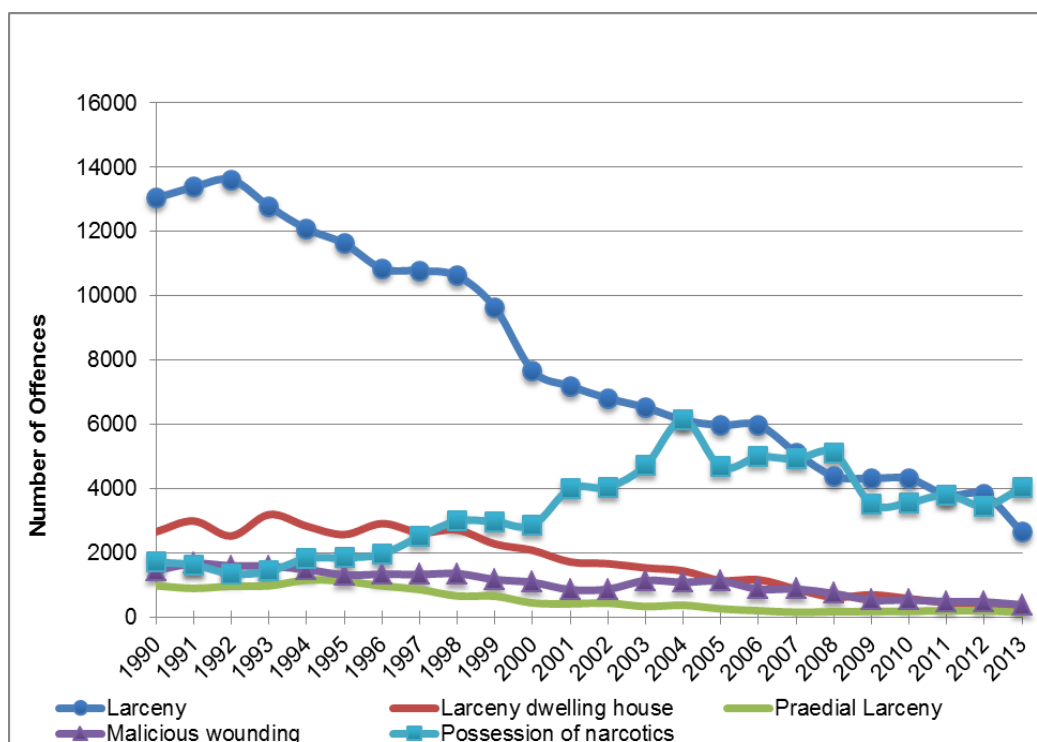


**Figure 9-31: Reported Major Crimes in Trinidad and Tobago, 1990-2019**

Source: Crime and Problem Analysis Branch of the Trinidad and Tobago Police Service

<sup>14</sup> Major crimes include murder, woundings and shootings, rape, incest, serious indecency, kidnapping, burglaries and break-ins, robbery, fraud that exceeds \$TT 2000, larceny that exceeds \$TT 2000, larceny of motor vehicles, larceny in dwelling houses when the value of the goods stolen exceeds \$TT 2000, and narcotics offences beyond a specified quantity.

<sup>15</sup> Minor crimes include indecent assault, assault on police and peace officers, possession of housebreaking implements, embezzlement, false pretence, fraud that is less than \$TT 2000, larceny that is less than \$TT 2000, larceny in dwelling houses in which the value of the goods stolen is less than \$TT 2000, praedial larceny, unlawful possession of goods (i.e., goods that one does not own), malicious wounding, possession of firearms and ammunition, possession of narcotics in which the quantity is less than a specified amount, and possession of apparatus that may be used for the consumption of illegal drugs.



**Figure 9-32: Reported Minor Crimes in Trinidad and Tobago, 1990-2013**

Source: Crime and Problem Analysis Branch of the Trinidad and Tobago Police Service

#### 9.5.2.11 Community Support Facilities and Services

##### 9.5.2.11.1 Educational Facilities

The education system in Trinidad and Tobago is organised into 4 phases: early childhood care and education, primary, secondary and higher or tertiary education. Early childhood care and education is the first phase of the education system in Trinidad and Tobago and targets children between the ages of three to four years with programmes that are developmentally appropriate and promote the holistic development of young children. There are currently 138 fully operational Government and Government Assisted early childhood care and education centres throughout Trinidad and Tobago, 63 SERVOL managed centres and 691 privately run early childhood care and education centres.

The primary and secondary educational facilities in the country are organised into 8 educational districts: Port of Spain and environs, North Eastern, St George East, Caroni, Victoria, St Patrick, South Eastern and Tobago. Primary school education is free and compulsory in Trinidad and Tobago and consists of an infant or preparatory stage followed by a standard stage. There are 552 primary schools in the country, of which 513 can be found in Trinidad. One in five primary schools in the nation is in the St George East district. Secondary schools can either be public or private. Further, public schools may be fully funded and operated by the government or run by private bodies, often religions boards, where all operating expenses, except teacher costs, are publicly funded (government assisted). There are 65 private secondary schools that serve roughly just 2 percent of the eligible population<sup>16</sup>. Of the 136 public schools, 94 are

<sup>16</sup> Beuermann, D., Jackson, C. K., & Sierra, R. (2015). *Privately Managed Public Secondary Schools and Academic Achievement in Trinidad and Tobago: Evidence from Rule-Based Student Assignments*. *Privately Managed Public Secondary Schools and Academic Achievement in Trinidad and Tobago: Evidence from Rule-Based Student Assignments*. <https://doi.org/10.18235/0000213>

government run while 42 receive assistance from the government. Port of Spain and the environs contains the most government run (16) or assisted (9) schools in the country.

Trinidad and Tobago has numerous higher-level institutions. The most prominent of these being the regional University of the West Indies and the University of Trinidad and Tobago which was established by the government in 2004. Other tertiary institutions include the College of Science, Technology and Applied Arts; and the Polytechnic Institute, which provides adult education in the evenings and shares premises with the Sixth Form Government School. There are also many private colleges offering franchised North American and British degree and diploma programmes. The Ministry of Education also provides technical and vocational training through The Youth Training and Employment Partnership Programme's full time training centres, part-time centres and through its community based projects and nursing education via schools of nursing and midwifery affiliated with the major teaching hospitals in North and South Trinidad.

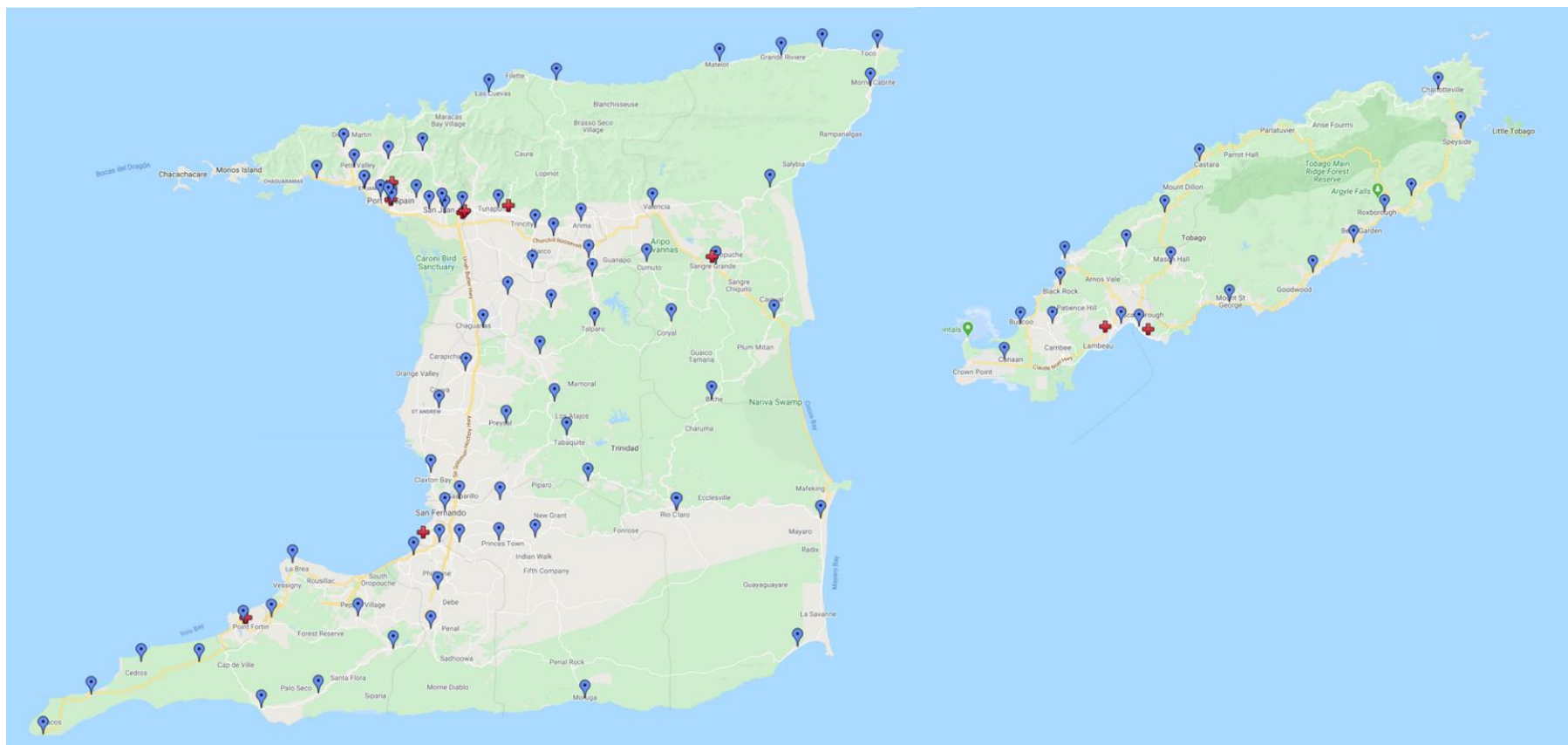
#### **9.5.2.11.2 Health Facilities**

Universal healthcare in Trinidad and Tobago is administered by a two-tier system. The primary tier is the public sector that provides basic medical services financed by the government. The secondary tier is the private sector which offers medical services that go beyond the coverage provided by the publicly financed sector to those who have adequate funds. Private doctors on the island account for 54 percent of curative primary care<sup>17</sup>. In order to improve the quality of service, the country's health services were decentralized into 5 Regional Health Authorities (RHAs). This initiative divided the health sector into autonomous bodies designed to carry out the vision of its Board of Directors and by extension the Government, for and on behalf of the citizens of Trinidad and Tobago. These bodies are the North Western Regional Health Authority (NWRHA), the North Central Regional Health Authority (NCRHA), the Eastern Regional Health Authority (ERHA), South Western Regional Health Authority (SWRHA) and the Tobago Regional Health Authority (TRHA).

There are 9 hospitals, 9 district health facilities and 97 health centres dispersed across the 5 RHAs. The SWRHA serves a population of approximately 600,000 persons, the largest catchment area amongst the RHAs, and accordingly has 2 hospitals, 3 district health facilities and 33 health centres located throughout the region. The NWRHA also provides healthcare to a significant population (roughly 500,000) through the administration and management of 3 hospitals, 1 district health facility and 25 health centres. The smaller RHAs each cater to a population between 120,00 and 350,000 with at most 2 hospitals and less than 20 health service centres each (Figure 9-33).

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<sup>17</sup> UN Volunteers. (2018, April 8). Providing primary healthcare in Trinidad and Tobago.  
<https://www.unv.org/ourstories/providing-primary-healthcare-trinidad-and-tobago>



**Figure 9-33: Health Services in Trinidad and Tobago**

The Fire Service operates 16 fires station under four main divisions strategically located throughout the country. These are the Northern Division, Southern Division, Central Division and Tobago Division (Figure 9-34).

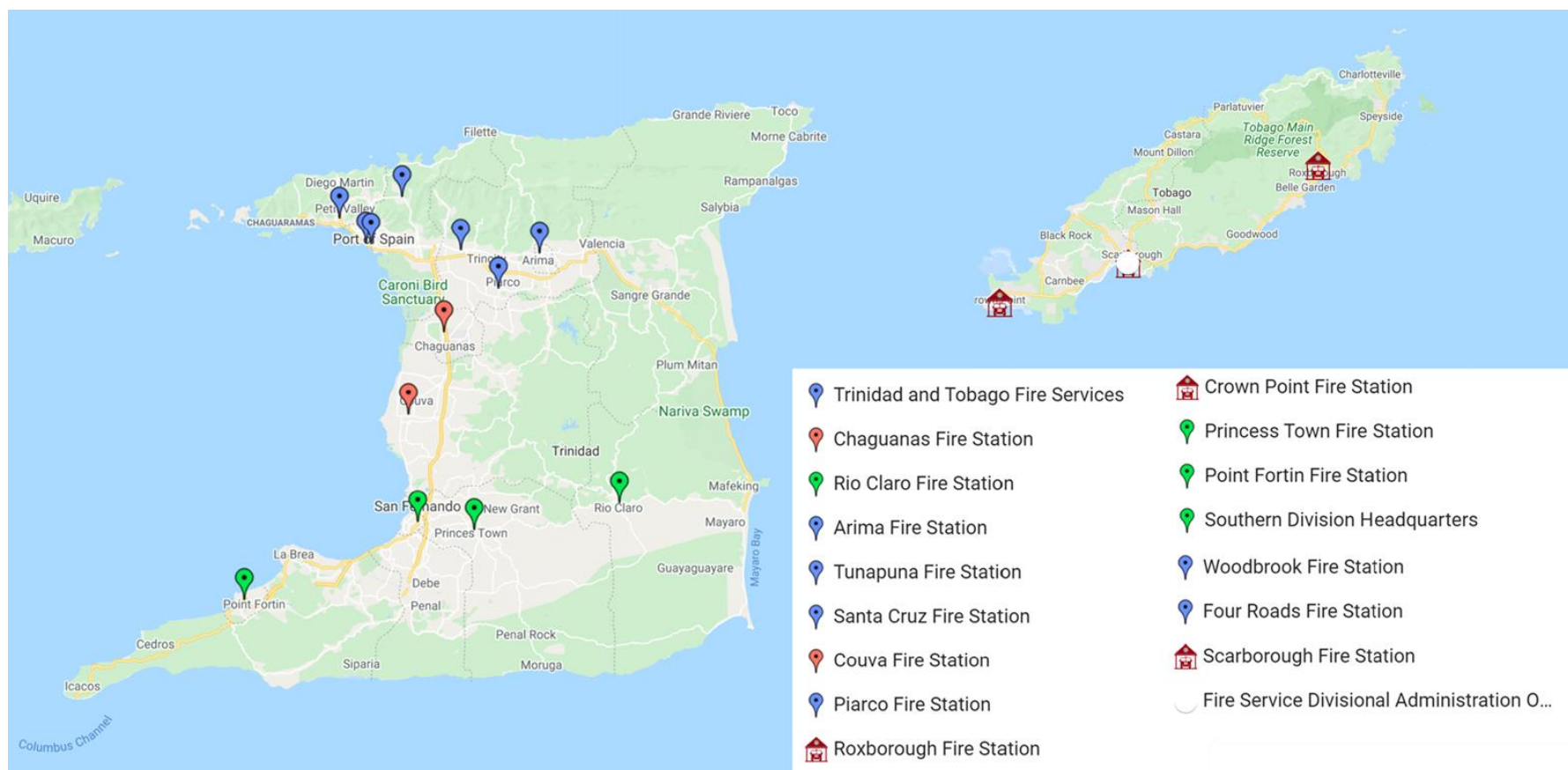


Figure 9-34: Fire Stations in Trinidad and Tobago

#### 9.5.2.11.3 Security and Safety

The Trinidad and Tobago Police Service (TTPS) is civil and para-military which functions in accordance with the Police Service Act Chapter 15:01. The TTPS is organised into 9 Divisions and 18 Branches, Squads and Units. Figure 9-35 shows the 84 police stations that are located across the North, North Eastern, Port of Spain, Eastern, Western, Central, Southern, South Western and Tobago divisions. Thirty four of the 84 police stations are located in Western, Port of Spain, Northern and North Eastern divisions and 7 in Tobago.

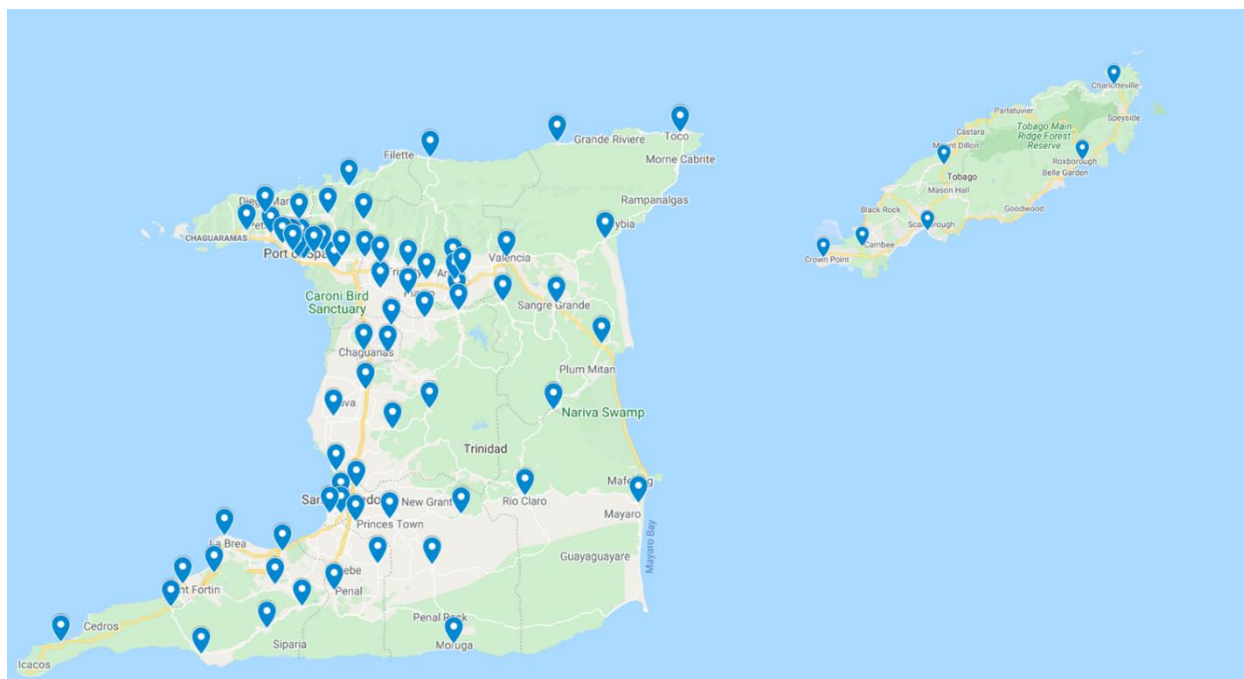


Figure 9-35: Police Stations in Trinidad and Tobago

The 2012 Human Development Atlas recognises that “Crime and Violence continues to be one of the most critical areas that need to be addressed in the context of national development. Economic growth and meaningful democracy will not be possible unless crime and violence is brought under control and all citizens can feel safe and secure.” The 2010 UNDP Citizen Security Survey revealed citizens’ concerns about their safety with between 20 and 65 percent of persons across each police divisions identifying crime as a problem in their community, particularly in the Western division (64.8%), and, with the exception of Tobago, more than 50 percent of persons across each division fearful of becoming a victim of crime.

In spite of the fact that it has been found that official crime statistics underestimate the level of victimization when compared to self-reported victimization data, official crime data are important in estimating the level of victimization, since the most serious crimes tend to be captured in such data<sup>18</sup>.

#### 9.5.2.11.4 Community Development, Recreation and Sporting Facilities

Municipal corporations manage and deliver a wide range of services that enhance communities and the lives of community residents. The corporations also provide recreational and other facilities and control

<sup>18</sup> Seepersad, Randy. 2016. "Crime and violence in Trinidad and Tobago." *Inter-American Development Bank*. Retrieved Jun 10, 2020.



the use of these amenities. The facilities provided and maintained by municipal corporations include public parks, recreation grounds and other public spaces, public retail markets, stages and platforms for community events and town halls and community centres. Corporations also coordinate trade fairs, athletic events, cultural displays, and entertainment.

There are several stadia, indoor sports areas or sports complexes; youth facilities and centres; and community swimming located throughout Trinidad and Tobago (Table 9-22).

**Table 9-22: Sporting Facilities in Trinidad and Tobago**

<b>Stadia and Sport Complexes</b>	<b>Youth Facilities and Youth Centres</b>	<b>Swimming Pools</b>
<ul style="list-style-type: none"> <li>• Eastern Regional Indoor Sport Complex</li> <li>• Hasely Crawford Stadium</li> <li>• Maloney Indoor Sport Complex</li> <li>• South West Regional Indoor Sport Complex</li> <li>• St. Paul Street Multipurpose Facility</li> <li>• Southern Regional Sport Arena</li> <li>• Mannie Ramjohn Stadium</li> <li>• Larry Gomes Stadium</li> <li>• Ato Bolden Stadium</li> <li>• Dwight York Stadium</li> <li>• Mayaro Sport Facility</li> <li>• Central Regional Indoor Sport Arena</li> </ul>	<ul style="list-style-type: none"> <li>• Laventille Youth Facility</li> <li>• El Dorado Youth &amp; Apprenticeship Centre</li> <li>• Chatham Youth &amp; Apprenticeship Centre</li> <li>• Presto Praesto Youth &amp; Apprenticeship Centre</li> <li>• Woodbrook Youth Facility</li> <li>• Malick Youth Facility</li> <li>• California Youth Centre</li> <li>• Las Bajos Youth Centre</li> </ul>	<ul style="list-style-type: none"> <li>• Couva Swimming Pool</li> <li>• Diego Martin Swimming Pool</li> <li>• La Horquetta Swimming Pool</li> <li>• Sangre Grande Swimming Pool</li> <li>• Siparia Swimming Pool</li> <li>• Cocoyea Community Swimming Pool</li> </ul>

#### **9.5.2.12 Heritage and Cultural Resources**

The National Trust of Trinidad and Tobago is responsible for formally listing any monument, fossil, place or site of natural beauty or national, historic, scientific or archaeological interest which is important to the country's national heritage. Once listed, a site is protected under the National Trust of Trinidad and Tobago Act 1991 against any unauthorised change, alteration, damage, injury, or defacement. Before a site is listed it is added to the Heritage Asset Register. Currently, there are 42 official listed sites and 455 nominated sites on the Heritage Asset Register nationally (Figure 9-36).

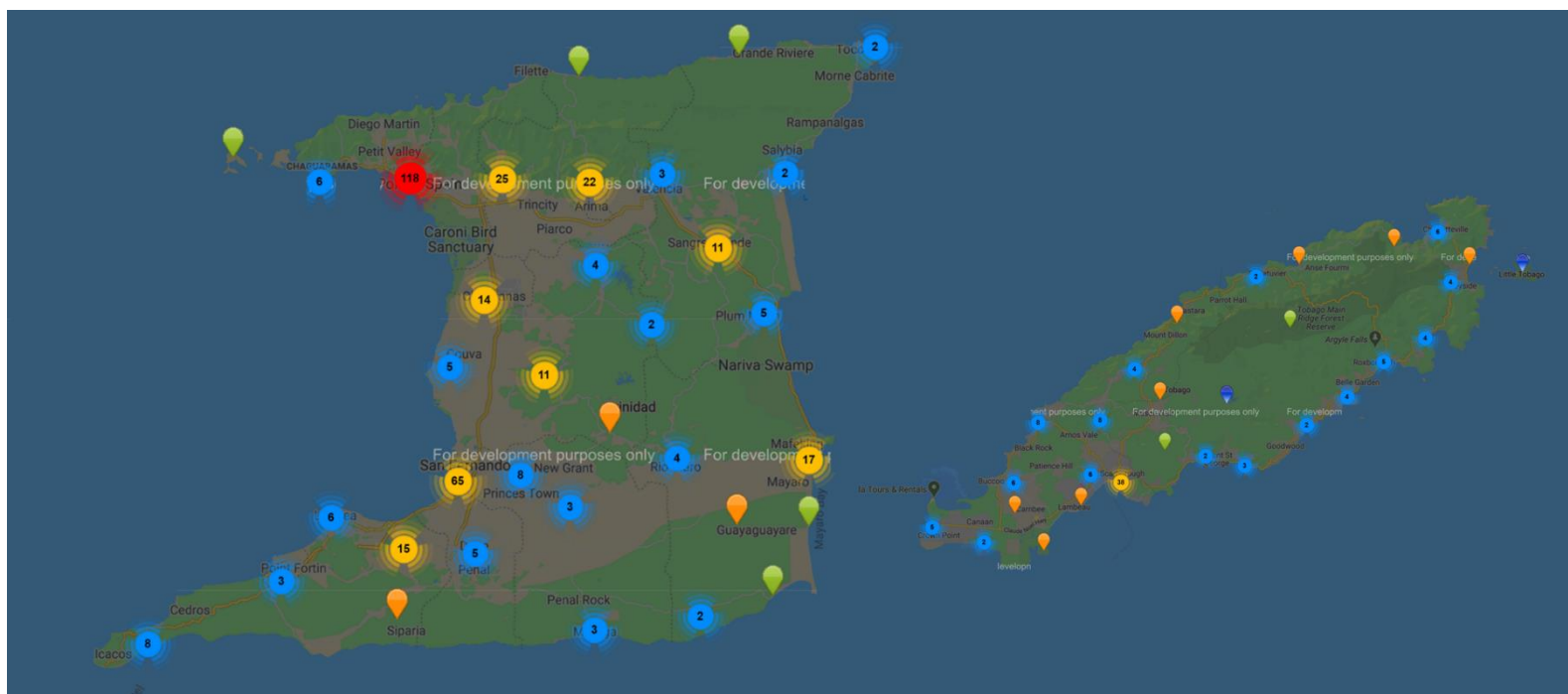


Figure 9-36: Listed Heritage Sites and Heritage Assets in Trinidad and Tobago

## 10 IMPACT ANALYSIS AND MITIGATION MEASURES

This section presents an assessment of the potential environmental and social impacts using a framework approach for the overall CCLIP for the TT Water Supply Improvement Program. The analysis considers the likely physical, ecological and socio-economic impacts associated with the various phases and type of activities.

### 10.3 Construction Phase

The Construction Phase of the project considers the likely impacts during construction activities under the overall CCLIP program. Further details are included in the Programmatic Environmental and Social Guidelines which is in Section III of this document.

The main activities anticipated under CCLIP are outlined below.

- **Component 1. Water Stabilization and Improvement: (US\$44 Million).** This component will finance the development of a comprehensive program to urgently stabilize water supply services to prevent further service decline throughout the country and to ensure access to water, sanitation and hygiene to unserved and underserved households. The activities to be financed include: (i) Construction of new water treatment infrastructure in six locations at Ravine Sable, Sangre Grande, Santa Cruz-Green Meadows, Goldsborough River, Blue Basin and Mayaro, inclusive of intakes; (ii) Refurbishment & upgrading water treatment infrastructure for nine WTPs at Freeport, Caroni, North Oropouche, Guanapo, Maraval, Navet, Hillsborough, Chatam and Courland; (iii) Drilling and equipping of three new wells at Freeport; (iv) Rehabilitation of El Socorro high lift and booster station (v) Drilling and equipping new wells at Penal, Chatam/Palo Seco, and Tucker Valley.
- **Component 2. Support for Water Sector Transformation Plan: (US\$2.74 Million).** The Bank's AquaRating International Standard will be used to characterize the performance of WASA and establish a baseline for the restructuring efforts. The results of the assessment will inform the effort to restructure and transform WASA, including addressing issues such as (i) gender equality, diversity and inclusion at the company level; (ii) Resilience to Climate Change, Natural Disasters and Risk management and promulgation throughout WASA; and (iii) Improvement of the Ministry of Public Utilities' (MPU) technical oversight capacity for coordination of water sector transformation and stabilization. In addition, institutional strengthening could be considered to separate the functions of water resources management from WASA and to implement Integrated Water Resources Management (IWRM) supported by a HydroBID based information system.
- **Component 3. Network Optimization: (US\$31 Million).** This component will finance priority works to optimize network performance and reduce non-revenue water. These works will be executed through a Co-Management Performance Based Contract with a specialized consulting firm (CF) which would involve WASA and the CF working together as a single Project Team to deliver the targeted results. This would allow for the seamless transfer of know-how and expertise

to WASA that is crucial to the long-term sustainability and success of the program. The CF will be required to prepare and implement a Non-Revenue Water Reduction Strategy and Program for the country. The water audit under TT-T1108 will provide production and transmission flows and pressure data as well as hydraulic models to inform the NRW program. Reduction of commercial and physical losses as part of the NRW Reduction program will be implemented. The CF will also provide strategic advice and technical support to the Executive Team of WASA in the transformation of WASA. Under this component, flow and pressure monitoring and water loss reduction will be achieved through (i) the replacement of aged and fragile transmission and distribution network to reduce water loss and high leakages in Petit Valley, La Cuesta, Freeport, Wallerfield and Pt. Fortin; Mt. Lambert, North West; Nelson Street, POS; Laventille; Valsayn South; Freeport Todd and La Cuesta (ii) Installation of two hundred and fifty-six (256) bulk meters and loggers to monitor via telemetry systems production and flows for various facilities (water treatment plants, wells and booster stations) throughout T&T, (iii) selective implementation of DMAs/PMAAs, targeted leak detection and repair, smart water infrastructure tools (SWIT), and management information systems; (iv) Implementation of remote monitoring and control SCADA automation for real-time analysis of the most critical areas around T&T; and (v) training and capacity building of WASA personnel in water loss management and SWIT.

- **Project management and other costs:(US\$2.26 Million).** This component will finance administrative expenses including, support for project execution (PEU) dedicated staff, audits, monitoring and evaluation, communication, and supervision and implementation of an Environmental and Social Management Plan (ESMP).

Table 10-1: Impacts, Proposed Mitigation Measures, Management Plans and Responsible Party for the Construction Phase

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
PHYSICAL ENVIRONMENT									
<p><b>Soil erosion</b></p> <p>Soil stripping and the clearing of trees and vegetation during construction preparation and excavation creates unprotected soils that are prone to erosion when disturbed.</p> <p>Compaction of topsoil from construction activities can increase rates of runoff.</p>	Low	Soil erosion can lead to loss of topsoil, blocked drains from sedimentation and water pollution	Negative	Reversible	Minor	Medium	<ul style="list-style-type: none"><li>• Only clear topsoil from areas to be used.</li><li>• Place berms around stockpiles of topsoil and aggregate (sand, gravel, etc.)</li><li>• Avoid steep cuts and where there are steep cuts, they must be shored.</li><li>• Utilise sediment traps to minimise sediment runoff.</li><li>• Replant trees in affected areas of the project site or other areas.</li><li>• Construction vehicles must be restricted to designated paths and must not be allowed to drive all over the cleared site.</li><li>• Compacted soils should be routinely ripped during construction until they are revegetated</li></ul>	Environmental Health and Safety Management Plan  Contractor Management Plan	Implementing Agency  Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							after construction is complete. <ul style="list-style-type: none"> <li>Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T &amp; T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and The National Environmental Policy; the Waterworks and Water Conservation Act (2016)</li> </ul>		
<b>Soil contamination</b>  Leaks and spills of fuel from vehicles and machinery, misuse and spillage of hazardous substances such as paint and chlorine and improper	Low	Soil contamination can result in poor soil quality and could potentially contaminate shallow groundwater in construction areas and adjacent surface water sources	Negative	Reversible	Minor	Medium Term	General <ul style="list-style-type: none"> <li>Environmental conditions must be included in any construction contract, thereby making contractors accountable for preventing accidental spillages.</li> </ul>	Environmental Health and Safety Management Plan  Contractor Management Plan	Implementing Agency  Contractor



RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
management of waste can pollute soil during construction activities.							<ul style="list-style-type: none"><li>• Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules and action by the Environmental Authority.</li></ul> <p>Fuel Spills and Leaks</p> <ul style="list-style-type: none"><li>• Conduct preventive maintenance for vehicles and machinery to ensure integrity and reliability and reduce/avoid leaks.</li><li>• Conduct any on site repairs on impervious surfaces.</li></ul> <p>Chemicals and Hazardous Substances</p> <ul style="list-style-type: none"><li>• Ensure proper handling, use and storage of all chemical and hazardous waste according to best practices.<ul style="list-style-type: none"><li>○ Provide spill containment and clean-up</li></ul></li></ul>		

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							<div>equipment on site.</div> <div>○ Personnel handling chemicals and hazardous substances must be trained in the use of spill prevention measures.</div> <div>○ Personnel handling chemicals and hazardous substances must be provided with, and trained in the correct use of the appropriate Personal Protective Equipment (PPE).</div> <div>○ Utilise the proper dispensing equipment</div> <div>○ Storage areas must be well marked with appropriate signage.</div>		

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							<ul style="list-style-type: none"><li>○ All hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110 % of the total volume of materials stored at any given time.</li><li>○ Store fuel, chemicals, and hazardous substances with secondary (spill) containment infrastructure. Use spill prevention measures such as drip trays during refuelling, bunds around storage tanks, etc. to capture spills and contain any leaks</li><li>○ Clean up any spills (including</li></ul>		

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							<p>existing spills) immediately, through containment and removal of product and appropriate rehabilitation or disposal of contaminated soils</p> <ul style="list-style-type: none"><li>○ All hazardous waste must be disposed of at a registered hazardous waste disposal facility or stored in designated, lined and bunded areas.</li><li>○ Any spilling incidents must be reported as soon as possible.</li></ul>		
<b>Land pollution</b>  Inert and hazardous solid waste generated from	Medium	Land pollution can lead to soil contamination and water pollution. Additionally, land	Negative	Reversible	Minor	Short to Medium term	<ul style="list-style-type: none"><li>• Contain garbage and construction debris onsite until disposal at</li></ul>	Environmental Health and Safety Management Plan	Contractor  Implementing Agency

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
construction activities and the poor housekeeping practices of construction staff is inappropriately disposed and/ or accumulates on construction site.		pollution can negatively impact the visual aesthetics at and near the construction site.					<p>the approved municipal disposal site.</p> <ul style="list-style-type: none"> <li>Prohibit burning of solid waste on project sites.</li> <li>Create green areas and/or plant trees around the perimeter of the site to act as a visual screen if possible.</li> <li>Implement waste management sub-plan during construction phase.</li> <li>Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Authority</li> </ul>	Contractor Management Plan	
<p><b>Water pollution</b></p> <p>Surface water contamination due to polluted or sediment laden runoff entering surrounding watercourses or groundwater</p>	Low/Medium	Water pollution can cause the deterioration of the quality of local water resources.	Negative	Reversible	Moderate	Short Term	<p>General</p> <ul style="list-style-type: none"> <li>Environmental conditions must be included in any construction contracts, thereby making contractors accountable</li> </ul>	<p>Environmental Health and Safety Management Plan</p> <p>Grievance Mechanism</p>	<p>Implementing Agency</p> <p>Contractor</p>

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
contamination (particularly of unconfined aquifers) from polluted surface runoff, fuel or chemical leaks, inappropriate disposal of solid waste and sewage, and drilling and operating wells which can occur during all construction phases							<p>for preventing accidental spillages</p> <ul style="list-style-type: none"> <li>Effective implementation, monitoring and enforcement of the Water Conservation Act, effective implementation, monitoring and enforcement of the Public Health Ordinance, enforcement of the National Pollution Rules</li> <li>Proper storage and management of excavated sand at RSSP that has been stockpiled awaiting sale. Construct berms around stockpiling area and ensure proper siting of stockpile away from riverbank to prevent sedimentation of downstream.</li> </ul> <p>Fuel Spills and Leaks</p> <ul style="list-style-type: none"> <li>Conduct preventive maintenance for vehicles</li> </ul>	<p>Consultation Plan</p> <p>Contractor Management Plan</p>	



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							<p>and machinery to ensure integrity and reliability and reduce/avoid leaks</p> <ul style="list-style-type: none"><li>• Conduct any on site repairs on impervious surfaces.</li><li>• Where possible vehicles and equipment should be located more than 50 meters away from surface waters. If this is not possible, safety measures should be implemented in order to prevent water pollution especially within the construction site.</li></ul> <p>Chemicals and Hazardous Substances</p> <ul style="list-style-type: none"><li>• Ensure proper handling, use and storage of all chemical and hazardous waste according to best practices:<ul style="list-style-type: none"><li>○ Provide spill containment and clean-up</li></ul></li></ul>		

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							<div>equipment on site.</div> <div>○ Personnel handling chemicals and hazardous substances must be trained in the use of spill prevention measures.</div> <div>○ Personnel handling chemicals and hazardous substances must be provided with and trained in the correct use of the appropriate Personal Protective Equipment (PPE)</div> <div>○ Utilise the proper dispensing equipment</div> <div>○ Storage areas must be well</div>		

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							<div>marked with appropriate signage.</div> <div><div>○ All hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110 % of the total volume of materials stored at any given time.</div><div>○ Store fuel, chemicals, and hazardous substances with secondary (spill) containment infrastructure. Use spill prevention measures such as drip trays during refuelling, bunds around storage</div></div>		

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							<div>tanks, etc. to capture spills and contain any leaks</div> <div><div>○ Clean up any spills (including existing spills) immediately, through containment and removal of product and appropriate rehabilitation or disposal of contaminated soils</div><div>○ All hazardous waste must be disposed of at a registered hazardous waste disposal facility or stored in designated, lined and bunded areas</div><div>○ Any spilling incidents must</div></div>		

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							<p>be reported as soon as possible</p> <ul style="list-style-type: none"> <li>Roofing of potentially polluting sites if possible.</li> <li>All potential pollutants should be removed immediately after the completion of works.</li> </ul> <p>Sewage</p> <ul style="list-style-type: none"> <li>Implement the management of contaminated wastewater generated from construction camps</li> </ul>		
<p><b>Air pollution</b></p> <p>During component 1, construction activities, fugitive dust and emissions from increased vehicular traffic, heavy duty equipment, piling of construction material and excavation may impact local air quality.</p>	High	Air pollution can lead to negative health impacts for construction workers and local communities (i.e. respiratory conditions).	Negative	Reversible	Moderate	Short Term	<p>General</p> <ul style="list-style-type: none"> <li>Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Authority</li> <li>Record complaints and relevant responses</li> </ul> <p>Fugitive dust</p>	<p>Environmental Health and Safety Management Plan</p> <p>Grievance mechanism</p> <p>Consultation Plan</p>	Contractor Implementing Agency

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							<ul style="list-style-type: none"><li>• Cover haulage vehicles transporting aggregate, soil and cement</li><li>• Cover and/or wet onsite stockpiles of aggregate, soil etc., especially during windy and dry conditions</li><li>• Locate sources of dust away from sensitive receptors</li><li>• Ensure proper stock piling/storage and disposal of solid waste</li><li>• Wet cleared land areas regularly</li><li>• Wet dust suppression methods on unsealed roads must be implemented to prevent generation of nuisance dust.</li><li>• Provide workers with the necessary PPE e.g. dust masks, and ensure that they are worn correctly</li><li>• There must be strict speed limits on dust roads to prevent dust entrainment into the atmosphere.</li></ul>	Contractor Management Plan	



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							<ul style="list-style-type: none"> <li>Restrict the dropping of material from height during loading and unloading</li> <li>Revegetate cleared areas immediately following construction to prevent loose soil from being blown away</li> </ul> <p>Emissions</p> <ul style="list-style-type: none"> <li>Operate well maintained vehicles and equipment</li> <li>All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability.</li> <li>Construction vehicles and machinery shall not be left to idle when not in use.</li> <li>Maintain all generators, vehicles, and other equipment in good working order to minimise exhaust fumes</li> <li>Limit use of roads in populated areas</li> </ul>		
<b>Noise and vibration pollution</b>	High	Noise and vibration pollution can be a	Negative	Reversible	Moderate	Short Term	<ul style="list-style-type: none"> <li>Provide workers with the necessary PPE e.g.</li> </ul>	Environmental Health and	Contractor

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Noise and vibrations propagated from construction equipment and pre-construction, construction and maintenance activities may exceed background noise.		nuisance and have negative health impacts (i.e. hearing impairment, discomfort, etc.) on construction staff and the local population. Noise and vibration pollution can also affect fauna, especially birds, inhabiting areas adjacent to construction areas.					<ul style="list-style-type: none"> <li>hearing protection and ensure that they are worn</li> <li>Sensitize residents in the area to the types of activities that will take place ahead of the works and assign a liaison person with whom the residents can relate</li> <li>Ensure project activities are scheduled during working hours of 8:00 a.m. to 8:00 p.m.</li> <li>Maintain all equipment in proper working order to avoid excessive noise generation</li> <li>If complaints regarding noise are received from residents, consider installing partial screening around the noisiest activities and/or mufflers on noisy equipment</li> <li>Limit implementation of noisy works simultaneously and time intervals</li> </ul>	Safety Management Plan  Grievance Mechanism  Consultation Plan  Contractor Management Plan	Implementing Agency

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							<ul style="list-style-type: none"> <li>• Frequent change of personnel that are employed for noisy works</li> <li>• In case of complaints, they should be recorded, and appropriate action should be taken.</li> <li>• Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Authority</li> </ul>		
<b>Flooding</b>  Soil stripping and the clearing of trees and vegetation during construction can make flooding more likely and more severe, especially in flood prone areas.	Low	Flooding can damage houses, buildings and roads and lead to soil erosion, sedimentation, and surface water pollution. Flooding can also be the cause of landslides. Traffic could also be affected.	Negative	Irreversible	Major	Short Term	<ul style="list-style-type: none"> <li>• Only clear topsoil from areas to be used.</li> <li>• Avoid steep cuts and where there are steep cuts, they must be shored.</li> <li>• Replant trees in affected areas of the project site or other areas.</li> <li>• An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained</li> </ul>	Environmental Health and Safety Management Plan	Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<p>in the requirements of the emergency preparedness and response plan.</p> <ul style="list-style-type: none"> <li>• Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T &amp; T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011); the National Environmental Act and The National Environmental Policy;</li> <li>• Implement Construction Best Practices</li> <li>• As much as possible works should be undertaken in the dry season.</li> </ul>		
<p><b>Landslides</b></p> <p>Soil made unstable by soil stripping and the clearing of trees and vegetation during construction can increase the</p>	Low	Landslides can lead to further soil erosion, sedimentation, water pollution and can damage property, houses, buildings and roads.	Negative	Irreversible	Major	Short term	<ul style="list-style-type: none"> <li>• Only clear topsoil from areas to be used.</li> <li>• Avoid steep cuts and where there are steep cuts, they must be shored.</li> </ul>	Environmental Health and Safety Management Plan	Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
likelihood and/or severity of landslides.							<ul style="list-style-type: none"> <li>Replant trees in affected areas of the project site or other areas.</li> <li>An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency preparedness and response plan.</li> <li>Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T &amp; T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and The National Environmental Policy;</li> <li>Implement Construction Best Practices.</li> </ul>		

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							<ul style="list-style-type: none"> <li>As much as possible works should be undertaken in the dry season.</li> </ul>		
<b>ECOLOGICAL ENVIRONMENT</b>									
<b>Disruption of/ damage to ecosystems</b>  Preparation and construction activities that can impact terrestrial ecosystems, particularly activities that can result in soil disruption, soil erosion, soil and surface water contamination, and noise pollution.  Also, if water resources are unmanaged and results in a reduction in environmental water this will result in the disruption/loss of ecologically	Medium	Soil disruption, soil erosion, soil and surface water contamination and noise pollution can lead to full or partial loss of habitat, habitat fragmentation, loss of functionality, loss of biodiversity and wildlife migration	Negative	Partially irreversible	Moderate	Long Term	General <ul style="list-style-type: none"> <li>Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, the National Biodiversity Policy, action by the Environmental Authority</li> <li>Effective implementation, monitoring and enforcement of the Water Conservation Act, effective implementation, monitoring and enforcement of the Public Health Ordinance, enforcement of the National Protected Areas Policy.</li> </ul>	Environmental Health and Safety Management Plan	Implementing Agency



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sensitive systems sensitive flora and fauna in Rivers and Swamp ecosystems.							<p>Soil disruption and erosion</p> <ul style="list-style-type: none"><li>• Replant trees in the same area of the project site or other areas. Exotic vegetation managed and affected sites should be replanted or rehabilitated with indigenous grass species.</li><li>• Avoid indiscriminate habitat destruction and localise the proposed development as much as possible (including support areas and services).</li><li>• Control erosion through the utilization of silt traps, silt fencing, Gabions, etc. This is especially pertinent within areas of steeper gradients.</li></ul> <p>Soil and surface water contamination</p> <ul style="list-style-type: none"><li>• Ensure that proper handling, use and storage of all chemicals are done</li></ul>		

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							<p>according to best practices.</p> <ul style="list-style-type: none"><li>• Have spill containment and clean-up equipment on site and dispose of waste in accordance with best practices.</li><li>• Do not store fuel and chemicals near or at watercourses or waterbodies.</li><li>• Report and clean accidental spills immediately.</li><li>• Contaminated soils must be removed and disposed of at a registered disposal site.</li><li>• Properly maintain and service equipment</li><li>• Refuelling should not be done within the riparian zones.</li></ul> <p>Noise pollution</p> <ul style="list-style-type: none"><li>• Limit animal disruptive activities to short time frames</li></ul>		
SOCIO-ECONOMIC ENVIRONMENT									

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<b>Social conflict</b>  Suspicion, tension and mistrust arising from metering of homes and the use of external labour.	High	Discord and disputes between the affected communities and the implementing agency	Negative	Reversible	Major	Medium term	Establish a fair and impartial mechanism that is accessible to all for addressing Project-related complaints and issues by affected community residents in keeping with IFO guidelines.  Establish a stakeholder engagement process and channels of communication from the onset of the project to continuously inform the affected communities and the public about the project (especially the Metering Component) and project works.	Social Management Plan  Grievance Mechanism  Consultation Plan  Security Management Plan	Implementing agency  Contractor
<b>Institutional conflict</b>  Conflicts arising from inadequate communication and coordination between implementing agency and the Municipal Corporation	Moderate	Scheduling clashes and poor working relationships between implementing agency and stakeholder agencies	Negative	Reversible	Moderate	Medium to Long Term	Establish a formal system to inform, coordinate and reduce conflicts that may arise in conducting project works and planned municipal activities.	Social Management Plan	Implementing agency  Contractor
<b>Under-representation of</b>	Moderate	Temporary local employment opportunities are	Negative	Reversible	Minor	Short Term	As part of the Implementing 's agency contractual arrangements with the	Social Management Plan	Implementing Agency Contractor

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<p><b>Women in the Project Workforce</b></p> <p>Women are less likely to actively seek employment or be hired to undertake project construction works because traditionally construction is perceived as ‘men’s work.’ This is changing gradually with regard to professional jobs with more women graduating with civil engineering degrees. However, there is still low participation of women in semi-skilled and unskilled areas in the industry.</p>		<p>only beneficial for men seeking employment in the unskilled and semi-skilled categories;</p> <p>Low employment opportunities for women.</p>					<p>construction contractor, encourage the contractor to maximise local employment opportunities and to work with the local communities (and their leaders) in establishing a fair and transparent system for local worker recruitment.</p> <p>Inform the Division of Community Development, the Institute of Technology (MIC) – Multi-Sector Skills Training Programme (MuST), and the Regional Corporations of the types of job opportunities that will be available through the Project to influence the types of semi-skilled training programmes offered in the Project area during pre-construction and construction phases.</p> <p>Emphasis should be placed on training women as well as men to improve their recruitment perspectives for semi-skilled positions.</p>	<p>Grievance Mechanism</p> <p>Consultation Plan</p>	

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							Take steps to ensure that qualified women are afforded equal access to job opportunities from the Project (linked to the first mitigation measure).		
<b>Employment Generation</b>  Professional, skilled and unskilled personnel will be employed throughout the design and construction works in Components 1 and 3	High	This would lead to improved living conditions and quality of life for the residents in these communities.	Positive	Reversible	High	Short Term	Prioritize the hiring of local workers  Avoid discrimination in employment through establish social policies and guidelines to which the contractors responsible for hiring, should adhere.  Provide training opportunities and jobs for young people.	Social Management Plan	Implementing Agency  Contractor
<b>Noise pollution</b>  The construction works may result in generation of noise levels above acceptable ambient noise levels and sounds intensity due to the operation of	High	This could have negative health related impacts. Exposure influences will be linked strongly to proximity to construction works, with the greatest effects likely to occur to project	Negative	Reversible	Moderate	Short Term	Continuous monitoring will be necessary.  Schedule the hours for construction work to minimise the impact on community.  Collaborate with impacted communities and notify of	Environmental Health and Safety Management Plan  Grievance Mechanism	Implementing Agency  Contractor

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construction vehicles and equipment.		workers, and to households and sensitive receptors that are closest to the construction works. Sensitive receptors include persons who stay at home during construction hours, pregnant women, children, older adults (the elderly), and persons with pre-existing medical conditions (such as hypertension, heart conditions, mental disorders)					the scheduling of construction activities at least one month in advance of start of construction works in their area.	(These are described in the ESMP)	
<b>Poor Air Quality</b>  The construction works may result in increased dust and exhaust emissions which may impact on local air quality.	High	This could have negative health impacts. Exposure influences will be linked strongly to proximity to construction works, with the greatest effects likely to occur to project workers, and to households and sensitive	Negative	Reversible	Moderate	Short Term	Continuous monitoring will be necessary. The parameters to be monitored during construction include PM <sub>10</sub> and PM <sub>2.5</sub> , NO <sub>2</sub> , SO <sub>2</sub> , CO and O <sub>3</sub> .  Frequent wetting and other methods of dust suppression is recommended where digging is taking place.	Environmental Health and Safety Management Plan  Grievance Plan  (These are described in the ESMP)	Implementing Agency  Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
		receptors that are closest to the construction works. Sensitive receptors include persons who stay at home during construction hours, pregnant women, children, and older adults (the elderly), persons with pre-existing respiratory conditions.					Roads that are used for transportation of materials should be watered to avoid dust emissions.  Promote the use of the Grievance Mechanism		
<b>Disruption of Community Activities</b>  Disruption in normal activities within the affected communities as a result of construction works	High	Unfavourable changes in traffic patterns, congestion and delays to drivers and commuters.  Construction works may disrupt community events and the operation of local businesses by creating nuisance, traffic and restricting parking for and access to businesses.  Public notice of construction	Negative	Reversible	Moderate	Short to Medium Term	Before the start of construction works, develop and distribute an initial project information packet to business owners and community groups/association.  Alert businesses about local construction works two weeks in advance (or a stipulated time frame as agreed between local businesses and the Contractor) and of any changes in the initial scheduling.	Social Management Plan  Consultation Plan  Grievance Mechanism  Security Management Plan	Implementing Agency  Contractor



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		activities may cause visitors to stay away from affected area, resulting in down time and the loss of business revenue to owners.					Promote the use of the Grievance Mechanism		
<b>Community road safety</b>  Construction works within communities may disrupt people's walking patterns and create unsafe and risky conditions for pedestrians.	Moderate	Additional traffic generated from construction activities may increase the number of road safety incidents and accidents.  Sensitive receptors include children, persons with disabilities and the elderly.	Negative	Reversible	Moderate	Short Term	Implement the use of proper signage; construction vehicle speed limits; training of drivers; maintenance of construction vehicles, and use of traffic wardens.  Establish procedures for the transport of equipment and heavy loads, a protocol for reporting vehicle accidents and a log for traffic related incidents.  Establish a Project community road safety awareness for residents living close to the road and for workers and a monitoring mechanism to ensure effective implementation of the plan.	Environmental Health and Safety Management Plan  Social Management Plan  Grievance Mechanism  Consultation Plan	Implementing Agency  Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Occupational health and safety</b>	High	Minor and major worker injury and death may result from accidental falls, improper operation of construction hand-held tools, equipment, vehicular accidents and improper handling and storage of chemicals. Other injuries may result from workers operating equipment without proper care, inadequate training or due to a lack of personal protective equipment or from extended exposure to heat and dehydration from outdoor weather, dust, noise, and vibration.	Negative	Reversible	Moderate	Short to Medium term	<p>Comply with national laws and regulations related to the provision of the following:</p> <ul style="list-style-type: none"> <li>- Fair compensation and treatment of workers for work done</li> <li>- Equitable and ethical terms and conditions of employment for workers</li> <li>- Safe and acceptable working conditions and standards, including those securing project worker health and safety.</li> <li>- Measures to protect the health and wellbeing all project workers in keeping with national and IDB guidelines to safeguard against the spread of COVID-19.</li> <li>- Measures to ensure gender equality on the project construction sites.</li> </ul> <p>Prepare and implement a health and safety plan prior to the start of construction works which takes the following into consideration:</p>	<p>Environmental Health and Safety Management Plan</p> <p>Social Management Plan</p> <p>Grievance Mechanism</p> <p>Consultation Plan</p>	<p>Implementing Agency</p> <p>Contractor</p>

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<ul style="list-style-type: none"><li>- All the necessary measures and maintain acceptable working conditions.</li><li>- Informing the employees of the occupational risks and preventative measures that must be taken to address these risks.</li><li>- Informing workers of their legal rights and obligations and provide them with the necessary training on Project occupational health and safety.</li><li>- Ensuring all workers have the required personal protective equipment required of them to work on the Project and to regularly monitor to ensure compliance.</li><li>- Routine checking of health and safety equipment to ensure that they proper functioning.</li></ul> <p>Assigning an officer with responsibility for worker health and safety.</p>		

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Disruption of Water Supply</b>  As a result of implementation of construction works	Moderate	The disruption of public water supply to domestic, commercial and industrial customers may affect routine activities and events. Sensitive receptors will include schools, hospitals, health centres, day care facilities, elderly care facilities, etc.	Negative	Reversible	Moderate to Major	Medium Term	Notify impacted communities of the possible disruption of services starting two weeks in advance of construction works. Provision of truck-borne water supply to sensitive receptors, as needed	Social Management Plan  Grievance Mechanism  Consultation Plan	Implementing Agency and Implementing Agency Contractor
<b>Health and Safety Hazards to Affected Communities</b>	Moderate	Minor and major injury and possible death due to both accidental and natural hazards, especially in cases where structural elements or components of the project are accessible to affected community members or where failure could result in injury to the community.	Negative	Reversible	Moderate	Short Term	Use of proper signage and safeguards to protect the public in case of authorized and unauthorized entry on the site to the highest extent possible.  Inform affected community of the potential hazards at or around a construction site, and measures in place to protect against these hazards  Establish proper protocol for the reporting and handling of worksite accidents.	Environmental Health and Safety Management Plan  Grievance Mechanism  Consultation Plan	Implementing Agency Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Damage to private property</b>  As a result of the conduct of construction works	Moderate	There may be property loss and damage, asset loss and/or economic loss by private landowners, businesses, and leaseholders/ renters  Disruption to other utility infrastructure and services due to damage	Negative	Reversible	Minor	Medium term	Provide compensation for loss of assets (property – land and structures) to private landowners (persons with legal rights to land or recognisable claims under Trinidad and Tobago law, such as letters of comfort) and persons occupying property  Promote the use of the grievance mechanism plan to address project related complaints and issues  Promptly repair any damage to vital infrastructure and services in consultation with, or by the service provider.	Social Management Plan  Security Management Plan	Implementing Agency Contractor
<b>Land Acquisition</b>  During the pre-construction and construction phases to make way for the construction works associated with establishment of the RSSP Reservoir	Moderate	Displacement of families, individuals, and businesses and loss of employment in the affected communities. Highly impactful for households occupying public or private land under	Negative	Reversible	Major	Long term	Develop the site specific RSSP Land Acquisition and Compensation Plan in accordance with the Implementing Agency's Land Acquisition and Compensation Strategy	RSSP specific Land Acquisition and Compensation Plan  Consultation Plan	Implementing agency

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
		unauthorized/ disputed arrangements.						Grievance Mechanism	
<b>Resettlement</b>  During the pre-construction and construction phases to make way for the construction works associated with establishment of the RSSP Reservoir	Moderate	Relocation or involuntary resettlement of households will be absolutely necessary.  Displacement of families, individuals, and businesses and loss of employment in the affected communities. Highly impactful for households occupying public or private land under unauthorized/ disputed arrangements.	Negative	Reversible	Major	Long term	Develop the site specific RSSP Resettlement and Compensation Plan in accordance with IDB's Involuntary Resettlement Policy, the GORTT Land Acquisition Act and WASA's Land Acquisition and Compensation Strategy.	RSSP specific Resettlement and Compensation Plan  Consultation Plan  Grievance Mechanism	Implementing agency
<b>Damage to or destruction of cultural and historical heritage resources</b>  As a result of the implementation of construction works	Moderate	Loss of sites/ artifacts of cultural and historical value close to or within the boundaries of the project sites, particularly in cases of laying of new pipelines.	Negative	Irreversible	Major	Long term	Design project activities taking care to avoid recorded site locations. In cases where it is suspected that resources may be in the project area of disturbance but are not specifically located, collaborate with the National Trust/Archaeological	Environmental Health and Safety Management Plan	Implementing Agency and Implementing Agency's Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
due to the on-site works and people and vehicle traffic.		Visual modification of landscapes.					<p>Committee in identifying their exact locations.</p> <p>In the case of the unearthing of unknown sites during construction, the following sequence of activities should be followed:</p> <ul style="list-style-type: none"><li>• Suspend works in the vicinity of the discovery and allow for assessment of materials and location by the National Trust/Archaeological Committee before further construction activities can be taken.</li><li>• Notify the Trust and collaborate with them in organizing the assessment materials and location and, if proven significant, in determining a plan of action for their preservation.</li><li>• Include clauses in the contract document for contractors specifying actions and responsibilities if discoveries are made, including sensitising</li></ul>		



RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							workers about these actions and against theft of any discovered materials.		

## 10.4 Operation Phase

The following table presents the likely impacts of various phases of the overall CCLIP Program and some possible mitigation measures. Further details are included in the Programmatic Environmental and Social Guidelines which is in Section III of this document.

Table 10-2: Impacts, Proposed Mitigation Measures, Management Plans and Responsible Party for the Operational Phase

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
PHYSICAL ENVIRONMENT									
<b>Soil contamination</b>  Leaks and spills of fuel from vehicles and machinery, misuse and spillage of hazardous substances such as paint and chlorine and improper management of waste can pollute soil during maintenance activities.	Low	Soil contamination can result in poor soil quality and could potentially contaminate shallow groundwater in areas adjacent to maintenance to activities and adjacent surface waters.	Negative	Partially Reversible	Moderate	Short to Medium Term	<p>Fuel Spills and Leaks</p> <ul style="list-style-type: none"><li>• Conduct preventive maintenance for vehicles and machinery to ensure integrity and reliability and reduce/avoid leaks</li><li>• Conduct any on site repairs on impervious surfaces.</li></ul> <p>Chemicals and Hazardous Substances</p> <ul style="list-style-type: none"><li>• Ensure proper handling, use and storage of all chemical and hazardous waste according to best practices<ul style="list-style-type: none"><li>○ Provide spill containment and clean-up equipment on site</li><li>○ Personnel handling chemicals and hazardous substances must be trained in the use of spill prevention measures</li><li>○ Personnel handling chemicals and</li></ul></li></ul>	Environmental Health and Safety Management Plan  Contractor Management Plan	Water & Sewerage Authority

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<p>hazardous substances must be trained in the correct use of the appropriate Personal Protective Equipment (PPE)</p> <ul style="list-style-type: none"><li>○ Utilise the proper dispensing equipment</li><li>○ Storage areas must be well marked with appropriate signage.</li><li>○ All hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time.</li><li>○ Store fuel, chemicals, and hazardous substances with secondary (spill) containment infrastructure. Use spill prevention measures such as drip trays</li></ul>		

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<p>during refuelling, bunds around storage tanks, etc. to capture spills and contain any leaks</p> <ul style="list-style-type: none"><li>○ Clean up any spills (including existing spills) immediately, through containment and removal of product and appropriate rehabilitation or disposal of contaminated soils</li><li>○ All hazardous waste must be disposed of at a registered hazardous waste disposal facility or stored in designated, lined and bunded areas</li></ul> <ul style="list-style-type: none"><li>• Any spilling incidents must be reported as soon as possible</li></ul>		
<b>Water pollution</b>  Surface water and groundwater contamination	Low	Water pollution can cause the deterioration of the quality of local water resources.	Negative	Reversible	Moderate	Short to Medium Term	<b>Fuel Spills and Leaks</b> <ul style="list-style-type: none"><li>• Conduct preventive maintenance for vehicles and machinery to ensure integrity and reliability and reduce/avoid leaks</li></ul>	Environmental Health and Safety Management Plan	WASA

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
from fuel or chemical leaks or damage of equipment, or entry of eroded sediment into surrounding water courses during the maintenance phase.							<ul style="list-style-type: none"><li>• Conduct any on site repairs on impervious surfaces.</li><li>• Where possible vehicles and equipment should be located more than 50 meters away from surface waters. If this is not possible, the permanent control and safety measures should be implemented in order to prevent water pollution</li></ul> <p>Chemicals and Hazardous Substances</p> <ul style="list-style-type: none"><li>• Ensure proper handling, use and storage of all chemical and hazardous waste according to best practices<ul style="list-style-type: none"><li>○ Provide spill containment and clean-up equipment on site</li><li>○ Personnel handling chemicals and hazardous substances must be trained in the use of spill prevention measures</li></ul></li></ul>		

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<ul style="list-style-type: none"><li>○ Personnel handling chemicals and hazardous substances must be trained in the correct use of the appropriate Personal Protective Equipment (PPE)</li><li>○ Utilise the proper dispensing equipment</li><li>○ Storage areas must be well marked with appropriate signage.</li><li>○ All hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110 % of the total volume of materials stored at any given time.</li><li>○ Store fuel, chemicals, and hazardous substances with secondary (spill) containment infrastructure. Use spill</li></ul>		



RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<p>prevention measures such as drip trays during refuelling, bunds around storage tanks, etc. to capture spills and contain any leaks</p> <ul style="list-style-type: none"> <li>○ Clean up any spills (including existing spills) immediately, through containment and removal of product and appropriate rehabilitation or disposal of contaminated soils</li> <li>○ All hazardous waste must be disposed of at a registered hazardous waste disposal facility or stored in designated, lined and bunded areas</li> <li>○ Any spilling incidents must be reported as soon as possible</li> </ul>		
<b>Noise and vibration pollution</b>	Low/Medium	Noise and vibration pollution can be a nuisance and have	Negative	Reversible	Moderate	Short term	<ul style="list-style-type: none"> <li>• Provide workers with the necessary PPE e.g. hearing protection and ensure that they are worn</li> </ul>	<p>Environmental health and Safety Management Plan</p> <p>Grievance mechanism</p>	Water & sewerage Authority

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
Noise and vibrations propagated from maintenance and repair operations may exceed background noise.		negative health impacts (i.e. hearing impairment, discomfort, etc.) on maintenance staff and the local population. Noise and vibration pollution can also affect fauna, especially birds, inhabiting areas.					<ul style="list-style-type: none"> <li>• Sensitize residents in the area to the types of activities that will take place ahead of the maintenance works and assign a liaison person with whom the residents can relate.</li> <li>• Ensure maintenance activities are scheduled during working hours of 8:00 a.m. to 8:00 p.m.</li> <li>• Maintain all equipment in proper working order to avoid excessive noise generation</li> <li>• If complaints regarding noise are received from residents, consider installing partial screening around the noisiest activities and/or mufflers on noisy equipment</li> <li>• Limit implementation of noisy works simultaneously</li> <li>• Frequent change of personnel that are employed for noisy works</li> <li>• In case of complaints, they should be recorded, and appropriate action should be taken.</li> </ul>		
<b>Over Extraction of water resources</b>	Low	Excessive extraction of groundwater can lead to	Negative	Irreversible	Major	Long Term	Abstraction should not be greater than the sustainable yield of the aquifer	Environmental Health and Safety Management Plan	Water Resources Agency- Water & Sewerage Authority

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
Excessive pumping can reduce stream flow and mine the groundwater storage.		aquifer mining and/or saltwater intrusion and potential depletion.  Excessive extraction from surface water resources can negatively reduce volume water available for downstream users (domestic, commercial, recreational) and environmental flows necessary for the sustenance of riverine ecosystems.					Sustainable Yield Determinations for aquifers  Sustainable Yield Determinations for surface water resources. This should consider the variation of stream based on dry and wet seasons, which will guide WASA on appropriate abstraction rates for surface water resources during the dry and wet seasons.		

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Flooding</b>  Soil exposed during operation and maintenance activities can make flooding more likely and more severe, especially in flood prone areas.	Low	Flooding can damage houses, buildings and roads and lead to soil erosion, sedimentation, and surface water pollution. Traffic could also be affected.	Negative	Partially irreversible	Moderate	Short to Medium term	<ul style="list-style-type: none"> <li>An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency preparedness and response plan.</li> <li>Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T &amp; T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and The National Environmental Policy</li> <li>Conduct maintenance work during the dry season</li> </ul>	Environmental Health and Safety Management Plan  Consultation Plan  Grievance Mechanism	Implementing Agency
<b>Landslides</b>  Soil exposed during operation and maintenance activities can make landslides	Low	Landslides can lead to further soil erosion, sedimentation, water pollution and can damage property, houses,	Negative	Partially Irreversible	Moderate	Short term	<ul style="list-style-type: none"> <li>An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency preparedness and response plan.</li> <li>Proper implementation of the National Physical development</li> </ul>	Environmental Health and Safety Management Plan  Contractor Management Plan	Water Resources Agency- Water & Sewerage Authority

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
more likely and more severe.		buildings, and roads.					Plan (1984) and the National Spatial development Strategy for T & T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and the National Environmental Policy; <ul style="list-style-type: none"> <li>Conduct maintenance work during the dry season</li> </ul>		
	High	Development of the RSSP as a reservoir acts as a flood mitigation measure for the Caparo River Basin and the surrounding areas	Positive	Reversible	High	Long term	<ul style="list-style-type: none"> <li>Expansion of the RSSP as a reservoir as a key project activity, once completed will facilitate more water to be stored and the implementation of the supporting infrastructure works will significantly alleviate flooding in the Caparo River Basin.</li> </ul>	Environmental Health and Safety Management Plan	Implementing Agency
<b>Earthquakes</b>  Earthquakes can cause disruption to utilities and damage pipelines. They	Medium	Earthquakes can lead to rupture or leaking of pipelines. It may also disrupt electrical	Negative	Partially Irreversible	Moderate	Medium term	<ul style="list-style-type: none"> <li>Use of flexible pipe joints and penetrations into tanks to prevent breakage from earthquake movements.</li> <li>All works should be done to local and international building codes and standards where possible.</li> </ul>	Environmental Health and Safety Management Plan  Contractor Management Plan	Water Resources Agency- Water & Sewerage Authority

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
may also induce landslides.		utilities which may disruption water distribution networks and pumps.					<ul style="list-style-type: none"> <li>An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency.</li> </ul>		
<b>ECOLOGICAL ENVIRONMENT</b>									
<b>Alteration of habitat</b>  Soil disruption, soil erosion, soil and surface water contamination and noise pollution during maintenance activities can impact the terrestrial and marine ecosystems.	Low/medium	Soil disruption, soil erosion, soil and surface water contamination and noise pollution can lead to full or partial loss of habitat, habitat fragmentation, loss of functionality, loss of biodiversity and migration of wildlife.	Negative	Partially irreversible	Moderate	Medium to long term	General <ul style="list-style-type: none"> <li>Implementation of the National Environmental Policy, and National Biodiversity Policy</li> </ul> Soil disruption and erosion <ul style="list-style-type: none"> <li>Replant trees in the same area of the project site or other areas. Exotic vegetation managed and affected sites should be replanted or rehabilitated with indigenous grass species</li> </ul> Soil and surface water contamination <ul style="list-style-type: none"> <li>Ensure that proper handling, use and storage of all chemicals are done according to best practices</li> <li>Have spill containment and clean-up equipment on site and</li> </ul>	Environmental Health and Safety Management Plan	Implementing Agency - WASA Contractor

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
							<p>dispose of waste in accordance with best practices</p> <ul style="list-style-type: none"> <li>Do not store fuel or chemicals near or at watercourses or waterbodies</li> <li>Report and clean accidental spills immediately</li> <li>Contaminated soils must be removed and disposed of at a registered disposal site.</li> <li>Properly maintain and service equipment</li> <li>Refuelling should not be done within the riparian zones</li> </ul> <p>Noise pollution</p> <ul style="list-style-type: none"> <li>Limit animal disruptive activities to short time frames</li> </ul>		
<b>SOCIO-ECONOMIC ENVIRONMENT</b>									
Over abstraction can impact to downstream users (domestic, commercial and recreational users)	Moderate-High	Reduced availability and access to water	Negative	Reversible	Moderate-High	Medium to Long Term	Proper Monitoring location to of the stream flow to ensure that the environmental baseflow is sustained and downstream users will still have access.	Environmental Health and Safety Management Plan	Water Resources Agency- Water & Sewerage Authority



RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Minimisation of non-revenue water</b>  From implementing project holistically	High	Reduction in losses of non- revenue water  Better assessment of demand due to metering customers	Positive	Reversible	Major	Long Term	N/A	N/A	N/A
<b>Increased reliable water supply to customers</b>  From implementing project holistically	High	More reliable water for the public and TT can meet the SDG goals.	Positive	Reversible	Major	Long Term	N/A	N/A	N/A
<b>Improved institutional efficiency of WASA</b>  Due to implementation of institutional strengthening changes	High	Sustainability in managing the water resources in the north west region.  Better customer relations and customer satisfaction	Positive	Reversible	Major	Long Term	N/A	N/A	N/A

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
<b>Occupational Health and safety</b>	High	Minor and major worker injuries and possible death may result from accidental falls, improper operation of construction hand-held tools, equipment, vehicular accidents and improper handling and storage of chemicals. Other injuries may result from workers operating equipment without proper care, inadequate training or due to a lack of personal protective	Negative	Reversible	Moderate	Medium term	<p>Comply with national laws and regulations related to the provision of the following:</p> <ul style="list-style-type: none"> <li>- Fair compensation and treatment of workers for work done</li> <li>- Equitable and ethical terms and conditions of employment for workers</li> <li>- Safe and acceptable working conditions, including securing worker health and safety.</li> </ul> <p>Prepare and implement a health and safety plan prior to the start of construction works which takes the following into consideration:</p> <ul style="list-style-type: none"> <li>- All the necessary measures and maintain acceptable working conditions.</li> <li>- Informing the employees of the occupational risks and preventative measures that must be taken to address these risks.</li> <li>- Informing workers of their legal rights and obligations and provide them with the necessary training on Project occupational health and safety.</li> <li>- Ensuring all workers have the required personal protective equipment required of them to</li> </ul>	<p>Environmental Health and Safety Management Plan</p> <p>Grievance Mechanism</p>	Implementing Agency

RISKS	PROBABILITY Of IMPACT	POTENTIAL IMPACTS	DIRECTION OF IMPACT	PERMANENCE	MAGNITUDE OF IMPACT	IMPACT DURATION	PROPOSED MITIGATION MEASURES	MANAGEMENT PLANS REQUIRED	RESPONSIBLE PARTY
		<p>equipment or from extended exposure to heat and dehydration from outdoor weather, dust, noise, and vibration.</p> <p>Minor or major injury to community members during maintenance</p>					<p>work on the Project and to regularly monitor to ensure compliance.</p> <p>- Routine checking of health and safety equipment to ensure that they proper functioning.</p> <p>Assigning an officer with responsibility for worker health and safety.</p> <p>Use of proper signage and safeguards to protect the public in case of authorized and unauthorized entry on the site to the highest extent possible.</p> <p>Inform affected community of the potential hazards at or around a construction site, and measures in place to protect against these hazards</p> <p>Establish proper protocol for the reporting and handling of worksite accidents.</p>		

### 10.5 Cumulative Impacts

As indicated above, the project area has been experiencing an increase in population. It also has some of the major developments in the country. As such, the project area will continue to experience an increase in demand for water. However, with the implementation of the project, it is unlikely to have a negative impact on the water sector.

## 11 CONCLUSION

In conclusion, based on the findings of the programmatic environmental and social evaluation, it is the professional opinion of the Consultants that the overall CCLIP is likely to result in moderate negative environmental impacts. With respect to the physical and ecological impacts, these are mostly short-term and reversible and can be mitigated to minimize the residual impact. It is recommended that a project specific environmental and social impact assessment is conducted for construction of new water treatment plants/infrastructure particularly within proximity of cultural heritage site, ecologically sensitive areas

With respect to the social aspects there are both significant positive and negative impacts anticipated.

The CCLIP is expected to result in significant positive social impacts associated with the improvement in the supply of water to customers in Trinidad and Tobago. With the proper implementation of all phased activities, it is anticipated that more persons will be able to get water 24/7 as opposed to the current scheduled system. Additionally, significant improvements in the efficiency at which WASA operates and the ability of being able to properly assess demand with metering infrastructure this will result in improved long-term integrated water resources management, which in the face of climate change will result in the sustainable supply of water to the benefit of all.



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## SECTION III



## PROGRAMMATIC ENVIRONMENTAL AND SOCIAL GUIDELINES



## 12 INTRODUCTION

This Programmatic Environmental and Social Guidelines document is being developed to function as the overall management framework for the CCLIP. It specifies all procedures, mitigation measures, rules, and guidance that the Executing Agency will have to follow to ensure that future projects are properly presented to the IDB for approval.

### 12.3 Project Overview

As outlined in Section 1- Programmatic Environmental & Social Evaluation, The GoRTT has sought funding from the Inter-American Development Bank through a Conditional Credit Line for Investment Project (CCLIP). This overall CCLIP is for US\$315 million credit line to address water supply issues across the entire country and is to be implemented through 3 loan operations valued at US\$80 million. This project was considered relevant and necessary because of the following:

- Currently, potable water is not supplied to all households in Trinidad and Tobago on a 24/7 basis.
- Most of the domestic customers pay a flat fee per month or per quarter and 100% of industrial customers are metered and pay for water by volume used.
- There is a high percentage of non-revenue water (NRW) lost through leaks, metering and billing issues.
- There has not been a consistent focus on WASA's accountability for the resources allocated and WASA's management structure.
- WASA is dependent on subventions from the Government of the Republic of Trinidad and Tobago GoRTT without defined performance targets to account for its use of the resources and in the absence of these subventions.
- Water tariffs charged on domestic customers are the lowest in the Caribbean and have not been adjusted since 1993. Revenues are insufficient to meet operating costs.
- There is an inability to take advantage of abundant water resources to meet dry season demand due to WASA's lack of storage capacity.
- The aging infrastructure and bottlenecks in the network that inhibits the transmission of water from water rich areas to water scarce areas.

The total cost of Phase I is estimated at US\$315 million (TT\$2.14 billion). It is proposed that the entire cost of its implementation will be financed by an IDB loan and supported by an estimated US\$800,000 non-reimbursable Technical Cooperation (TC) to fund activities that support loan preparation, commencement of baseline studies and studies to support the execution.

The CCLIP will be implemented in various operations throughout Trinidad and Tobago. The first operation has three components which are outlined below as extracted from the Terms of Reference.

- **Component 1. Water Stabilization and Improvement: (US\$44 Million).** This component will finance the development of a comprehensive program to urgently stabilize water supply services to prevent further service decline throughout the country and to ensure access to water, sanitation and hygiene to unserved and underserved households. The activities to be financed include: (i) Construction of new water treatment infrastructure in six locations at Ravine Sable, Sangre Grande, Santa Cruz-Green Meadows, Goldsborough River, Blue Basin

and Mayaro, inclusive of intakes; (ii) Refurbishment & upgrading water treatment infrastructure for nine WTPs at Freeport, Caroni, North Oropouche, Guanapo, Maraval, Navet, Hillsborough, Chatam and Courland; (iii) Drilling and equipping of three new wells at Freeport; (iv) Rehabilitation of El Socorro high lift and booster station (v) Drilling and equipping new wells at Penal, Chatam/Palo Seco, and Tucker Valley.

- **Component 2. Support for Water Sector Transformation Plan: (US\$2.74 Million).** The Bank's AquaRating International Standard will be used to characterize the performance of WASA and establish a baseline for the restructuring efforts. The results of the assessment will inform the effort to restructure and transform WASA, including addressing issues such as (i) gender equality, diversity and inclusion at the company level; (ii) Resilience to Climate Change, Natural Disasters and Risk management and promulgation throughout WASA; and (iii) Improvement of the Ministry of Public Utilities' (MPU) technical oversight capacity for coordination of water sector transformation and stabilization. In addition, institutional strengthening could be considered to separate the functions of water resources management from WASA and to implement Integrated Water Resources Management (IWRM) supported by a HydroBID based information system.
- **Component 3. Network Optimization: (US\$31 Million).** This component will finance priority works to optimize network performance and reduce non-revenue water. These works will be executed through a Co-Management Performance Based Contract with a specialized consulting firm (CF) which would involve WASA and the CF working together as a single Project Team to deliver the targeted results. This would allow for the seamless transfer of know-how and expertise to WASA that is crucial to the long-term sustainability and success of the program. The CF will be required to prepare and implement a Non-Revenue Water Reduction Strategy and Program for the country. The water audit under TT-T1108 will provide production and transmission flows and pressure data as well as hydraulic models to inform the NRW program. Reduction of commercial and physical losses as part of the NRW Reduction program will be implemented. The CF will also provide strategic advice and technical support to the Executive Team of WASA in the transformation of WASA. Under this component, flow and pressure monitoring and water loss reduction will be achieved through (i) the replacement of aged and fragile transmission and distribution network to reduce water loss and high leakages in Petit Valley, La Cuesta, Freeport, Wallerfield and Pt. Fortin; Mt. Lambert, North West; Nelson Street, POS; Laventille; Valsayn South; Freeport Todd and La Cuesta (ii) Installation of two hundred and fifty-six (256) bulk meters and loggers to monitor via telemetry systems production and flows for various facilities (water treatment plants, wells and booster stations) throughout T&T, (iii) selective implementation of DMAs/PMAs, targeted leak detection and repair, smart water infrastructure tools (SWIT), and management information systems; (iv) Implementation of remote monitoring and control SCADA automation for real-time analysis of the most critical areas around T&T; and (v) training and capacity building of WASA personnel in water loss management and SWIT.

- **Project management and other costs:(US\$2.26 Million).** This component will finance administrative expenses including, support for project execution (PEU) dedicated staff, audits, monitoring and evaluation, communication, and supervision and implementation of an Environmental and Social Management Plan (ESMP).

The timelines for the project need to be revised and finalised.

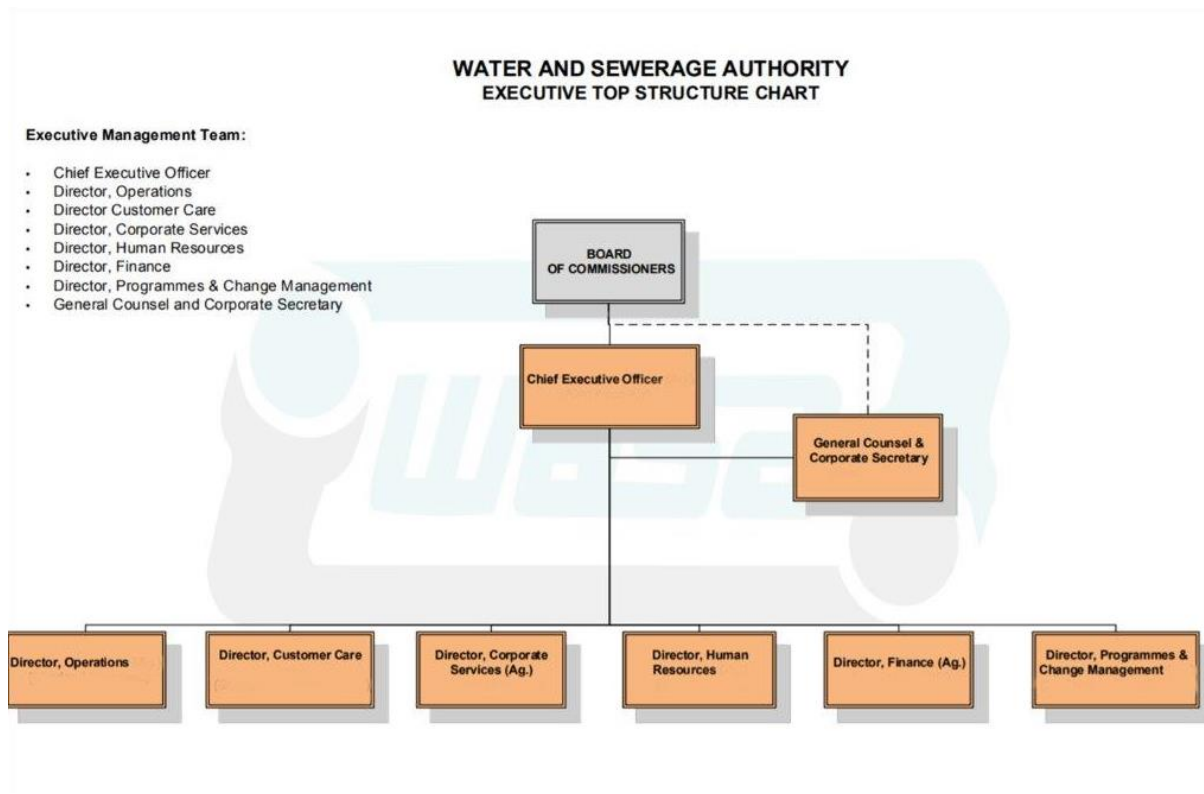
#### 12.4 Scope of the Programmatic Environmental and Social Guidelines

The **Programmatic Environmental & Social Guidelines** is a document that supports and is prepared based on the results of the Programmatic Environmental & Social Evaluation elaborated in Sections I and II. This guideline document involved the following activities:

- Defining and developing the overall management framework for the CCLIP, specifying all procedures, mitigation measures, rules, and guidance that the Executing Agency will have to follow to ensure that future projects are properly presented to the IDB for approval (including for example, minimum requirements, exclusion list, general plans, etc.)
- Evaluation of relevant aspects of previous studies of NRW in T&T, especially the ones financed by the IDB.
- Defining eligibility criteria for subsequent projects in compliance with the Bank's safeguards.
- Providing a description of the environmental and social management process of the entire Program during the execution stage (requirements, organizational structure, responsibilities, timelines, etc.), covering the entire cycle of each project (from the "eligibility" phase, covering the phases of "implementation" and "monitoring" of each).
- Preparing management frameworks that describe the main guidelines to guarantee compliance with the environmental and social requirements identified for the following projects, including, among others, Framework for Resettlement and Restoration of Livelihoods, guidelines for conducting meaningful consultations.

#### 12.5 Responsibilities and Commitments

It is the overall responsibility of the Water and Sewerage Authority (WASA) that operates under the Ministry of Public Utilities (MPU) to ensure the guidelines outlines in this document are followed. Section 3 of the Programmatic Environmental and Social Evaluation in Section I presents the wider institutional framework that governs the overall project. WASA's current organisational structure is presented in Figure 12-1 below.



**Figure 12-1: Organisational Structure for the Water and Sewerage Authority**

The MPU will have the responsibility of the transformation of WASA in terms of changes with the Board and within the enabling institutions that support sector governance. It is therefore the responsibility of MPU to ensure the institutional strengthening activities under the project are implemented. Additionally, the MPU will have oversight of execution of the entire Program and will ensure compliance with IDB and EMA's environmental requirements, and environmental policy as outlined in Section 11.3.1 below.

## 12.6 Institutional, Legal and Funding Requirements

This section outlines the relevant local and international policies, legislation and regulations to which the implementation of project activities under CCLIP are to be compliant.

### 12.6.1 WASA's Environmental Policy

The Board of Commissioners at its 560th Ordinary Meeting held on 22nd February 2001 approved the following policy statement:

The Water and Sewerage Authority is committed to the constructive use and conservation of the environment. We will provide our customers with safe, reliable and responsive utility service at reasonable rates. We will do so in an environmentally sensitive and responsible manner by adhering to the following principles:

a. Organisation Priority

To recognize environmental management as among the highest corporate priority and as a key determinant in sustainable development; to establish policies, programs and practices in conducting operation in an environmentally sound manner.

b. Integrated System

To integrate these policies, programs and practice fully into each area of activity/facility as an essential element of management in all its functions.

c. Employee Education

To educate, train and motivate employees to conduct their activities in an environmentally responsible manner.

d. Environmental Assessment

To assess the environmental impacts before implementing any new project and before decommissioning any facility or leaving/abandonment a site.

e. Precautionary Approach

To minimize any significant adverse impacts of new projects by use of new technologies and design.

f. Reduce Consumption

To minimize the consumption of natural resources.

g. Adoption by Interested Parties

To promote the adoption of these principles by our customers, consultants and suppliers as well as developers.

h. Emergency Preparedness

To develop and maintain, where significant hazards exist, emergency preparedness plans.

i. Compliance

We will comply with all applicable laws, regulations and guidelines. We will employ appropriate resources to implement proactive programs and procedures to assure compliance. Adherence to Environmental Standards will be a key ingredient in training and incentives to employees.

j. Pollution Prevention

We will prevent pollution by employing management systems and procedures specifically designed to prevent activities and/or conditions that pose a threat to human health, safety or the environment. We will minimize risk and protect our employees and the communities in which we operate. We will set and review environmental objectives and targets that will minimize the amount of toxicity and waste generated. We will also ensure the safe treatment and disposal of waste generated and promote the use of environmentally safe materials and technologies.

k. Targets

We are committed to the setting of appropriate performance targets annually in accordance with requirements of the regulatory agencies and our Corporate Objectives.

l. Continuous Improvement

We are committed to continual improvement and will continuously seek opportunities to improve our adherence to these principles; we will periodically reward progress and set new targets, and will communicate and reinforce this policy throughout the organization.

m. Review

We will undertake a comprehensive review of the policy every two years.

- In consideration of the legal mandate and the Authority's environmental policy as well as the vision and mission statements, the Authority's Environmental objectives will be:
- To development and maintain of an Environmental Management System (EMS);

- To assess of the Environmental Impacts of development and land use on water resources;
- To establish Environmental/watershed policies, strategies and plans;
- To comply with respective environmental legislations, policies and standards;
- To develop and maintain policies, strategies, procedures and plans to ensure the preservation and conservation of natural resources, eco-efficiency, reduction in energy consumption, reduction in waste, emissions and discharges;
- To predict, assess, minimize/mitigate, monitor and review the environmental impacts of the Authority's activities;
- To communication with stakeholders and regulatory agencies including WRA and EMA on operational impacts;
- To facilitate and promote institutional strengthening between other regulatory and government agencies;
- To promote environmental awareness and education;
- To continuously monitor, review and update environmental plan, procedures and policies.

#### **12.6.2 Local and International Requirements**

Section 3 of the Programmatic Environmental and Social Evaluation presents the local and international requirements that have to be adhered to as the entire project is implemented. The policies, plans, legislation, regulations and international treaties are listed below.

1. Key Policies and Plan
  - a. National Development Strategy of Trinidad and Tobago – Vision 2030
  - b. National Integrated Water Resources Management Policy 2005
  - c. National Environmental Policy, 2006
  - d. National Climate Change Policy (NCCP) 2011
  - e. Draft National Policy on Gender and Development 2009
  - f. National Protected Areas Policy, 2011
  - g. National Wildlife Policy, 2013
  - h. National Forest Policy, 2011
2. Key Legislation and Regulations
  - a. Water and Sewerage Authority Act of 1965
  - b. The Environmental Management Act, 2000
  - c. Certificate of Environmental Clearance Rules, 2001
  - d. Noise Pollution Rules 2001
  - e. Environmentally Sensitive Species Rules, 2001
  - f. Environmentally Sensitive Areas Rules, 2001
  - g. Forest Act #42 of 1915 Chapter 66:01 amended 1955, 1999
  - h. Occupational Safety and Health Act of Trinidad and Tobago, 2004
  - i. Air Pollution Rules 2014 and associated Regulations
  - j. Water Pollution Rules 2019
  - k. Land Acquisition Act
3. Key International Treaties

- a. Convention on Biological Diversity
- b. The 2030 Agenda - 17 Sustainable Development Goals (SDGs)
- c. Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat), 1998
- d. United Nations Framework Convention on Climate Change (UNFCCC) Gender Action Plan
- e. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

### 12.6.3 Funding Requirements - Relevant IDB Environmental and Social Safeguards

The IDB has several social and environmental safeguards that are applicable to all Bank-Financed Projects. They serve as a guide for the identification of potential social and environmental impacts of Bank-Financed Projects and how consultation should take place.

The principal Relevant Operational Policies are outlined in the table below. A brief description is provided along with its relationship of each policy to the project.

**Table 12-1: IDB Operational Policies**

NAME	CONTENT	RELATIONSHIP TO THE PROJECT
<b>OP-102: Access to Information Policy (April 2010)</b>	This policy sets out the principles which guide disclosure of information and the transparent use of public funds in order to enhance the Bank's accountability and development effectiveness.	The report will be required to be made available to the public and Project teams must comply with the Information Disclosure Policy.
<b>OP-703: Operational Policy on Environment and Safeguards Compliance (January 2006) and Guidelines (May 2007)</b>	This policy guides the environmental quality of the Bank's operations and its support to environmental projects in the Latin American and Caribbean region. Contained within are the policy directives related to both environmental mainstreaming and safeguards. The environmental safeguards establish procedures and standards to ensure quality and the environmental sustainability of both public and private sector operations.	<p>The Bank requires that Category A and B operations be subject to Environmental Assessments (EA). This project is a Category B project which has required the need for an Environmental and Social Assessment and an Environmental and Social Management Plan (ESMP).</p> <p>A Programmatic Environmental and Social Evaluation and a Programmatic Environmental and Social Guidelines Document is also required.</p> <p>The first operation of the CCLIP which focuses on NRW was considered a Category B project. It required the need for an</p>



NAME	CONTENT	RELATIONSHIP TO THE PROJECT
		<p>Environmental and Social Assessment and an Environmental and Social Management Plan (ESMP).</p> <p>Each activity within the CCLIP should be evaluated against this policy to confirm the need for an Environmental Assessment. It is, however, likely that the EMA will require that an EIA is conducted for the RSSP reservoir prior to implementation.</p>
<b>OP-704: Operational Policy on Natural Disaster Risk Management (February 2007) and Guidelines (March 2008)</b>	<p>The purpose of the Bank's disaster risk management policy is to guide its efforts to assist borrowers in reducing risks emanating from natural hazards and in managing disasters, in order to support the attainment of their social and economic development goals.</p> <p>The Bank will not finance projects that, according to its analysis, would increase the threat of loss of human life, significant human injuries, severe economic disruption or significant property damage related to natural hazards.</p>	<p>This project is required to consider the necessary measures to reduce disaster risk to acceptable levels as determined by the Bank on the basis of generally accepted standards and practices.</p> <p>A Strategic Disaster Risk Assessment is being prepared as part of this project and is included in the Programmatic Environmental and Social Evaluation.</p>
<b>OP-708: Public Utilities Policy (November 2013)</b>	<p>This Policy's objective is to guide the Bank's actions to promote universal access to and increase the efficiency and quality of public utilities service delivery under conditions that are affordable and environmentally and socially sustainable, so they contribute to the process of socially inclusive economic development.</p> <p>This Policy covers the following public utilities: water and sanitation, electricity, natural gas, solid waste, and telecommunications services.</p>	<p>This project is a public utilities project (water and sanitation) and aligns with the general Policy Principles of access, good governance, efficiency, innovation and environmental sustainability</p>
<b>OP-710: Operational Policy on Involuntary Resettlement (July 1998) and Guidelines (November 1999)</b>	<p>The objective of the policy is to minimize the disruption of the livelihood of people living in a project's area of influence, by avoiding or minimizing the need for physical displacement, ensuring that when people must be displaced they are</p>	<p>This project is unlikely to require involuntary resettlement. However, as such a Resettlement Plan will be developed if necessary.</p>

NAME	CONTENT	RELATIONSHIP TO THE PROJECT
	treated equitably and, where feasible, can share in the benefits of the project that requires their resettlement.	A grievance mechanism/ management plan will also be prepared and included in the ESMP.
<b>OP-761: Operational Policy on Gender Equality in Development (November 2010) and Guidelines (September 2013)</b>	This policy seeks to ensure that gender issues are addressed in the design of projects supporting infrastructure, economic opportunities and competitiveness, and institutional capacity of the State; and that gender elements are included in the execution and evaluation of projects	This project actively promotes gender equality and the empowerment of women and introduces safeguards to prevent or mitigate adverse impacts on women or men. A Stakeholder Engagement Plan will also be prepared. The ESMP will also consider any of these issues.
<b>OP-765: Operational Policy on Indigenous Peoples (July 2006) and Guidelines (October 2006)</b>	This policy directs the Bank to use its best efforts prevent or minimize exclusion and adverse impacts that Bank operations might generate with respect to indigenous peoples and their rights.	This project is not expected to impact any Indigenous groups in Trinidad.

## 12.7 Evaluation of Relevant Aspects of Previous Studies of ESA conducted for the National Water Sector Transformation Program

Table 12-2 below elaborates on the previous studies that have been done that relate to addressing non-revenue water in Trinidad and Tobago.

**Table 12-2: Evaluation of Relevant Aspects of Previous Studies for the TT National Water Sector Transformation Program**

Previous Study	Objective	Relevance to TT National Water Sector Transformation Program
Review of Existing Water Demand Management Initiatives  Water and Sewerage Authority	This report describes the initiatives presently undertaken by the Water and Sewerage Authority, and its customers on Demand Management of potable water, and Water Use Efficiency.	Identifying the initiative helps to identify gaps that need to be addressed. For instance, this report noted that WASA does not have a strategic or dedicated Water Demand Management program other than Leakage Management and Repair, and Water Loss Control through monitoring of small District Metered Areas throughout the country. As such, the CCLIP intervention can seek to include project activities that directly address gaps in Trinidad and Tobago's water supply and management.
Review of Water Demand & Consumption  Water and Sewerage Authority	This report presents the present demand and consumption of potable water in Trinidad and Tobago.	Assessing current demand and consumption provides valuable information on the current shortfall in supply to customers. The report showed that as of June 2007, WASA provides potable water to 342,971 customers, comprised of Domestic, Commercial, Industrial, Cottage and Agricultural customers. Despite a total average daily production of 1,000,397 m <sup>3</sup> /day by all surface and ground water and desalination sources, only 17.1% of customers in Trinidad, and 41.1% of customers in Tobago receive a water supply 24 hours a day, 7 days a week. The remaining customers receive a scheduled supply.  This significant shortfall identified is being used to inform project activities under CCLIP.
Updated Definition of an Action Plan for Water Supply Improvement Programme	The "Updated Definition of an Action Plan" focuses on four deliverables: a. Promoting and delivering the Minister of Public Utilities initiative on NRW reduction	This "Updated Definition of an Action Plan for Water Supply Improvement Programme" paves the way for the implementation of the CCLIP.

Previous Study	Objective	Relevance to TT National Water Sector Transformation Program
(National Public Water Supply Strategy)  (February 2019)	<p>b. Supporting the MPU and WASA in the planning, design and implementation of universal metering, and non-revenue water reduction</p> <p>c. Supporting the IFC Workshop “No Regret” approach to procurement of new sources</p> <p>d. Working within WASA, to understand the causes of the institutional and corporate issues that cause poor water supply, and make proposals for improvement.</p>	<p>The update of the Action reflects the recent developments in the sector, and to takes into account any other relevant information that become available since December 2017 and, in so doing, ensure that “Definition of an Action Plan” remains current, providing a National Public Water Supply Strategy.</p> <p>It is very important that the Water Sector Action plan directly aligns with the activities of the CCLIP which was the purpose of this report.</p>

### 13 KEY ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION

The Environmental and Social Evaluation of the CCLIP has identified several potential direct negative impacts, which are mostly short-term and reversible and can be mitigated (see also Section I, Chapter 6). Once mitigated, the potentially negative physical and ecological impacts highlighted above are significantly minimised.

Table 13-1 below summarises the identified impacts in terms of their magnitude, nature of the impact, spatial extent of the project impacts, duration, direction and permanence of the impact. The mitigation measures have been elaborated in Section 6 above of the Programmatic Environmental and Social Evaluation.

**Table 13-1: Summary Impacts of CCLIP - TT Water Supply Improvement Program**

RISK	MAGNITUDE OF IMPACT	NATURE OF POTENTIAL IMPACT	SPATIAL EXTENT	DURATION	DIRECTION OF IMPACT	PERMANENCE	RESIDUAL IMPACTS POST MITIGATION
<b>Soil erosion</b>	Minor	Loss of topsoil; Sedimentation; soil disruption; negative water quality impact	Areas surrounding construction activities	Medium-long term	Negative	Irreversible	Minor
<b>Soil contamination</b>	Minor	Contamination of water resources	Areas surrounding construction activities	Medium term	Negative	Reversible	Minor
<b>Land pollution</b>	Minor	Poor aesthetics; soil contamination; contamination of water resources	Areas surrounding construction activities	Short term	Negative	Reversible	Minor
<b>Water pollution</b>	Moderate	Contamination of water resources (surface and groundwater)	Areas surrounding construction activities	Medium-long term	Negative	Reversible	Minor
<b>Increased noise</b>	Moderate	Nuisance; Hearing	Areas surrounding	Short term	Negative	Reversible	Minor

RISK	MAGNITUDE OF IMPACT	NATURE OF POTENTIAL IMPACT	SPATIAL EXTENT	DURATION	DIRECTION OF IMPACT	PERMANENCE	RESIDUAL IMPACTS POST MITIGATION
		impairment; wildlife disruption	g construction activities				
<b>Increased dust and emissions</b>	Moderate	Respiratory conditions; possible contribution to climate change	Areas surrounding construction activities	Short term	Negative	Reversible	Minor
<b>Over-extraction of water resources</b>	Moderate	Aquifer mining; saltwater intrusion; aquifer depletion  Loss of use of the resources from the aquifers if mined to depletion	Study area in particular aquifers and rivers	Medium-Long term	Negative	Reversible if mining managed but Irreversible if there is depletion	Minor
<b>Landslides</b>	Major	Soil erosion; sedimentation  Damage caused to property and roads	Localised works that may be required on slopes within the study area	Short-medium term	Negative	Irreversible	Minor
<b>Earthquakes</b>	Moderate	Damage to infrastructure, landslides  Damage caused to property and roads	Study area and entire island	Short-Long term	Negative	Reversible	Minor
<b>Flooding</b>	Major	Soil erosion; sedimentation; Surface water contamination  Damage to property and roads	Flood prone areas within study area including RSSP reservoir and Caparo River	Short-medium term	Negative	Irreversible	Minor
<b>Flood Mitigation</b>	Major	Development of the RSSP as a reservoir acts as a flood mitigation measure for the Caparo River Basin and the surrounding areas	Caparo River Basin and surrounding communities	Long term	Positive	Reversible	Major
<b>Disruption of biological communities</b>	Moderate	Full or partial habitat loss; impaired habitat functionality; loss of biodiversity	Areas surrounding construction activities	Long term	Negative	Partially irreversible	Minor

*Programmatic Environmental & Social Evaluation and Guidelines for the Trinidad and Tobago National Water Sector Transformation Program*

<b>RISK</b>	<b>MAGNITUDE OF IMPACT</b>	<b>NATURE OF POTENTIAL IMPACT</b>	<b>SPATIAL EXTENT</b>	<b>DURATION</b>	<b>DIRECTION OF IMPACT</b>	<b>PERMANENCE</b>	<b>RESIDUAL IMPACTS POST MITIGATION</b>
<b>Minimisation of non-revenue water</b>	Major	Reduction in losses of non-revenue water  Better assessment of demand due to metering customers	Study area	Long term	Positive	Reversible	Major
<b>Increased reliable water supply to customers</b>	Major	More reliable water for the public and TT can meet the SDG goals.	Study area	Long term	Positive	Reversible	Major
<b>Improved institutional efficiency of WASA</b>	Major	Sustainability in managing the water resources in the north west region.  Better customer relations and customer satisfaction	Study area	Long term	Positive	Reversible	Major
<b>Land Acquisition</b>	Major	Displacement of families, individuals, and businesses and loss of employment in the affected communities. Highly impactful for households occupying public or private land under unauthorized/ disputed arrangements.	Specific Project Locations and surrounding settlements	Long term	Negative	Reversible	Minor
<b>Resettlement</b>	Major	Relocation or involuntary resettlement of households will be absolutely necessary.  Displacement of families, individuals, and businesses and loss of employment in the affected communities. Highly impactful for households occupying public or private land	Specific Project Locations and surrounding settlements	Long term	Negative	Reversible	Minor

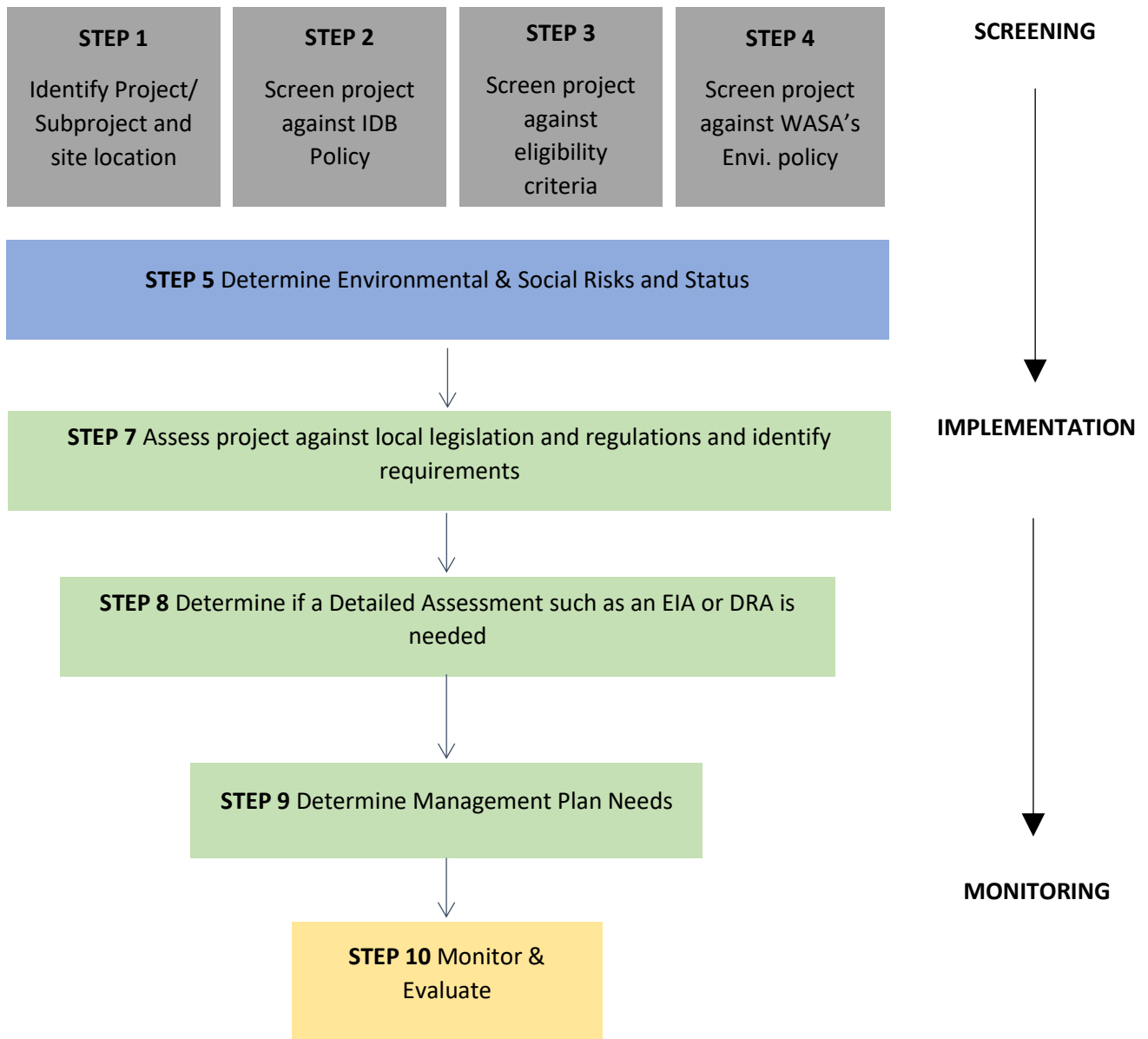
RISK	MAGNITUDE OF IMPACT	NATURE OF POTENTIAL IMPACT	SPATIAL EXTENT	DURATION	DIRECTION OF IMPACT	PERMANENCE	RESIDUAL IMPACTS POST MITIGATION
		under unauthorized/disputed arrangements.					

On the completion of the project, it is expected that there will be significant positive social impacts associated with the improvement in the supply of water to customers in Trinidad and Tobago. With the proper implementation of all three components, it is anticipated that persons will be able to get water 24/7 as opposed to the current scheduled system. Additionally, significant improvements in the efficiency at which WASA operates and the ability of being able to properly assess demand with metering infrastructure, will result in improved long-term integrated water resources management, which in the face of climate change will result in the sustainable supply of water to the benefit of all.

## 14 ENVIRONMENTAL AND SOCIAL MANAGEMENT PROCESS

This chapter describes the approach to be taken by the Implementing Agency for all stages of a project or sub-project being implemented under the CCLIP. The general approach is illustrated in Figure 14-1 below.





**Figure 14-1: Environmental and Social Management Process**

### 14.3 Project Screening

All project activities should be reviewed and screened for environmental and social risk prior to implementation. Screening will determine the need for further assessments as well as the development of the applicable set of management plans to guide the specific activity. The Environmental Management and Guidelines can be developed and applied to more than one applicable activity, but it is necessary to refine/revise necessary steps or roles and responsibilities to be fit for purpose. The screening procedure should assist this process. More critically, Phase II activities of the CCLIP have not yet been defined and as soon as these have been developed this screening procedure should be applied.

#### 14.3.1 Eligibility Criteria

Projects that are eligible for inclusion at this stage are those that are not listed on the IDB's exclusion list. The IDB does not finance projects or companies involved in the production, trade, or use of the products, substances or activities listed below:

- Those that are illegal under host country laws, regulations or ratified international conventions and agreements
- Weapons and ammunitions
- Tobacco
- Gambling, casinos and equivalent enterprises
- Wildlife or wildlife products regulated under Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Radioactive materials
- Unbounded asbestos fibres
- Forestry projects or operations that are not consistent with the Bank's Environment and Safeguards Compliance Policy
- Polychlorinated biphenyl compounds (PCBs)
- Pharmaceuticals subject to international phase outs or bans
- Pesticides/herbicides subject to international phase outs or bans
- Ozone depleting substances subject to international phase out
- Drift net fishing in the marine environment using nets in excess of 2.5 km. in length
- Trans boundary trade in waste or waste products, except for non-hazardous waste destined for recycling
- Persistent Organic Pollutants (POPs)
- Non-compliance with workers fundamental principles and rights at work

#### 14.3.2 Screening Procedure

Environmental issues should be considered prior to the start of each phase and each planned activity. Screening should be done for all sub-projects. The purpose of the screening is to assess planned projects and determine the level of risk for negative impacts (taking into consideration potential impacts, mitigation measures, project design, etc.). A series of environmental and social management framework (ESMF) checklists are made available for the Implementing Agency namely:

1. ESMF Checklist 1: Safeguard Trigger Checklist
2. ESMF Checklist 2: Permit/License Status Checklist
3. ESMF Checklist 3: Management Plan Trigger Checklist

##### 14.3.2.1 ESMF Checklist 1: Safeguard Trigger Checklist

Table 14-1 below presents a checklist to be used to screen projects/ subprojects against the IDB's Environmental and Social Safeguards Policy.

**Table 14-1: ESMF Checklist 1: Safeguard Trigger Checklist Criteria**

ESMF Checklist 1 - Safeguard Trigger Checklist Criteria		If Yes,
Will project involve land excavation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-703: Operational Policy on Environment and Safeguards</b>

<b>ESMF Checklist 1 - Safeguard Trigger Checklist Criteria</b>		<b>If Yes,</b>
Will project involve modification of habitats (mangrove forests, coral reefs, seagrass, beaches)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>Compliance (January 2006) and Guidelines (May 2007)</b> Triggered
Will project contribute to habitat degradation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project generate solid wastes, including toxic wastes?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does project generate effluents?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project contribute to sedimentation of waterbodies?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does project generate air emissions?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project result in resettlement of individuals or families?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project involve hazardous materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is project located in or near sensitive areas?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project cause underground or surface water pollution?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project impact or involve modification of mangrove or terrestrial forests?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will the sub-project potentially impact areas of known local, regional or national cultural heritage significance?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will project involve introduction of alien species?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will the project be impacted by natural or manmade hazards?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-704: Operational Policy on Natural Disaster Risk Management (February 2007) and Guidelines (March 2008)</b> Triggered
Will the project result in aggravated impacts associated with natural or manmade hazards?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the project involve the supply of, access to or governance of water and sanitation, electricity, natural gas, solid waste, and telecommunications services.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-708: Public Utilities Policy (November 2013)</b> Triggered
Will the project result in a gender biased workforce?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-761: Operational Policy on Gender Equality in Development (November 2010) and Guidelines (September 2013)</b> Triggered
Will the project result in the temporary or permanent property, loss of crops, fruit trees and household infrastructure (such as granaries, outside toilets and kitchens, etc.)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-710: Operational Policy on Involuntary Resettlement (July 1998) and Guidelines (November 1999)</b> Triggered
Does project impact or involve indigenous persons?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>OP-765: Operational Policy on Indigenous</b>

ESMF Checklist 1 - Safeguard Trigger Checklist Criteria		If Yes,
		Peoples (July 2006) and Guidelines (October 2006) Triggered
Will the project require the disclosure of information to stakeholders	[ ] Yes [ ] No	OP-102: Access to Information Policy (April 2010) Triggered

#### 14.3.2.2 ESMF Checklist 2: Permit/License Status Checklist

Many project types require environmental clearance under the Certificate of Environmental Clearance Rules, 2001. Broad categories for designated activities that require a CEC are as follows:

- a. Agriculture
- b. Heavy and Light manufacturing industries
- c. Civil works
- d. Natural resource mineral excavation and processing
- e. Waste disposal
- f. Transport operations and construction and associated infrastructure
- g. Other service-oriented industries

Municipalities will also require building and/or zoning permits for projects which change land use, emissions, or require construction. The Applicant must provide any relevant license or required permit to demonstrate that they are in compliance with the applicable Municipal regulations.

**Table 14-2: ESMF Checklist 2 - Permit/Licence Status Checklist**

ESMF Checklist 2 – Permit/Licence Status Checklist	Permit/Licence in Place	Is an EIA/ other Assessment needed	Mitigation Measures needed
Does project have valid operating permit, licenses, approvals, etc?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does project meet all Trinidad and Tobago environmental regulations regarding air, water and solid waste management?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does project have any significant outstanding environmental fees, fines or penalties or any other environmental liabilities? (e.g. lack of permit from EMA, contaminated soil, water, dead or stressed vegetation, stockpiled chemicals, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### 14.3.2.2.1 Liabilities Associated with Soil Contamination

Importantly, environmental due diligence assessments of the project site should be done to determine liabilities associated with soil contamination. Lands not yet owned by WASA that are found to be contaminated should be remediated by the landowner prior to selling it to WASA. Land owned by WASA that has been found with soil contaminated is the responsibility of WASA for remediating prior to any works.

#### 14.3.2.3 ESMF Checklist 3: Identification of Environmental and Social Risks and Status Checklist

The Implementing Agency would need to assess the project/ subproject in light of its site location to determine environmental and social risks or concerns, their impacts and likely mitigation measures. Site assessment should be conducted to gather more information about the site and situation in light of the project plans to assist in this process. Risks would relate to how the project will impact the site and how the site can impact the project as well as cumulative impacts. Positive and negative impacts should be noted. The ESMF Checklist 3 is presented in Table 14-3.

**Table 14-3: ESMF Checklist 3: Identification of Environmental and Social Risks and Status Checklist**

Project Name:			
Brief Description of Project: <i>to include nature of project, estimated size and cost, specific site area/location, whether it is expansion of construction, etc.</i>			
Will the project have impacts on the following criteria? Check all that apply.			
	Preparation Phase	Implementation Phase	Mitigation Measures needed
<b>Physical Environment</b>			
Will project involve land excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project involve modification of habitats (mangrove forests, coral reefs, seagrass, beaches)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project contribute to habitat degradation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project generate solid wastes, including toxic wastes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does project generate effluents that:			
a. Are different than currently discharged and would therefore require a new permit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Violate effluent standards of Trinidad and Tobago	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Result in an impact on water quality standards for Trinidad and Tobago	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Contaminate public drinking water resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Harm fish or aquatic ecosystems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Contaminate a natural habitat or protected area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Are difficult, expensive or hard to control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Are inconsistent with IDB's Environment and Social Safeguards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Alter downstream river basin characteristics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Contain hazardous materials (including petroleum products etc.)			

Does project generate air emissions that are:			
a. Are different than currently discharged and would therefore require a new permit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Violate Trinidad and Tobago air emission standards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Result in a long-term violation of Trinidad and Tobago air quality standards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Release pollutants that affect downwind sensitive receptors (hospitals, schools, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Harm sensitive ecosystems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Impact a natural habitat or protected area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Are difficult, expensive or hard to control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Are inconsistent with IDB's Environment and Social Safeguards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is project located in or near sensitive areas?			
a. protected areas or areas under consideration by the Government for official protection status?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. forested areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. coastlines, wetlands, or other bodies of water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. river valleys where well-preserved vegetation still exists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project involve introduction of or proliferation of alien species?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project contribute to the spread of weeds, pests or animal / plant diseases?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project contribute to sedimentation of waterbodies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project generate noise levels that:			
a. Violate Trinidad and Tobago noise standards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Impact particularly sensitive receptors (natural habitats, schools, hospitals, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Are inconsistent with IDB's Environment and Social Safeguards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project consume, store, produce or utilize hazardous materials (HazMat's can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; asbestos; radioactive material; and corrosive substances) that:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. require special permits or licences			
b. require licenced or trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. are outlawed or banned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. are difficult, expensive, or hard to manage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. are inconsistent with IDB's Environment and Social Safeguards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. have a high risk of explosion, fire, or danger to workers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

g. are vulnerable to seismic, flood, terrorist attack, or other danger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Socio-Economic Environment</b>			
Will the project impact assure non-deterioration of human health, occupational safety, and non-disturbance or persons involved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. identification of hazardous tasks and training as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. use of personal protective equipment (e.g. construction related equipment etc.) as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. first aid and emergency plans?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. supervision and enforcement of rules and regulations regarding health and safety?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. road safety, safe ingress and egress to the property for delivery and equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. accident and incident reporting, investigation and resolution?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the project require public consultation to consider local people, environmental concerns and inputs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have there been any complaints raised by local community or affected groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will the sub-project potentially impact areas of known local, regional or national cultural heritage significance? These may include:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. historical structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. archaeological sites	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. buildings or areas not officially protected but recognized by the local population as significant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project reduce other people's access to their economic resources, like fishing grounds, agriculture, water, public services or other resources that they depend on?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will the project likely impede the normal flow of traffic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will the project likely impede livelihood activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does project have the potential to increase community tension or dispute?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will project result in permanent or temporary resettlement of individuals or families?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will the project result in the temporary or permanent loss of property, crops, fruit trees and household infrastructure (such as granaries, outside toilets and kitchens, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Might the project adversely affect vulnerable people and underserved groups (e.g., elderly poor pensioners, physically challenged, women, particularly head of households or widows, etc.) living in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



### On - Site Observations

Question - Site and Situation	Observation(s)
<b>Environmental Issues</b>	
<i>Use this list as a check for indication of the existing environmental issues</i>	
a. Location of site and situation	
b. Topography (flat, hilly, swampy, etc)	
c. Any low lying of flood prone areas	
d. Identify any ecologically sensitive areas on or near site	
e. Are there existing issues with air emission from chimney or stacks (clean or dirty) (Could contribute to cumulative impacts)	
f. Odour of site (no odour or strong odour)	
g. Noise level (high or low)	
h. Current land use	
i. Storage of hazardous or polluting materials, by-products or waste (check method of disposal for environmental impact)	
j. Location of other utilities in proximity to site location	
k. Underground storage of liquids (difficult to see leakage but ask about how Management control possibility of leaks).	
l. Proximity to residential areas (close or distant).	
m. Proximity to polluting source e.g. neighbouring industry (could contribute to cumulative impacts)	
n. Proximity to water courses (indicates likelihood of contamination by accident/leakage).	
o. Road and traffic conditions	
p. Proximity to commercial activity	
q. Farming or fishing activities identified	
r. Any tourism related activity on site or situation	

#### 14.3.2.4 ESMF Checklist 4: Management Plan Trigger Checklist

Table 14-4 shows the various management plans that may be triggered by specific project activities. It is important that all project activities are screened using the checklist prior to implementation so that the relevant management plan to guide contractors and the Implementing Agency are utilised during execution.

**Table 14-4: ESMF Checklist 4: Management Plan Trigger Checklist**

ESMF Checklist 3 – Management Plan Trigger Checklist	Construction Phase	Operation Phase	Management Plan Required
Will the project result in air emissions or dust nuisance?	<input type="checkbox"/>	<input type="checkbox"/>	Environmental Health and Safety Management Plan
Will the project result in noise nuisance?	<input type="checkbox"/>	<input type="checkbox"/>	

<b>ESMF Checklist 3 – Management Plan Trigger Checklist</b>	<b>Construction Phase</b>	<b>Operation Phase</b>	<b>Management Plan Required</b>
Will the project result in negative impacts on Flora and Fauna?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project result in the general of waste including hazardous waste?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project impede the flow of normal traffic?	<input type="checkbox"/>	<input type="checkbox"/>	
Can the project impact negatively the health and safety of workers?			
Can the project impact negatively the health and safety of community members?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project result on the generation of wastewater?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project result in impacting access to communities?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project be impacted by natural or manmade hazards?	<input type="checkbox"/>	<input type="checkbox"/>	
Will the project result in aggravated impacts associated with natural or manmade hazards?	<input type="checkbox"/>	<input type="checkbox"/>	
Is the project activity likely to result in social conflict?	<input type="checkbox"/>	<input type="checkbox"/>	Social Management Plan
Will the project involve the installation of household metering?	<input type="checkbox"/>	<input type="checkbox"/>	
Does the project have the potential to result in the under-representation of women in the project workforce?	<input type="checkbox"/>	<input type="checkbox"/>	
Can the project activities result in the disruption in water supply?	<input type="checkbox"/>	<input type="checkbox"/>	
Can the project activities result in damage to property?	<input type="checkbox"/>	<input type="checkbox"/>	
Can the project activities result in institutional conflict?	<input type="checkbox"/>	<input type="checkbox"/>	
Is the project likely to impact on the safety and security of personnel and equipment?	<input type="checkbox"/>	<input type="checkbox"/>	Security Management Plan
Will the activity require the hiring of a Contractor?	<input type="checkbox"/>	<input type="checkbox"/>	Contractor Management Plan
Will the project activity likely disrupt livelihood activities?	<input type="checkbox"/>	<input type="checkbox"/>	Livelihood Protection Plan
Will the project require communication to stakeholders?	<input type="checkbox"/>	<input type="checkbox"/>	Stakeholder Engagement Plan

ESMF Checklist 3 – Management Plan Trigger Checklist	Construction Phase	Operation Phase	Management Plan Required
			(including grievance Mechanism)
Will the project require the acquisition of land or resettlement of persons?	<input type="checkbox"/>	<input type="checkbox"/>	Land Acquisition, Resettlement and Compensation Plan

## 14.4 Project Implementation and Monitoring

Following project screening, the risks and impact identified for each project are managed through employing the requisite mitigation measures. These mitigation measures are elaborated in management plans that support the specific project activity for the construction and operational phases. Implementation of project activities should be done in accordance with these management plans.

### 14.4.1 Types of Management Plans

Mitigation measures have been proposed (See Section I, Chapter 6) to address the range of risks and impacts summarized in Table 13-1 above that will require the development of detailed management plans.

The environmental and social management framework for the construction and operational phases includes the following plans to guide compliance with standards and policies discussed in Section 11.4 above. Each of these plans, when required, should be developed to include roles and responsibilities, budgetary considerations (where necessary), reporting mechanisms, detailed procedures, etc. These plans and procedures will be developed in accordance with Lender requirements as well as local regulatory agencies (EMA, etc.). Guidelines are presented in Sections 13.2.1.1 to 13.2.1.7.

#### 14.4.1.1 Environmental Health and Safety Management Plan

This EHSMP presents management activities and monitoring standards to be adhered to during construction and maintenance activities. This Plan is an overarching plan that meets IDB OP-703: Operational Policy on Environment and Safeguards Compliance (January 2006) and Guidelines (May 2007) and the OP-704: Operational Policy on Natural Disaster Risk Management (February 2007) and Guidelines (March 2008). It pays particular attention to pollution prevention, resource efficiency and environmental health and safety guidelines. It should be completed in detail to include all requirements necessary to monitor the effectiveness of the mitigative measures implemented to reduce adverse impacts from the activities carried out under both aspects of the construction phase. The monitoring plan will extend across all phases of the project. It is the responsibility of the Implementing Agency and its Contractor in respect to its scope of works. Subplans of the Environmental Health and Safety Management Plan should include management of the following aspects:

##### 14.4.1.1.1 Air quality

###### 14.4.1.1.1.1 Monitoring Standards

Ambient air quality monitoring will be in accordance with the relevant EMA standards as outlined in the extract from the Air Pollutions Rules (2014) below.

**Table 14-5: Air Quality Standards Extracted from the Air Pollution Rules, 2014**

No.	Substance	Short-term Maximum Permissible Levels		Long-term Maximum Permissible Levels	
		Maximum Permissible Levels	Averaging Time	Maximum Permissible Levels	Averaging Time
PARTICULATES					
1	Total suspended particles (TSP)	150µg/m <sup>3</sup>	24 hours		
2	Particulate Matter PM <sub>10</sub>	75µg/m <sup>3</sup>	24 hours	50µg/m <sup>3</sup>	1 year
3	Particulate Matter PM <sub>2.5</sub>	65µg/m <sup>3</sup>	24 hours	15µg/m <sup>3</sup>	1 year

#### 14.4.1.1.1.2 Monitoring Equipment and Stations

##### **Particulate Matter**

Samples for particulate matter should be collected using calibrated pumps. The pumps should be placed at the approximate respiratory height of the individual(s) for a 24-hour period. The data obtained from the analyses of the filter should be expressed as the exposure levels of particulate matter (PM<sub>10</sub>) using a Time Weighted Average (TWA). The results at the end of the sampling period will be compared to the EMA standards.

##### **Stations**

The Monitoring stations will be changed as the activities progress. The monitoring stations established will be based on the prevailing winds and most sensitive human receptors.

#### 14.4.1.1.1.3 Monitoring Frequency

Prior to the construction, a monitoring baseline will be established for both particulate matter and noise. This will involve continuous monitoring for a 24-hour period along the length of the proposed site.

During construction, monitoring will be carried out randomly twice per month during the first month or as stipulated by the EMA only along the sections that are under construction at the time. After the first month, once per month is recommended until the end of construction or maintenance activities.

#### 14.4.1.1.1.4 Management and Mitigation Measures

In addition to the monitoring procedures, the Contractor will ensure that these measures are followed:

##### **General measures**

- Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Authority
- Record complaints and relevant responses

##### **Fugitive dust control measures**

- Cover haulage vehicles transporting aggregate, soil and cement

- Cover and/or wet onsite stockpiles of aggregate, soil etc., especially during windy and dry conditions
- Locate sources of dust away from sensitive receptors
- Ensure proper stock piling/storage and disposal of solid waste
- Wet cleared land areas regularly
- Wet dust suppression methods on unsealed roads must be implemented to prevent generation of nuisance dust.
- Provide workers with the necessary PPE e.g. dust masks, and ensure that they are worn correctly
- There must be strict speed limits on dust roads to prevent dust entrainment into the atmosphere.
- Restrict the dropping of material from height during loading and unloading
- Revegetate cleared areas immediately following construction to prevent loose soil from being blown away.

#### Emissions control measures

- Operate well maintained vehicles and equipment
- All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability.
- Construction vehicles and machinery shall not be left to idle when not in use.
- Maintain all generators, vehicles, and other equipment in good working order to minimise exhaust fumes.
- Limit use of roads in populated areas.

#### 14.4.1.1.1.5 Key Performance Indicators

The following KPIs have been selected in order to evaluate the effectiveness of the air quality monitoring system.

**Table 14-6: Key performance Indicators for Air Quality Management**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Equipment maintenance log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Notices to stakeholders	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
3	Air quality parameters within EMA standards	Results certificates	Contractor. Results to be presented to the Implementing Agency
4	Log of wetting frequency	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
5	Use of personal equipment gear	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.1.6 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that all mitigation measures are carried out and that monitoring reports are prepared. The Contractor should ensure that an Environmental Health and Safety (EHS) Manager is employed to oversee the specific requirements of this plan.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.1.7 Data Analysis and Reporting

The sampled data will be compared to the EMA's standard for air quality and included in the environmental monitoring report prepared and submitted to EMA. If there are any exceedances, this will be reported immediately to the EHS Manager to allow for the implementation of corrective measures or adjustment in management strategies based on the results and where practicable to the operations.

#### 14.4.1.1.2 Noise

The EMA's Noise Standards are presented in Table 14-7. The EMA's certificate of environmental clearance permit to carry out the slated activities will stipulate the frequency with which monitoring should take place. Noise level readings, wind direction and any unusual local noise sources will be recorded. Measurements will be taken using approved and calibrated sound level meters. The frequency spectrum of the noise will be measured.

The results at the end of the sampling period will be compared with EMA standards.

#### 14.4.1.1.2.1 Monitoring Standards

Noise monitoring for construction activities will be in accordance with the relevant EMA standards approved methods for sampling as outlined in Table 14-7 below.

**Table 14-7: Noise Standards Extracted from the Air Pollution Rules, 2014**

TYPE OF ZONES WHERE THE SOUND ORIGINATES	MAXIMUM PERMISSIBLE SOUND PRESSURE LEVELS Note: All sound pressure levels shall be measured in accordance with the Second Schedule	
ZONE I— Industrial areas	Anytime	The sound pressure level shall not exceed the following: (a) equivalent continuous sound pressure level of 75 dBA; (b) instantaneous unweighted peak sound pressure level of 130 dB (peak).
ZONE II— Environmentally sensitive areas	Daytime Limits	On Mondays to Sundays of every week from 8.00 a.m. to 8.00 p.m. on each day (a) the sound pressure level when measured as the equivalent continuous sound pressure level shall not be more than 3 dBA above the background sound pressure level; and

TYPE OF ZONES WHERE THE SOUND ORIGINATES	MAXIMUM PERMISSIBLE SOUND PRESSURE LEVELS <b>Note: All sound pressure levels shall be measured in accordance with the Second Schedule</b>	
		<p>(b) the sound pressure level when measured as instantaneous unweighted peak sound pressure level shall not exceed 120 dB (peak). Notwithstanding the above, no person shall emit or cause to be emitted any sound that causes the sound pressure level when measured as the equivalent continuous sound pressure level to exceed 60 dBA.</p>
	Night-time Limits	<p>On Mondays to Sundays of every week from 8.00 p.m. to 8.00 a.m. on each day— (a) the sound pressure level when measured as the equivalent continuous sound pressure level shall not be more than 3 dBA above the background sound pressure level; and (b) the sound pressure level when measured as instantaneous unweighted peak sound pressure level shall not exceed 115 dB (peak). Notwithstanding the above, no person shall emit or cause to be emitted any sound that causes the sound pressure level when measured as the equivalent continuous sound pressure level to exceed 60 dBA.</p>
ZONE III— General Area	Daytime Limits	<p>On Mondays to Sundays of every week from 8.00 a.m. to 8.00 p.m. on each day— (a) the sound pressure level when measured as equivalent continuous sound pressure level shall not be more than 5 dBA above the background sound pressure level; and (b) the sound pressure level when measured as instantaneous unweighted peak sound pressure level shall not exceed 120 dB (peak). Notwithstanding the above, no person shall emit or cause to be emitted any sound that causes the sound pressure level when measured as the equivalent continuous sound pressure level to exceed 80 dBA.</p>
	Night-time Limits	<p>On Mondays to Sundays of every week from 8.00 p.m. to 8.00 a.m. on each day— (a) the sound pressure level when measured as equivalent continuous sound pressure level shall not be more than 5 dBA above the background sound pressure level; and (b) the sound pressure level when measured as instantaneous unweighted peak sound pressure level shall not exceed 115 dB (peak). Notwithstanding the above, no person shall emit or cause to be emitted any sound that causes the sound pressure level when measured as the equivalent continuous sound pressure level to exceed 65 dBA.</p>



#### 14.4.1.1.2.2 Monitoring Equipment and Stations

Ambient noise measurements will be conducted simultaneously, at the same stations sampled for air quality during construction. A calibrated sound level meter will be used to measure noise. The model of the equipment will be clearly stated, and the meter will be calibrated before each survey.

Monitors will be located approximately 1.5 m above the ground and no closer than 3m to any reflecting surface (e.g., wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation. In addition, before and after the survey, the instrument will be checked with a calibrator, which is factory calibrated.

#### 14.4.1.1.2.3 Monitoring Frequency

The noise level readings will be taken over a period of 2-3 minutes and the average (geometric mean) noise level recorded in decibels (dBA). These readings will be taken at the same time as the air samples during the construction period or period of maintenance activities.

#### 14.4.1.1.2.4 Management and Mitigation Measures

In addition to the monitoring procedures, The Contractor will ensure the following noise reduction options are implemented where necessary.

- Provide workers with the necessary PPE e.g. hearing protection and ensure that they are worn
- Sensitize residents in the area to the types of activities that will take place ahead of the works and assign a liaison person with whom the residents can relate
- Ensure project activities are scheduled during working hours of 8:00 a.m. to 8:00 p.m.
- Maintain all equipment in proper working order to avoid excessive noise generation
- If complaints regarding noise are received from residents, consider installing partial screening around the noisiest activities and/or mufflers on noisy equipment
- Limit implementation of noisy works simultaneously and time intervals
- Frequent change of personnel that are employed for noisy works
- In case of complaints, they should be recorded, and appropriate action should be taken.
- Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Management Authority.

#### 14.4.1.1.2.5 Key Performance Indicators

The following KPIs in Table 14-8 have been selected in order to evaluate the effectiveness of the noise monitoring system.

**Table 14-8: Key Performance Indicators for Noise Management**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Equipment maintenance log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Notices to stakeholders	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
3	Noise parameters within EMA standards	Results certificates	Contractor. Results to be presented to the Implementing Agency
4	Log of complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
5	Use of personal equipment gear	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.2.6 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that all mitigation measures are carried out and that monitoring reports are prepared. The Contractor should ensure that an EHS Manager is employed to oversee the specific requirements of this plan.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.2.7 Data Analysis and Reporting

The results from the sampling exercise will be compared to the EMA's noise pollution standards and included in the environmental monitoring report prepared and submitted to the EMA. If there are any exceedances, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### 14.4.1.1.3 Waste

The administration and oversight of solid waste management is primarily to be carried out by the Contractor or Maintenance Manager. Below are the definitions used in the management of solid waste:

##### **Solid (Non-Hazardous) Waste**

The International Finance Corporation's (IFC) General Environment, Health and Safety (EHS) Guidelines define solid (non-hazardous) waste as generally any garbage refuse including domestic trash; inert construction/demolition materials; refuse such as scrap metal; and empty containers. Solid waste that is likely to be generated in this project will primarily be inorganic waste.

##### **Hazardous Material/Waste**

The International Finance Corporation's (IFC) General Environment, Health and Safety (EHS) Guidelines define hazardous waste as substances that possess at least one of four characteristics: ignitability, corrosivity, reactivity, or toxicity – or appear on special lists.

The International Finance Corporation's (IFC) General Environment, Health and Safety (EHS) Guidelines define hazardous material as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. They can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidising substances; toxic materials; radioactive material; and corrosive substances. These may include waste oils and oil contaminated material, waste chemicals, fluorescent

light bulbs, waste electrical and electronic equipment, used lead-acid batteries, asbestos and spent catalysts.

#### 14.4.1.1.3.1 Monitoring Frequency

At most locations, waste collection is conducted on a weekly basis and so monitoring of waste should be done weekly to ensure that all measures are being implemented and followed.

#### 14.4.1.1.3.2 Management and Mitigation Measures

So as to reduce the possible negative impacts of improper waste disposal and management, the Contractor or Maintenance Manager will ensure that during construction or operations, every effort is made to adhere to the following mitigation measures:

##### General solid waste management

- Contain garbage and construction debris onsite until disposal at the approved municipal disposal site
- Prohibit burning of solid waste on project sites
- Create green areas and/or plant trees around the perimeter of the site to act as a visual screen.
- Develop and implement waste management plan during construction phase
- Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, action by the Environmental Authority.

##### Spill Prevention and Hazardous waste management

- Environmental conditions must be included in any construction contracts, thereby making contractors accountable for preventing accidental spillages
- Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules and action by the Environmental Authority
- Conduct preventive maintenance for vehicles and machinery to ensure integrity and reliability and reduce/avoid leaks
- Conduct any on site repairs on impervious surfaces.
- Ensure proper handling, use and storage of all chemical and hazardous waste according to best practices
  - Provide spill containment and cleanup equipment on site
  - Personnel handling chemicals and hazardous substances must be trained in the use of spill prevention measures
  - Personnel handling chemicals and hazardous substances must be trained in the correct use of the appropriate Personal Protective Equipment (PPE)
  - Utilise the proper dispensing equipment
  - Storage areas must be well marked with appropriate signage.
  - All hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110 % of the total volume of materials stored at any given time.
  - Store fuel, chemicals, and hazardous substances with secondary (spill) containment infrastructure. Use spill prevention measures such as drip trays during refuelling, bunds around storage tanks, etc. to capture spills and contain any leaks
  - Clean up any spills (including existing spills) immediately, through containment and removal of product and appropriate rehabilitation or disposal of contaminated soils
  - As signatory to the Basel Convention, it is important that all hazardous waste must be disposed of at a registered hazardous waste disposal facility, which is under the Trinidad

- and Tobago Solid Waste Management Company Limited (SWMCOL) or stored in designated, lined and bunded areas as approved by the Environmental Management Authority.
- Handling and disposal of hazardous waste is only conducted by trained personnel wearing the correct PPE.
- Any spilling incidents must be reported as soon as possible
- Ensure proper handling and disposal of asbestos material:
  - Asbestos material, such as can be found in old pipelines, is a deadly carcinogen that should only be handled by licensed asbestos abatement professionals.
  - When handling asbestos trained personnel must seal off the work area with plastic sheeting to prevent contamination outside. Surfaces that do not need abating must be covered in plastic sheeting.
  - Warning signs must be posted to alert others that an asbestos project is underway.
  - Wear Personal Protective Equipment such as an N-100 or P-100 respirator and protective clothing to prevent asbestos exposure.
  - Asbestos-containing materials should be wetted prior to any removal efforts. Once removed it should be double bagged in 6-millimeter plastic bags and enclosed in a plastic, leak-tight container with a lid and proper labelling. It can only be disposed of in an appropriate way at the designated landfill as advised by SWMCOL.
  - Decontamination enclosure areas must be provided to allow workers to remove contaminated clothing, shoes and tools.

#### 14.4.1.1.3.3 Key Performance Indicators

The following Key Performance Indicators (KPIs) in Table 14-9 have been selected in order to evaluate the effectiveness of the solid waste management system.

**Table 14-9: Key Performance Indicators for Waste Management**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	No construction waste deposited on the roadways or in nearby rivers or drains	Location of a temporary storage site away from roads, drains, rivers, and walkways	Contractor. Results to be presented to the Implementing Agency
2	No leakages or spills	Monitor possible spills Inspection of site by Contractor	Contractor. Results to be presented to the Implementing Agency
3	Limited sediment-laden run-off during heavy rain	Monitor nearby/downstream wells and water bodies for significant sediment deposits	Contractor. Results to be presented to the Implementing Agency
4	Approved Contractors	Inspection of licences and documentation	Contractor Results to be presented to the Implementing Agency
5	Reuse of Construction waste where possible	Less construction waste being delivered to the dump	Contractor. Results to be presented to the Implementing Agency

KPIs will be reviewed occasionally to determine areas for improvement. Specific KPIs will need to be developed for the Solid Waste Management aspect of Component 1.

#### 14.4.1.1.3.4 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that all mitigation measures are carried out and that monitoring reports are prepared. The Contractor should ensure that an EHS Manager is employed to oversee the specific requirements of this plan.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.3.5 Data Analysis and Reporting

If there are any exceedances, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### 14.4.1.1.4 Traffic

The Traffic Management Branch at the Ministry of Works and Transport requires that authorization be sought for any temporary changes in traffic. Recommendations from the Traffic Management Branch should be taken into consideration before works begin.

##### 14.4.1.1.4.1 Monitoring Standards

Recommendations received from the Traffic Management Branch upon authorisation will serve as the standards to be adhered to during activities that will impact the normal flow of traffic.

##### 14.4.1.1.4.2 Monitoring Frequency

Monitoring will be carried out by the Traffic Management Branch according to the frequency that is stipulated in their authorisation.

##### 14.4.1.1.4.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage potential traffic disruptions:

- Work should only be carried out in sections.
- “Work Ahead” / “Detour” Signs should be used ahead of potential traffic disruptions.
- No work should be allowed in peak traffic times during weekdays:
  - 6-8am
  - 5-7pm
- Advertisements should be placed in the media before the roadworks will take place
- Avoid blocking entrances to businesses.
- Cuts in the road should be filled as soon as works in the area is completed so as to avoid disruptions in movement of traffic and erosion in case of heavy rains.
- Dirt/ debris should not be stored on sidewalks or roadways.
- Wherever works are taking place pedestrian and vehicular traffic must not be completely obstructed. The use of flag men will be required.
- Before the start of construction works, develop and distribute an initial project information packet to business owners and community leaders.

- Alert businesses about local construction works two weeks in advance (or a stipulated time frame as agreed between local businesses and the Contractor) and of any changes in the initial scheduling.
- Promote the use of the Grievance Mechanism
- Implement the use of proper signage; construction vehicle speed limits; training of drivers; maintenance of construction vehicles, and use of traffic wardens.
- Establish procedures for the transport of equipment and heavy loads, a protocol for reporting vehicle accidents and a log for traffic related incidents.
- Establish a Project community road safety awareness for residents living close to the road and for workers and a monitoring mechanism to ensure effective implementation of the plan.

#### 14.4.1.1.4.4 Key Performance Indicators

The following KPIs have been selected in order to evaluate the effectiveness of the traffic management system.

**Table 14-10: Key Performance Indicators for Traffic Management**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Detour signs	Inspection of the site	Contractor.  Results to be presented to the Implementing Agency
2	Advertisements in the media	Review and inspection of documentation	Contractor.  Results to be presented to the Implementing Agency
3	Log of Complaints	Review and inspection of documentation	Contractor.  Results to be presented to the Implementing Agency
4	Flag Men	Inspection of the site	Contractor.  Results to be presented to the Implementing Agency

#### 14.4.1.1.4.5 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that all management and mitigation measures are carried out and that monitoring reports are prepared.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.4.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### **14.4.1.1.5 Worker health and safety**

##### **14.4.1.1.5.1 Monitoring Frequency**

Monitoring will be carried out by the Contractor daily to minimize possible incidents.

##### **14.4.1.1.5.2 Management and Mitigation Measures**

The Contractor will ensure that the following mitigation measures are followed during construction and operational activities:

- The contractor must have a health and safety policy that is known and understood by all workers. It must be visible to the workers on site.
- All workers must observe the relevant COVID-19 protocols which include physical distancing, wearing of masks, washing and sanitizing of hands and work spaces.
- Provide fair compensation and treatment of workers for work done
- Provide equitable and ethical terms and conditions of employment for workers
- Provide safe and acceptable working conditions, including securing worker health and safety.
- Inform the employees of the occupational risks and preventative measures that must be taken to address these risks.
- Inform workers of their legal rights and obligations and provide them with the necessary training on Project occupational health and safety.
- Ensure all workers have the required personal protective equipment required of them to work on the Project and to regularly monitor to ensure compliance.
- Perform routine checks of health and safety equipment to ensure that they proper functioning.
- Assign an officer with responsibility for worker health and safety.
- Construction areas should be clearly demarcated with safety signs and barriers to prevent possible incidents.
- Workers should be properly trained in the proper use of construction equipment.
- All workers must be trained in the proper use of all health and safety equipment.
- All workers must be trained in the proper handling and management/ disposal of all types of waste.
- The contractor EHS Manager/ Officer shall maintain a register of all EHS related incidents that have occurred as a result of the activities associated with the contract. EHS incidents that should be recorded include fires, accidents, spills of hazardous materials that contaminate soil or water resources, stop-order notices issued by any Regional Corporation or any other relevant agency, non- compliance with this ESMP.
- Each EHS related incident will be investigated by the client's EHS officer and an incident report forwarded to the contractor. An incident report will be presented within five working days;
- EHS incident reports will include as a minimum, a description of the incident, actions taken to contain any damage to the environment, personnel or the public, and the corrective actions to repair/remediate any damage;
- All construction plant and equipment, tanks and machinery shall be maintained in a good state of repair throughout the construction period
- Equipment maintenance will be carried out on an impermeable surface
- Leakage from equipment will be prevented by regular inspection and repair



- Areas under construction should be clearly demarcated.
- Emergency medical supplies must be available and easily accessible in the case of an incident.
- In the event that the onsite medical supplies are not adequate, the incident needs to be escalated to the hospital.
- In the event that a worker is exposed to hazardous material they should immediately be taken for medical attention.

#### 14.4.1.1.5.3 Key Performance Indicators

The following KPIs have been selected in order to evaluate the effectiveness of the health and safety management system.

**Table 14-11: Key Performance Indicators for Worker Health and Safety**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Health and Safety Policy	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Health and Safety Signs	Inspection of the site	Contractor. Results to be presented to the Implementing Agency
3	Training log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
4	Register of all EHS related incidents	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
5	Equipment maintenance log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
6	Emergency Kit	Inspection of site office	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.5.4 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that the health and safety management policy is clearly understood by all workers and that all mitigation measures are carried out and that monitoring reports are prepared.

It is the responsibility of the workers to ensure that they understand the health and safety requirements and that they abide by them.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.5.5 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### **14.4.1.1.6 Community health and safety**

##### **14.4.1.1.6.1 Monitoring Frequency**

Monitoring will be carried out by the Contractor daily to minimize possible incidents.

##### **14.4.1.1.6.2 Management and Mitigation Measures**

The Contractor will ensure that the following mitigation measures are followed during construction and operational activities:

- Perform routine checks of health and safety equipment to ensure that they are properly functioning to prevent accidents that can negatively impact the public.
- All persons associated with the project must observe the relevant COVID-19 protocols which include physical distancing, wearing of masks, washing and sanitizing of hands and work spaces.
- Assign an officer with responsibility for community health and safety.
- Construction areas should be clearly demarcated with safety signs and barriers to prevent possible incidents.
- The contractor EHS Manager/ Officer shall ensure that they utilize the consultation plan to inform community members of planned activities and safety protocols that must be adhered to. This should take place before the start of construction or maintenance works. The community should be informed of the grievance mechanism that is to be utilized if there are any issues or complaints.
- The contractor EHS Manager/ Officer shall maintain a register of all EHS related incidents that have occurred as a result of the activities associated with the contract. EHS incidents that should be recorded include fires, accidents, spills of hazardous materials that contaminate soil or water resources, stop-order notices issued by any Regional Corporation or any other relevant agency, non-compliance with this ESMP.
- Each EHS related incident will be investigated by the client's EHS officer and an incident report forwarded to the contractor. An incident report will be presented within five working days;
- EHS incident reports will include as a minimum, a description of the incident, actions taken to contain any damage to the environment, personnel or the public, and the corrective actions to repair/remediate any damage;
- All construction plant and equipment, tanks and machinery shall be maintained in a good state of repair throughout the construction period.
- Equipment maintenance will be carried out on an impermeable surface
- Leakage from equipment will be prevented by regular inspection and repair
- Areas under construction should be clearly demarcated and restricted access to members of the community.
- Emergency medical supplies must be available and easily accessible in the case of an incident.
- In the event that the onsite medical supplies are not adequate, the incident needs to be escalated to the hospital.
- In the event that a community member is exposed to hazardous material they should immediately be taken for medical attention.

#### 14.4.1.1.6.3 Key Performance Indicators

The following KPIs have been selected in order to evaluate the effectiveness of the health and safety management system.

**Table 14-12: Key Performance Indicators for Worker Health and Safety**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Health and Safety Policy	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Health and Safety Signs	Inspection of the site	Contractor. Results to be presented to the Implementing Agency
3	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
4	Register of all EHS related incidents	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
5	Equipment maintenance log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
6	Emergency Kit	Inspection of site office	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.6.4 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that the community is aware of planned activities and the health and safety protocols that they need to abide by for their protection and safety. It is important that all mitigation measures are carried out and that monitoring reports are prepared.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.6.5 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### 14.4.1.1.7 Water quality

##### 14.4.1.1.7.1 Monitoring Standards

The works will be monitored by the Contractor based on adherence to the EMA certificate of environmental clearance. Water Pollutions Rules (2019) as seen in the figure below are the most recent water quality standards that would need to be followed.

SCHEDULE II					
(Rule 4)					
PERMISSIBLE LEVELS					
No.	Water Pollutants	Receiving Environment			
	Parameters or Substances	Inland Surface Water	Coastal Nearshore	Marine Offshore	Environmentally Sensitive Areas and/or Groundwater
Levels or Conditions					
1.	Temperature	35	40	45	NIAA
2.	Dissolved Oxygen	>4	>4	>4	>4
3.	Hydrogen ion (pH)	6-9	6-9	6-9	6-9
4.	Five day Biological Oxygen Demand (BOD <sub>5</sub> at 20°C)	30	50	100	10
5.	Chemical Oxygen Demand (COD)	250	250	250	60
6.	Total Suspended Solids (TSS)	50	150	200	15
7.	Total Oil and Grease (TO&G) or n-Hexane Extractable Material (HEM)	10	15	100	No release
8.	Ammoniacal Nitrogen (as NH <sub>3</sub> -N)	10	10	10	0.1
9.	Total Phosphorous (as P)	5	5	5	0.1
10.	Sulphide (as H <sub>2</sub> S)	1	1	1	0.2
11.	Chloride (as Cl <sup>-</sup> )	250	NIAA	NIAA	NIAA
12.	Total Residual Chloride (as Cl <sub>2</sub> )	1	1	2	0.2
13.	Dissolved Hexavalent Chromium (Cr <sup>6+</sup> )	0.1	0.1	0.1	0.01
14.	Total Chromium (Cr)	0.5	0.5	0.5	0.1
15.	Dissolved Iron (Fe)	3.5	3.5	3.5	1.0
16.	Total Petroleum Hydrocarbons (TPH)	25	40	80	No release
17.	Total Nickel (Ni)	0.5	0.5	0.5	0.5
18.	Total Copper (Cu)	0.5	0.5	0.5	0.01
19.	Total Zinc (Zn)	2	2	2	0.1
20.	Total Arsenic (As)	0.1	0.1	0.1	0.01
21.	Total Cadmium (Cd)	0.1	0.1	0.1	0.01
22.	Total Mercury (Hg)	0.01	0.01	0.01	0.005
23.	Total Lead (Pb)	0.1	0.1	0.1	0.05
24.	Total Cyanide (as CN <sup>-</sup> )	0.1	0.1	0.1	0.01
25.	Phenolic Compounds (as phenol)	0.5	0.5	0.5	0.1
26.	Radioactivity	NIAA	NIAA	NIAA	NIAA
Levels or Conditions					
27.	Toxicity	NATE	NATE	NATE	NATE
28.	Faecal Coliforms	400	400	400	100

Figure 14-2: Ambient Water Quality Standards Extracted from the Water Pollution Rules, 2019

#### 14.4.1.1.7.2 Monitoring Frequency

Monitoring will be carried out by the Contractor (via a qualified environmental specialist) according to the frequency that is stipulated in the EMA's CEC for the activity being performed.

#### 14.4.1.1.7.3 Management and Mitigation Measures

The following management actions and mitigation measures should be adhered to:

##### Erosion Control

- Only clear topsoil from areas to be used

- Place berms around stockpiles of topsoil and aggregate (sand, gravel, etc.)
- Avoid steep cuts and where there are steep cuts, they must be shored
- Utilise sediment traps to minimise sediment runoff
- Replant trees in affected areas of the project site or other areas
- Construction vehicles must be restricted to designated paths and must not be allowed to drive all over the cleared site.
- Compacted soils should be routinely ripped during construction until they are revegetated after construction is complete.
- Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T & T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and The National Environmental Policy; the Waterworks and Water Conservation Act (2016).

#### Landslides

- An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency preparedness and response plan.
- Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T & T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011) and the Upper Watersheds Management Plans; the National Environmental Act and The National Environmental Policy;
- Implement Construction Best Practices.
- Revegetate cleared areas immediately following construction.
- Comply with National forests Policy (2011) and Watershed management Plans.

#### Water Pollution Prevention

- Environmental conditions must be included in any construction contracts, thereby making contractors accountable for preventing accidental spillages.
- Effective implementation, monitoring and enforcement of the Water Conservation Act, effective implementation, monitoring and enforcement of the Public Health Ordinance, enforcement of the National Water Pollution Rules.
- Spill prevention mechanism outlined in Section 4.3 above entitled Waste Management should be adhered to prevent accidental spills which can contaminate rivers and nearby habitats with ecologically sensitive species.

#### Sewage

- Implement the management of contaminated wastewater generated from construction sites.

#### 14.4.1.1.7.4 Key Performance Indicators

The following KPIs have been selected in order to evaluate the effectiveness of the water quality management program.

**Table 14-13: Key Performance Indicators for Water Quality Management**

<b>No.</b>	<b>Key Performance Indicators</b>	<b>How will it be monitored and measured</b>	<b>Responsibility</b>
1	Sediment traps	Site Inspection	Contractor. Results to be presented to the Implementing Agency
2	Logs indicating when work was halted	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
3	Turbidity Results from a certified lab.	Review and inspection of documentation- certificate results	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.7.5 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that the management and mitigation measures for water quality are clearly understood by all workers and that they are carried out and relevant monitoring reports are prepared.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.7.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### 14.4.1.1.8 Access to communities

##### 14.4.1.1.8.1 Monitoring Standards

The works will be monitored by the Contractor.

##### 14.4.1.1.8.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as work progresses in the Community.

##### 14.4.1.1.8.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage access into the community and not disrupt the community from their normal daily routines:

- Prior to the start of works proper signage and safety guidelines with respect to site access and community access should be provided to the community in areas where works are planned, in accordance with the consultation plan.
- Appropriate location points should be identified and properly marked for the transfer and storage of construction material.
- The community should be given prior notice if access will be restricted

##### 14.4.1.1.8.4 Key Performance Indicators

The following KPIs in Table 14-14 have been selected in order to evaluate the effectiveness of the community access.

**Table 14-14: Key Performance Indicators for Management of Access to Communities**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Inspection Log and notes	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Signage	Inspection of the site	Contractor. Results to be presented to the Implementing Agency
3	Notices	Review and inspection	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.8.5 Roles and Responsibilities

It is the responsibility of the Contractor to ensure that access to communities is not disrupted. If there is a potential challenge with access due to planned works, the contractor must ensure that all workers and community members are adequately aware and the alternative location points are clearly marked.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.8.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any incidents logged.

#### 14.4.1.1.9 Emergency response

##### 14.4.1.1.9.1 Monitoring Standards

The works will be monitored by the Contractor based on adherence to the EMA's CEC.

##### 14.4.1.1.9.2 Monitoring Frequency

Monitoring will be carried out by the Contractor monthly.

##### 14.4.1.1.9.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place for effective emergency response:

#### **Fire**

- In the event of a fire- there should be sufficient, available and well-maintained firefighting equipment.
- If the fire is too large, the fire brigade shall be called to extinguish it.

#### **Heavy rainfall and Flood Prevention**

- As much as possible work should not be done during the rainy season.
- In the event of pending heavy rainfall, all equipment should be removed from near drains and rivers where it could be washed away.



- See also section 4.5
- Workers must be trained in the requirements of the emergency preparedness and response plan.
- Proper implementation and/or enforcement of the National Physical development Plan (1984) and the National Spatial development Strategy for T & T (2014); the National Forests Policy (2011), the National Protected Areas Policy (2011); the National Environmental Act and The National Environmental Policy;

### **Earthquakes**

- Use of flexible pipe joints and penetrations into tanks to prevent breakage from earthquake movements.
- All works should be done to local and international building codes and standards where possible.
- An emergency preparedness and response plan must be in place to cover man-made and natural hazards. Workers must be trained in the requirements of the emergency.

#### **14.4.1.1.9.4 Key Performance Indicators**

The following KPIs in Table 14-15 have been selected in order to evaluate the effectiveness of the emergency response measures.

**Table 14-15: Key Performance Indicators for Management of Emergency Response**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Maintenance Log	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Incident Log	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### **14.4.1.1.9.5 Roles and Responsibilities**

It is the responsibility of the Contractor to ensure that the emergency response measures are clearly understood by all workers and that all management and mitigation measures are carried out and that monitoring reports are prepared.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### **14.4.1.1.9.6 Data Analysis and Reporting**

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### **14.4.1.1.10 Flora and Fauna**

##### **14.4.1.1.10.1 Monitoring Standards**

The works will be monitored by the Contractor based on adherence to the EMA's CEC.

#### 14.4.1.1.10.2 Monitoring Frequency

Monitoring will be carried out by the Contractor (via a qualified environmental specialist) according to the frequency that is stipulated in the EMA's CEC.

#### 14.4.1.1.10.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage the flora and fauna in the construction area:

##### General

- Clearing of vegetation shall be kept to the minimum required and where possible, shall be avoided and areas for construction related activities shall be located where the natural habitat has been transformed;
- All construction sites should be clearly demarcated;
- Areas where priority plant species are growing must be demarcated as no-go zones;
- Access tracks should avoid sensitive areas, especially steep gradients;
- No clearing of vegetation, storage of materials or other construction related activities shall be permitted outside the demarcated construction area.
- Effective implementation, monitoring and enforcement of National Environmental Policy, and the National Pollution Rules, the National Biodiversity Policy, action by the Environmental Authority
- Effective implementation, monitoring and enforcement of the Water Conservation Act, effective implementation, monitoring and enforcement of the Public Health Ordinance, enforcement of the National Protected Areas Policy.

##### Erosion prevention and protection of sensitive flora and fauna

- Replant trees in the same area of the project site or other areas. Exotic vegetation managed and affected sites should be replanted or rehabilitated with indigenous grass species.
- Avoid indiscriminate habitat destruction and localise the proposed development as much as possible (including support areas and services).
- Control erosion through the utilization of silt traps, silt fencing, Gabions, etc. This is especially pertinent within areas of steeper gradients.

##### Contamination Prevention and protection of sensitive flora and fauna

- Ensure that proper handling, use and storage of all chemicals are done according to best practices
- Have spill containment and clean-up equipment on site and dispose of waste in accordance with best practices
- Do not store fuel and chemicals near or at watercourses or waterbodies
- Report and clean accidental spills immediately
- Contaminated soils must be removed and disposed of at a registered disposal site.
- Properly maintain and service equipment
- Refuelling should not be done within the riparian zones

Noise pollution prevention and protection of sensitive fauna

- Limit animal disruptive activities to short time frames

Criteria for Avoidance of protected areas

- No development activity is expected to be done within any protected areas
- Should any activity be planned within the vicinity of a protected area the Implementing Agency should respect any buffer lines demarcated in the Environmentally Sensitive Areas Rules, 2001.
- Environmental baseline and monitoring should be done to identify potential impacts and implement appropriate mitigation measures to protect these sensitive area

#### 14.4.1.1.10.4 Key Performance Indicators

The following KPIs in Table 14-16 have been selected in order to evaluate the effectiveness of the community access.

**Table 14-16: Key Performance Indicators for Management of Flora and Fauna**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	No major losses of priority species	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Signage	Inspection of the site	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.1.10.5 Roles and Responsibilities

It is the responsibility of the Contractor to ensure all workers are made aware of the importance of following the management and mitigation and that monitoring reports are prepared.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.1.10.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager to allow for management strategies to be changed according to the results.

#### 14.4.1.2 Social Management Plan

This plan will contain protocols for the management of social issues. This plan has been developed in accordance with OP-761: Operational Policy on Gender Equality in Development (November 2010) and Guidelines (September 2013) and the OP-708: Public Utilities Policy (November 2013). It will be the responsibility of the Implementing Agency and its Contractor. Subplans of the Environmental Health and Safety Management Plan should include management of the following aspects:

#### 14.4.1.2.1 Social conflict

##### 14.4.1.2.1.1 Monitoring Standards

The works will be monitored by the Contractor.

##### 14.4.1.2.1.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as work progresses in the Community.

##### 14.4.1.2.1.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage social conflicts in the community and on site:

- Establish a fair and impartial mechanism that is accessible to all for addressing Project-related complaints and issues by affected community residents
- Establish a stakeholder engagement process and channels of communication from the onset of the project to continuously inform the affected communities and the public about the project (especially the Metering Component) and project works.

##### 14.4.1.2.1.4 Key Performance Indicators

The following KPIs in Table 14-17 have been selected in order to evaluate the effectiveness of the social conflict management plan.

**Table 14-17: Key Performance Indicators for Management of Social Conflict**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

##### 14.4.1.2.1.5 Roles and Responsibilities

It is the responsibility of the Contractor to manage social conflicts. The contractor must ensure that all workers and community members are adequately aware of the grievance mechanism to log complaints that need to be addressed.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

##### 14.4.1.2.1.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.

#### 14.4.1.2.2 Installation of household metering stations

##### 14.4.1.2.2.1 Monitoring Standards

The works will be monitored by the Contractor and the Implementing Agency.

##### 14.4.1.2.2.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as installation progresses in the various communities.

#### 14.4.1.2.2.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage the installation of household metering in the project area:

- Conduct community sensitization sessions on the plans and process of installing household metres before beginning any work in any community. Take note of any feedback or suggestions provided by residents during these sessions and address if possible.
- Inform community residents of subsidies and grants that exist to alleviate pressure on the poor and vulnerable population. Inform those in need on the process of how these can be applied to residents that are in need.
- Inform community on the channels of communication and the grievance mechanism in place.

#### 14.4.1.2.2.4 Key Performance Indicators

The following KPIs in Table 14-18 have been selected in order to evaluate the effectiveness of the social conflict management plan.

**Table 14-18: Key Performance Indicators for Management of Installation of Household Metering Stations**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Community Meeting Schedule and Notes	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.2.2.5 Roles and Responsibilities

It is the responsibility of the Contractor to manage the installation of household metering stations. The contractor must ensure that all householders are properly sensitised before the installation process begins and that they are adequately aware of the grievance mechanism to log complaints that need to be addressed.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.2.2.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.

#### 14.4.1.2.3 Under-representation of women in the project workforce

##### 14.4.1.2.3.1 Monitoring Standards

The works will be monitored by the Contractor.

##### 14.4.1.2.3.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as work progresses in the Community.

#### 14.4.1.2.3.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to ensure there is adequate representation of women in the project workforce:

- As part of the Implementing 's agency contractual arrangements with the construction contractor, encourage the construction contractor to maximise local employment opportunities and to work with the local communities (and their leaders) in establishing a fair and transparent system for local worker recruitment.
- Inform the Division of Community Development, the Institute of Technology (MIC) – Multi-Sector Skills Training Programme (MuST), and the Regional Corporations of the types of job opportunities that will be available through the Project to influence the types of semi-skilled training programmes offered in the Project area during pre-construction and construction phases.
- Emphasis should be placed on training women as well as men to improve their recruitment perspectives for semi-skilled positions.
- Take steps to ensure that qualified women are afforded equal access to job opportunities from the Project (linked to the first mitigation measure).
- All applications will be made aware of the grievance mechanism to report any complaints associated with gender-biased or unfair treatment.

#### 14.4.1.2.3.4 Key Performance Indicators

The following KPIs in Table 14-19 have been selected in order to evaluate the effectiveness the plan to minimize the under-representation of women in project works.

**Table 14-19: Key Performance Indicators for Management of Under-representation of Women in Project Works**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Local worker recruitment Policy	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Training log and schedule	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
3	Register of all workers employed	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
4	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.2.3.5 Roles and Responsibilities

It is the responsibility of the Contractor to manage social conflicts. The contractor must adhere to the local worker recruitment policy to be free from gender biases. The contractor must also ensure that all workers and community members are adequately aware of the grievance mechanism to log complaints that need to be addressed.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### 14.4.1.2.3.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.

#### 14.4.1.2.4 Water supply

##### 14.4.1.2.4.1 Monitoring Standards

The works will be monitored by the Contractor.

##### 14.4.1.2.4.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as work progresses in the Community.

##### 14.4.1.2.4.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to mitigate against water supply disruptions that could occur during project execution:

- Notify impacted communities of the possible disruption of services starting two weeks in advance of construction works.
- Provision of truck-borne water supply to sensitive receptors, as needed.
- Inform customers of grievance mechanism

##### 14.4.1.2.4.4 Key Performance Indicators

The following KPIs in Table 14-20 have been selected in order to evaluate the effectiveness the plan to manage disruptions in water supply.

**Table 14-20: Key Performance Indicators for Management of Disruption in Water Supply**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Notices for disruption in services	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
3	Delivery Schedule for water trucking service	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

##### 14.4.1.2.4.5 Roles and Responsibilities

It is the responsibility of the Implementing. Internal grievance mechanism to log complaints should be in place. The Implementing Agency is responsible for monitoring and undertaking mitigation measures.

##### 14.4.1.2.4.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.



#### 14.4.1.2.5 Damage to property

##### 14.4.1.2.5.1 Monitoring Standards

The works will be monitored by the Contractor.

##### 14.4.1.2.5.2 Monitoring Frequency

Monitoring will be carried out by the Contractor as work progresses in the Community.

##### 14.4.1.2.5.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to prevent or mitigate against damage to property that could occur during project execution:

- Provide compensation for loss of assets (property – land and structures) to private landowners (persons with legal rights to land or recognisable claims under Trinidad and Tobago law, such as letters of comfort) and persons occupying property
- Promote the use of the grievance redress mechanism to address project related complaints and issues
- Promptly repair any damage to vital infrastructure and services in consultation with, or by the service provider.

##### 14.4.1.2.5.4 Key Performance Indicators

The following KPIs in Table 14-21 have been selected in order to evaluate the effectiveness the plan to manage property damage.

**Table 14-21: Key Performance Indicators for Management of Property Damage**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Assessment of cost of damage	Review and inspection of documentation	Implementing Agency
3	Preparation of compensation package	Review and inspection of documentation	Implementing Agency

##### 14.4.1.2.5.5 Roles and Responsibilities

It is the responsibility of the Implementing. Internal grievance mechanism to log complaints should be in place. The Implementing Agency is responsible for monitoring and undertaking mitigation measures.

##### 14.4.1.2.5.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.

#### 14.4.1.2.6 Institutional conflict

##### 14.4.1.2.6.1 Monitoring Standards

The works will be monitored by the Implementing Agency.

#### 14.4.1.2.6.2 Monitoring Frequency

Monitoring will be carried out by the Implementing Agency as project activities are being implemented.

#### 14.4.1.2.6.3 Management and Mitigation Measures

The Contractor will ensure that the following measures are put in place to manage institutional conflicts associated with the implementation of the project activities:

- Establish a formal system to inform, coordinate and reduce conflicts that may arise in conducting project works and planned municipal activities.

#### 14.4.1.2.6.4 Key Performance Indicators

The following KPIs in Table 14-22 have been selected in order to evaluate the effectiveness the plan to manage institutional conflicts.

**Table 14-22: Key Performance Indicators for Management of Institutional Conflict**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Log of Complaints	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.2.6.5 Roles and Responsibilities

It is the responsibility of the Implementing. Internal grievance mechanism to log complaints should be in place. The Implementing Agency is responsible for monitoring and undertaking mitigation measures.

#### 14.4.1.2.6.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the EHS Manager and any complaints logged.

### 14.4.1.3 Security Management Plan

This plan will contain protocols to ensure the safety and security of personnel and equipment during all phases of the project. The risk level and impact to work sites will have to be assessed and the appropriate mitigation measures devised. This plan is the responsibility of the Implementing Agency and its Contractor (s).

#### 14.4.1.4 Contractor Management Plan

##### 14.4.1.4.1 Monitoring Standards

The works will be monitored by the Implementing Agency.

##### 14.4.1.4.2 Monitoring Frequency

Weekly monitoring will be carried out by the Implementing Agency during both construction and operational phases.

##### 14.4.1.4.3 Management and Mitigation Measures

The Implementing Agency will ensure that the following measures are put in place to manage all contractors throughout the project:

- The Implementing Agency will provide the Contractors Management Plan with attributes for all parts, requirements to Contractors and also a Work Statement for the various phases of work including models for standard documents.
- The Contractor is expected to abide by this Contractors Management Plan.
- The Contractors will enter into a business partnership with the Implementing Agency after completing a successful tender process following the government procurement guidelines.
- Each contractor will have a legally binding, written contract that defines specific terms and conditions.
- The Contractor will provide the integrated solution for execution of the work phases, including the economic, environmental and social approach.
- The Contractor will abide by the management actions and mitigations measures provided in the Environmental and Social Management Plan associated with the project.
- The Contractors will present to the Implementing Agency, all the information for all subcontractors and the procedures for verification and validation services.
- Each Contractor will have a single point of contact to the Implementing Agency for contractual matters. The contact points, for each site, will monitor the activities.
- The Point of Contact will ensure compliance of the Project against the General Commitments Register. Weekly they will report about achievements and problems and the current situation to the Implementing Agency.
- Each Contractor/Subcontractor will identify the responsibilities and authorities of the Project staff. This information will be published in a project contact sheet and approved by the Implementing Agency.
- Each Contractor will have requirements for quality assurance clearly identified within the Statement of Work, including the requirement to allow independent quality inspections of materials and work processes;
- All products and services provided by the subcontractor (partners of Contractor) will be subject to the acceptance of the Implementing Agency;
- Each subcontract will contain appropriate terms and conditions;
- Adequate facilities will be provided to meet the needs of the Contractors, and the Contractors will support subcontractors in processing invoices and payments via standards and templates set by the Implementing Agency;
- The Contractor is responsible for project management, for control and monitoring activities regarding constructors' actions and has overall responsibility for environmental, social, health and safety, and cultural heritage aspects of the project.
- The Contractors will prepare work plans in compliance with the project's requirements and submit to the Implementing Agency for their Approval. These workplans should include site specific method statements for work in protected areas and sensitive habitats.
- Contractors must nominate the following employees:
  - representative for site coordination;
  - representatives for EHS responsibilities;
  - representatives for technical execution, budget, Project phases;
  - first aid competent person;

- representative for waste management;
- team for guarding the site; and
- team responsible for intervention on accidental pollution events.
- Any changes in execution of work will be approved by the Implementing Agency.
- All Contractors are also required to comply with all relevant national regulatory requirements.
- Each week, the Contractors will prepare and deliver to the Implementing Agency a weekly progress report for each aspect of the work.
- Each week, the Contractors will prepare and deliver to the Implementing Agency weekly progress reports on environmental, social and health and safety performance including reports on the KPIs presented in the Environmental and Social Management Plan.

#### 14.4.1.4.4 Key Performance Indicators

The following KPIs in Table 14-23 have been selected in order to evaluate the effectiveness of the contractor management process.

**Table 14-23: Key Performance Indicators for Management of Contractors**

No.	Key Performance Indicators	How will it be monitored and measured	Responsibility
1	Weekly Report on achievements and problems	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Project contact sheet	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
3	Reports on quality inspections	Quality inspections of materials and work processes	Contractor. Results to be presented to the Implementing Agency
4	Work plan	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
5	Weekly progress reports on each aspect of the work	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
6	Weekly progress reports on environmental, social and health and safety performance	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

#### 14.4.1.4.5 Roles and Responsibilities

It is the responsibility of the Implementing Agency to ensure that there are no issues when contracting services. The Implementing Agency is monitoring the Contractor and ensuring that they undertake all the requisite management and mitigation measures.

#### 14.4.1.4.6 Data Analysis and Reporting

If there are any violations, this will be reported immediately to the Implementing Agency.

#### **14.4.1.5 Livelihood Protection Plan**

This action plan should be developed in accordance with national and international policies and standards. The plan will seek to work with all stakeholders to ensure that disruptions are avoided or minimised.

##### **14.4.1.5.1 Monitoring Standards**

The works will be monitored by the Contractor.

##### **14.4.1.5.2 Monitoring Frequency**

Weekly monitoring will be carried out by the Contractor as work progresses in the Community until the end of activities.

##### **14.4.1.5.3 Management and Mitigation Measures**

The Contractor will ensure that the following measures are put in place to manage access into communities and not disrupt the community's livelihood activities from their normal daily routines:

- Before the start of construction works, develop and distribute an initial project information packet to business owners and community leaders.
- Alert businesses about local construction works two weeks in advance (or a stipulated time frame as agreed between local businesses and the Contractor) and of any changes in the initial scheduling.
- Promote the use of the Community Grievance Mechanism.

##### **14.4.1.5.4 Key Performance Indicators**

The following KPIs in Table 14-14 have been selected in order to evaluate the effectiveness of the community access.

**Table 14-24: Key Performance Indicators for Management of Access to Communities**

<b>No.</b>	<b>Key Performance Indicators</b>	<b>How will it be monitored and measured</b>	<b>Responsibility</b>
1	Inspection Log and notes	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency
2	Signage	Inspection of the site	Contractor. Results to be presented to the Implementing Agency
3	Complaints logged	Review and inspection of documentation	Contractor. Results to be presented to the Implementing Agency

##### **14.4.1.5.5 Roles and Responsibilities**

It is the responsibility of the Contractor to ensure that there are no disruptions in livelihood activities and as a result no negative social repercussions. If there is a potential challenge due to planned works, the contractor must ensure that all workers and community members are adequately aware and the alternatives are clearly expressed to minimize social impacts.

The Implementing Agency is responsible for monitoring the contractor to ensure that monitoring is being undertaken and mitigation measures are being enforced.

#### **14.4.1.5.6 Data Analysis and Reporting**

If there are any violations, this will be reported immediately to the EHS Manager and any incidents logged.

#### **14.4.1.6 Stakeholder Engagement Plan (SEP)**

This plan should outline the measures to be used for community engagement, dissemination of project information and grievance management and will be utilised as a key element in all the proposed management, monitoring and mitigation measures outlined in this document. This plan would be responsibility of the Implementing Agency and Contractor.

##### **14.4.1.6.1 Stakeholder Identification**

For the purpose of the analysis, stakeholders are grouped within the following broad categories:

1. Affected communities including community members living adjacent to the construction works – families, individuals and social structures and networks including formal or informal community organisations;
2. Sensitive human receptors in the vicinity of the construction works, including schools, health facilities (hospitals), nurseries and early childhood care and educational facilities, care facilities for older adults, persons who at home during the day, etc.;
3. Local businesses and their representative organisations;
4. Local persons seeking employment;
5. WASA customers;
6. Local Government – various Regional Corporations;
7. Politicians (Local Government Councillors, Members of Parliament and Representatives of the Opposition);
8. Residents of the affected municipalities;
9. Project contractors and sub-contractors;
10. Central government agencies (including regulatory agencies);
11. National civil societies (e.g. environmental NGOs);
12. The media; and
13. The general public.

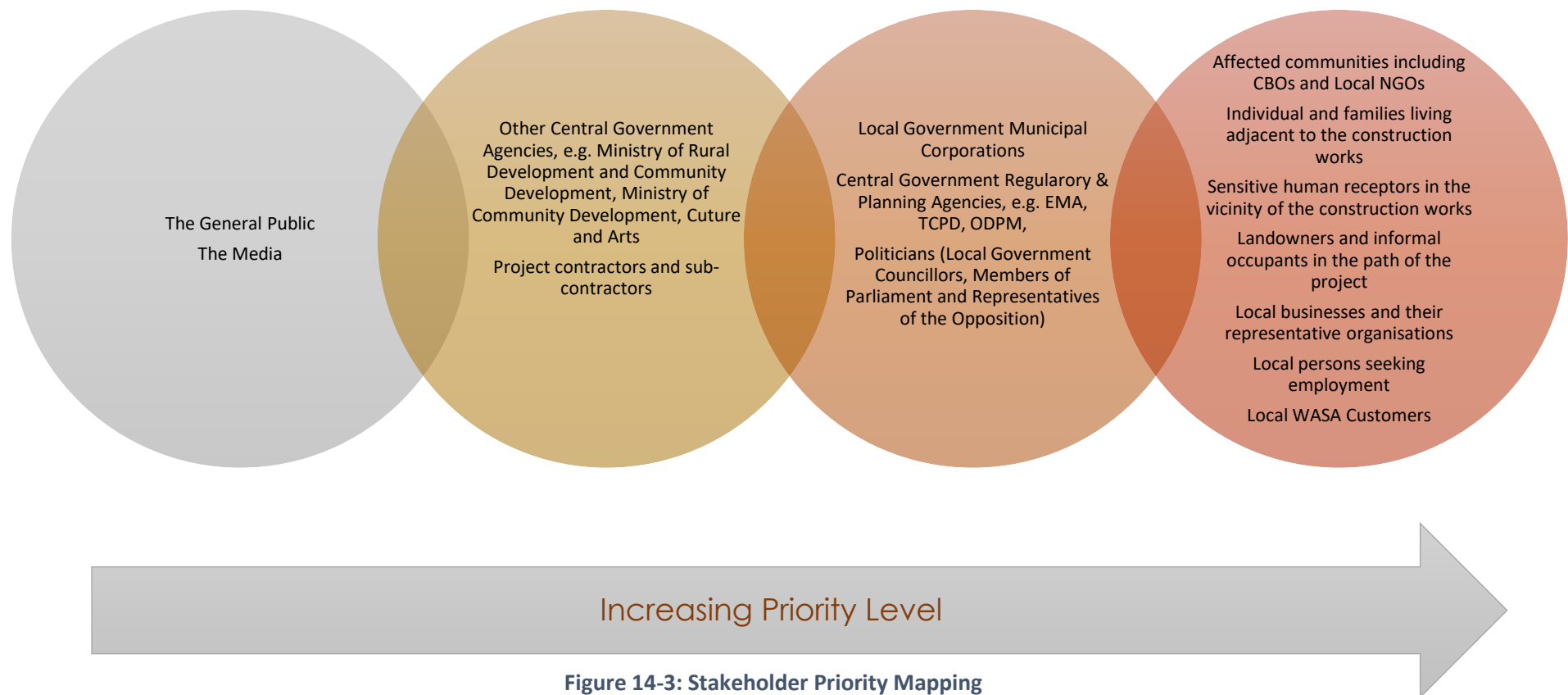


Figure 14-3: Stakeholder Priority Mapping



#### 14.4.1.6.2 Stakeholder Analysis and Engagement Strategies

Figure 14-3 ranks stakeholders based primarily on their level of importance (those who may be directly or indirectly affected by project activities) and their level of concern with regard to the outcome of the project. Individuals/families owning or using physical and productive assets in the footprint of the highway. The key local stakeholders (high priority stakeholders), those whose participation in the project is critical to achieving the project objectives, are the following:

- Affected communities including CBOs and local NGOs;
- Individual and families living adjacent to the construction works;
- Sensitive human receptors in the vicinity of the construction works;
- Landowners and informal occupants in the footprint of the project;
- Local businesses and their representative organisations;
- Local persons seeking employment; and
- Local WASA customers.

A second figure also maps stakeholders against their level of influence and their degree of interest in the project (Figure 14-4). This second figure also presents the recommended communication/engagement strategy as the project rolls-out. The level of interest is defined as the degree to which a stakeholder is concerned about the outcomes of the TT Water Supply Improvement Project. A key question here is, “Will stakeholders be positively or negatively affected?” The level of influence looks at the degree to which a stakeholder can make or break the project, for example, through the provision of funding, their cooperation, protest action, or through legal means, etc. Six stakeholder groups fall within the high influence and high interest category who should be managed thoroughly (engaged and consulted) throughout the project. Among them are the first six stakeholder groups listed above. The list of stakeholders at the community and institutional level with whom the project should engage and consult throughout the project is provided in Figure 14-4.

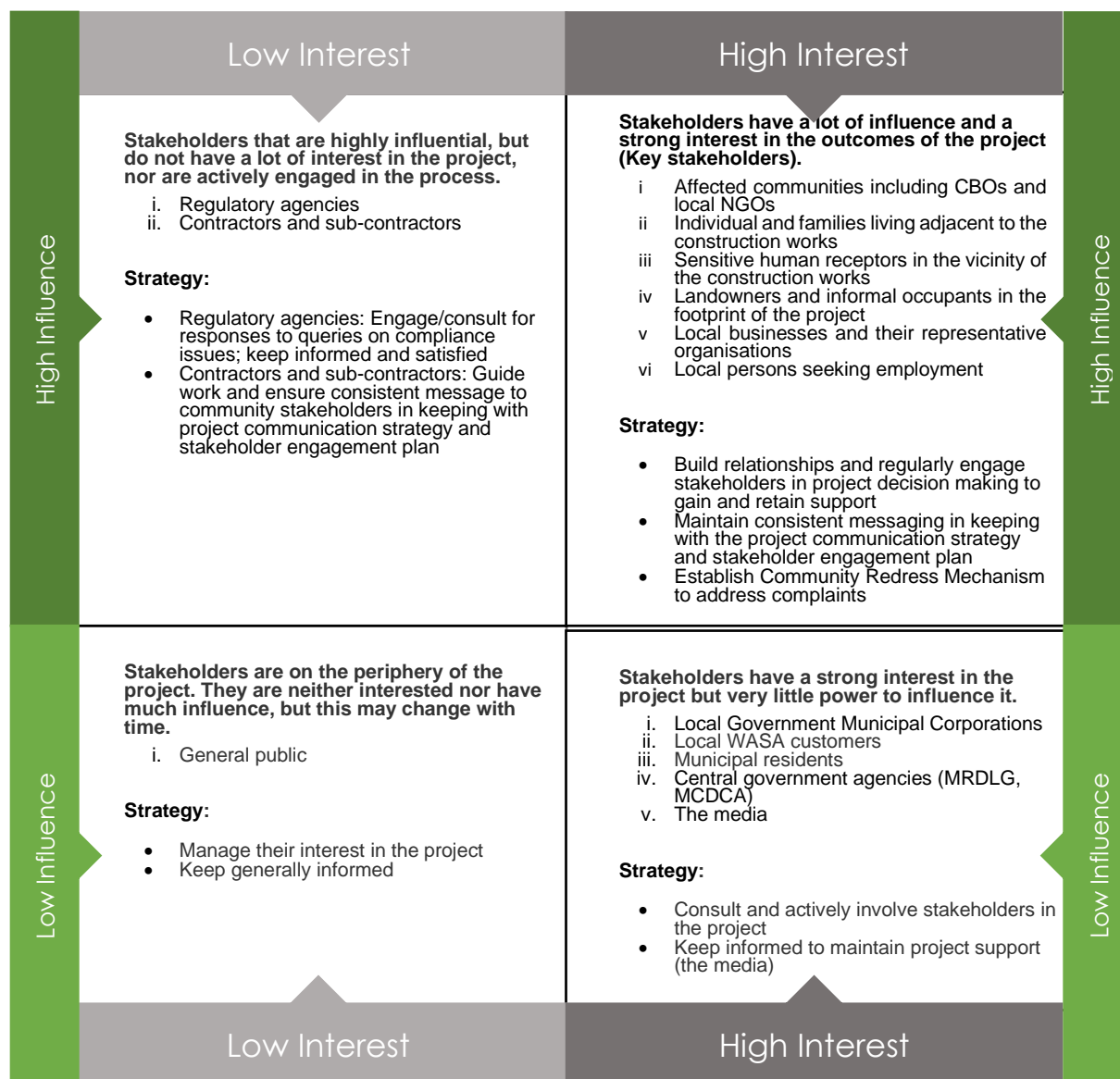


Figure 14-4: Stakeholder Mapping Results and Strategy for Engagement

#### 14.4.1.6.3 Consultation Schedule and Method of Communication

A schedule should be developed for the consultations intended to facilitate disclosure of information on the project. It is anticipated that engagement will help to build and maintain over time a constructive relationship with all stakeholders.

The sample consultation schedule is presented in the table below that shows likely communication required while executing the CCLIP. It outlines the communication needs, timing and method for the stakeholders relevant for each management plan.

**Table 14.5: Likely Stakeholder Consultations under the Project.**

#	Plan	Communication Needs	Timing	Method
1	Worker Health and Safety Plan	Training of employees about health and safety procedures and personal protective gear that need to be worn during construction activities.	Before and periodically during the Works	Training and sensitisation sessions with contract workers on site.  Bulletins on the notice board on site as reminders, safety signs.
2	Community Health and Safety Plan	Consultation with community about health and safety precautions and protocols that need to be adhered to during construction and operation activities.	Before and periodically during the Works	Meetings and sensitisation sessions with community members.  Bulletins on the community notice board and signage at site boundaries as reminders, safety signs.
3	Traffic Management Plan	Consultation with community about health and safety precautions and protocols that need to be adhered to during construction activities.	Before and periodically during the Works	Meetings and sensitisation sessions with community members.  Bulletins on the community notice board and signage at site boundaries as reminders, safety signs.
4	Management of Access to Communities	Consultation with community about temporary alternative routes or restrictions to access during construction activities.	Before and periodically during the Works	Meetings and sensitisation sessions with community members.  Bulletins on the community notice board and signage at site boundaries as reminders, safety signs.
5	Solid Waste Management Plan	Communication to solid waste collectors to receive and remove solid and hazardous waste offsite to appropriate off-site disposal.  Communication to workers about the procedures for handling and disposing of solid and hazardous waste material.	Prior to the start of construction	Collectors to be advised via letter and telephone conversation.  Worker sensitisation sessions

#	Plan	Communication Needs	Timing	Method
6	Plan to Avoid Social Impact on livelihoods	Consultation with community about nature of works and how this would impact livelihood operations in the area and alternative available to community members.	Before and periodically during the Works	Meetings and sensitisation sessions with community members.  Bulletins on the community notice board and signage at site boundaries as reminders, safety signs.
7	Social Management Plan	Communication to all potentially affected stakeholders	Throughout the project (pre-construction, construction and operation)	Direct engagement at the individual level
8	Security Management Plan	Communication to all security contractors and subcontractors during project activities as well as workers regarding proper security protocols.	Throughout the project (pre-construction, construction and operation)	Direct engagement at the individual level
9	Contractor Management Plan	Communication to all contractors and subcontractors during project activities	Throughout the project (pre-construction, construction and operation)	Direct engagement at the individual level
10	Land Acquisition, Resettlement and Compensation Plan	Communication to all potentially affected stakeholders	Throughout the project (pre-construction, construction and operation)	Direct engagement at the individual level

#### 14.4.1.6.4 Reporting

A Consultation Report should be completed in each phase. The results of engagement activities conducted throughout the project must be presented. At the end of each phase/major milestone, the subsequent results can be appended. Engagement activity summaries should include the following information:

1. Stakeholder engaged (name and contact details)
2. Date and location of meeting (photo if possible)
3. Topic of meeting
4. Feedback received from stakeholder
5. Answers from Implementing Agency (WASA)
6. If the Implementing Agency, WASA, commits to something, the commitment should be recorded as part of a commitment register identifying a responsible entities/person, and a deadline as appropriate.

#### 14.4.1.6.5 Grievance Mechanism

The grievance mechanism will allow for concerns/ complaints to be received and to facilitate resolutions of the affected individuals. Steps to be instituted for the CLLIP are below.

## Step 1

The process of accepting grievances is the first step which can take on varying levels of formality as outlined in Table 14-25 below. The Grievance Collection Form that complainants will first need to complete is presented in Appendix 2. Grievances can also be logged anonymously based on the nature of the problem. The Grievance Monitoring Form for use by WASA is presented in Appendix 3.

**Table 14-25: Methods for Grievance Receipt, from Least to most formal**

Level of Formalization	Examples
<b>Least formal:</b> Oral complaints received face to face	Staff charged with collection of grievances writes down complaints at group or individual meetings, during field visits, or at designated locations.
<b>Somewhat formalised:</b> Oral complaints received through remote-access methods	Staff accepts grievances through a designated telephone line.
<b>More formalised:</b> Written complaints received face-to-face	Staff accepts written submissions from an individual or a group at groups or individual meetings, during site visits, or at designated locations.
<b>Most formalised:</b> Written complaints received through remote access methods	Complaints come in via regular mail, internet, or grievance collection boxes (consider having multiple locations).  Complainants submit written grievances to third parties (to be forwarded to the local Contractor or the third party designated to administer the grievance redress mechanism).

While oral complaints are accepted from both internal and external stakeholders, a grievance collection form provided in the following section should be completed by the stakeholder following oral face to face or remote communication. This form will be made available at WASA's office.

## Step 2

The logging and addressing of complaints rests with the local Contractor or Project Coordinator. Following the logging of a complaint, the grievance will be addressed at this level. A response must be prepared for the grievant. Appropriate attention should be given to gender-based grievances.

Should the grievant not be satisfied with the response provided, then move on to step 3.

## Step 3

Grievances that cannot be handled in Step 2 will be taken to the designated authority within or assigned by the Implementing Agency, WASA. A further root cause analysis should be done to identify another appropriate corrective action and complete the Grievance Monitoring Form in the following section.

The complainant will then be informed in writing of the decision to correct the action within a forty (40) working day period.

## **Step 4**

If the complainant does not feel that the grievance has been adequately addressed, they would go to court if the complainant so desires. Local Non-governmental organisations (NGOs) also provide support for victims and persons affected by gender-based violence and can be accessed by the complainant.

### **14.4.1.7 Land Acquisition, Resettlement and Compensation Plan**

The development of the RSSP reservoir should require land acquisition and involuntary resettlement as such a Land Acquisition Resettlement and Compensation Plan will need to be developed. The plan should be developed to ensure that when people are being displaced, they are treated equitably and, where feasible, can share in the benefits of the project that requires their resettlement. This plan has been prepared in accordance with OP-710: Operational Policy on Involuntary Resettlement (July 1998) and Guidelines (November 1999). This plan is the responsibility of the Implementing Agency.

#### **14.4.1.7.1 Guidelines for Development of Plan**

WASA has a Land Acquisition and Compensation Policy (2012) which applies to all situations (voluntary and involuntary) in which people are physically displaced or lose their source of livelihood (fisheries, agricultural land, employment, business outlets, and so on) as a result of land acquisition for planned development of Water and or Wastewater Infrastructure. This policy speaks to both the Trinidad and Tobago regulations as well as the Inter-American Development Bank's Resettlement Guidelines, which have both been captured in Sections 2 and 11.4 above.

The policy aims to minimize the impacts of resettlement on the affected people, restore livelihoods to previous levels as a minimum, and take into consideration the special needs of particularly vulnerable population groups.

Important guidelines that should be adhered to when developing a detailed resettlement plan for the RSSP during the execution of CCLIP. These are outlined below:

1. **Accurate baseline information** must be compiled as early as possible. It must include information on the number of people to be resettled, and on their socio-economic and cultural characteristics, including disaggregation by gender. In addition, the data will provide an important basis for the definition of eligibility criteria, and compensation and rehabilitation requirements.
2. **Consultations with the community** are essential prior to any works beginning in RSSP and this should follow through post development to ensure full resolution and compensation is bright to each impacted person with particular care being given to vulnerable persons. The resettlement plan must include the results of stakeholder consultations carried out in a timely and socio-culturally appropriate manner with a representative cross-section of the displaced and host communities.
3. **Compensation and rehabilitation options** developed must provide a fair replacement value for assets (including intangible assets) lost, and the necessary means to restore subsistence and income, to reconstruct the social networks that support production, services and mutual assistance, and to compensate for transitional hardships (such as crop losses, moving costs, interruption or loss of employment, lost income, among others). These measures must be timely to avoid prolonged transitional hardships. Housing and service options, when included, should be

appropriate for the social and cultural context and will, at the very least, meet minimum standards of shelter and access to basic services, regardless of conditions prior to resettlement. Options must take into account the characteristics of the resettled population as identified in the disaggregated baseline data with respect to gender, ethnicity, age, and any other factors pointing to special needs and/or vulnerability.

4. The resettlement plan must identify **the legal and institutional context** within which the compensation and rehabilitation measures have to be implemented. The first step is to determine the entitlements of affected persons under applicable laws and regulations, identify any services or social benefits to which they might have access, and ensure that sufficient resources are available. The next step is to assess what additional measures are needed, if any, to restore the livelihoods of the affected population to the pre-resettlement standard, and to design mechanisms capable of delivering the goods or services that are needed, including effective and expeditious procedures for the resolution of disputes. This may lead to the identification of gaps in the local institutional and regulatory frameworks, that need not be incorporated into the resettlement plan, but which can eventually be addressed through institutional strengthening or other components if the borrower and the Bank so agree.
5. Resettlement plans must take **environmental considerations** into account in order to prevent or mitigate any impacts that result from the development of infrastructure, densification of the host area, or pressure on natural resources and ecologically sensitive areas. An environmental impact assessment, including carrying capacity and socio-economic induced impacts on the host community, should be carried out for each proposed relocation site, wherever the magnitude of the resettlement component or the nature of the affected areas so requires, and the environmental management plan be included in the resettlement plan.
6. The Resettlement plan must undergo a process of meaningful consultation with the affected population, and must be available as part of the EIA of the RSSP, prior to the analysis mission. It must include sufficient information to be evaluated along with other project components. The plan will be summarized in the Environmental and Social Impact Report (ESIR).
7. A final resettlement plan will be presented for approval to Bank Management, as a supplement to the ESIR, prior to distribution of the operation documents for consideration by the Board of Executive Directors.
8. **Monitoring and Evaluation** must be a part of resettlement during operation. The monitoring activities should focus on compliance with the resettlement plan in terms of the social and economic conditions achieved or maintained in the resettled and host communities. The plan and the loan agreement should specify the monitoring and evaluation requirements and their timing. Whenever possible, qualitative and quantitative indicators should be included as benchmarks to evaluate those conditions at critical time intervals related to the progress of overall project execution.
9. **Avoid or minimize the need for resettlement.** This requires that serious consideration be given to alternatives, such as the relocation of a dam axle or lower reservoir levels in the case of hydropower projects, or a narrower right-of-way and/or re-routing through less populated areas

in the case of highway projects. This principle should, however, balance considerations of safety for people living in the vicinity of the project.

10. **Ensure that the affected population can achieve an equivalent or improved standard of living within a reasonable time.** The affected population should be given access to land, natural resources, housing and infrastructure of a level at least equivalent to that which they previously enjoyed, allowing them to recover or improve their income levels within a reasonable period. They should be provided with an acceptable level of services, including potable water, drainage, sanitation and community infrastructure, regardless of their previous conditions.
11. **Fully compensate all transitional losses.** These include all legal costs, transport costs and loss of income resulting from displacement.
12. **Minimize the disruption of social networks and economic opportunities.** As far as possible the affected population should be encouraged to maintain their social networks. This can be achieved through close consultation, by resettling the affected population as a group, as near as possible to their original location, and by timing the move to coincide with the most appropriate times in the school year and/or agricultural cycle.
13. **The project should provide opportunities for development.** Wherever possible, the affected population should be the first to benefit from the opportunities provided by the project. This can be achieved by giving them preference in employment, and if necessary, training, and by offering opportunities for self-employment. Examples would include service contracts for local labour, or the provision of parking and basic facilities for roadside vendors affected by highway projects.
14. **Vulnerable Groups.** It is particularly important to ensure that vulnerable groups are adequately protected. They include poor ethnic minorities, such as indigenous peoples, landless rural poor, and small farmers or squatters who lack full legal title to the land they use or occupy. The Bank will only support resettlement of traditional land-based indigenous peoples if it can be shown that resettlement will result in direct benefits to them. This requires that their customary rights must be recognized and fully compensated, they must be offered a suitable land-for-land option, and they must give their informed consent to the resettlement proposals.  
Special attention should be given to those sectors of the population that are at risk of impoverishment or that may have special difficulty adjusting to the disruption caused by displacement. They include the elderly, the physically handicapped and female heads of household. In addition, the compensation and rehabilitation measures should ensure that the rights of partners living in common-law unions and their children are protected if the couple separate or if one of the partners dies.

*(Adapted from WASA, 2012)*

In order for these guidelines to be properly executed, qualified personnel and support personnel are needed to join the WASA team with the requisite social sciences background to facilitate proper implementation.

#### **14.4.2 Summary of Monitoring Frequency for Management Plan**

The following table summarises the monitoring frequency required for each area described previously:



PARAMETER	FREQUENCY
Air Quality	Twice per month or as stipulated by the EMA
Noise	Twice per month or as stipulated by the EMA
Waste Management	Twice per month
Traffic Management	As stipulated by Traffic Management Branch
Worker Health and Safety Management	Daily
Community Health and Safety Management	Daily
Water Quality	Monthly or as stipulated by the EMA
Access to the community	Weekly
Emergency Response	Monthly
Flora and Fauna	Weekly
Social conflict	Weekly
Installation of household metering	Weekly
Under-representation of women in the project workforce	Weekly
Water supply	Weekly
Damage to property	Weekly
Institutional Conflict	Weekly
Security Management	Daily
Contractor Management	Weekly
Livelihood Protection	Weekly
Stakeholder Engagement	Daily
Land Acquisition, Resettlement and Compensation	Daily

## 15 MONITORING AND EVALUATION OF THE CCLIP

Establishing the baseline, setting the targets, and monitoring of the achievement of each target are critical elements to monitoring and evaluating the performance of a project. In the case of CCLIP, WASA and the MPU will be responsible for this activity. It is recommended that a Program Executing Unit (PEU) be established under the MPU to work together with the Board of WASA and be responsible for implementation of the Governance, Policy and Institutional Reformulation; as well as work with WASA's Management and Operations and an international water operator water, the Infrastructure Rehabilitation and improvement of operations. This implies a type of co-executing arrangement with MPU taking the lead. This co-executing arrangement will be agreed upon and included in the loan operation. At minimum, the PEU will be comprised of a Programme Manager, a policy/institutional specialist, two engineers, a communications specialist, a procurement specialist, a legal specialist, and a financial specialist.

The PEU will be responsible for monitoring the performance and progress of Programme execution. Monitoring will be against the Programme's result matrix that will establish the baseline and the projected annual targets of the Programme. The KPI identified in any Management Plan developed should be pulled

out and used in the monitoring and evaluation of project implementation. The PEU will collate monthly status reports on the progress of the Programme. The PEU will submit to the IDB and Cabinet two semi-annual progress reports throughout the life of the Programme execution, within 90 days after the end of the calendar year or half year. Additionally, with Bank's resources, independent evaluators will be hired to conduct a midterm and final evaluation of the Programme.

The PEU will also support the Minister with setting and monitoring of the policy mandate against a pre-agreed performance management scorecard. The PEU can also support the recommendation to the Minister of the requisite skills on the Board to enhance governance over WASA.

A sample monitoring template has been presented in Table 15-1 which can be used to monitor the implementation of CCLIP.

**Table 15-1: Sample Monitoring Template**

Project Phases	Tasks	Subtasks/Activities	Baseline	Target	Indicator	Status	Comment
Phase 0-A Dry Season Emergency Actions;	Task 1 - Skeletonized Hydraulic Model Development for 5 Regions	1.1 Model set up and load allocation	TBD	TBD	TBD	TBD	TBD
		1.2 Preliminary calibration with historical data and limited monitoring	TBD	TBD	TBD	TBD	TBD
		1.3 Technical Memorandum	TBD	TBD	TBD	TBD	TBD
	Task 2 - Focused Regional Assessment of Intermittent Supply	2.1 Focused Wellfield Assessment	TBD	TBD	TBD	TBD	TBD
		2.2 Analysis of historic drought events	TBD	TBD	TBD	TBD	TBD
		2.3 Preliminary Water Balance with Historic data	TBD	TBD	TBD	TBD	TBD
		2.4 Identification of wells that can be repaired	TBD	TBD	TBD	TBD	TBD
		2.5 Fast-Track Geophysics Survey (Electromagnetic) in Targeted Areas	TBD	TBD	TBD	TBD	TBD
		2.6 Simplified modelling of water augmentation scenarios	TBD	TBD	TBD	TBD	TBD
		2.7 Technical Memorandum	TBD	TBD	TBD	TBD	TBD
		2.8 Fast-Track Well Restoration	TBD	TBD	TBD	TBD	TBD
		2.8 Provide Emergency Water Service	TBD	TBD	TBD	TBD	TBD
	Task 3 - Focused Water Loss Reduction and Leak Detection and Repairs	3.1 Selection of target areas that are historically impacted by dry season	TBD	TBD	TBD	TBD	TBD

Project Phases	Tasks	Subtasks/Activities	Baseline	Target	Indicator	Status	Comment
		3.2 Perform selective leak detection	TBD	TBD	TBD	TBD	TBD
		3.3 Repair Leaks	TBD	TBD	TBD	TBD	TBD
	Task 4 - Water Conservation Educational Campaign	TBD	TBD	TBD	TBD	TBD	TBD
Phase 0-B Detailed preparation of the Programme and Baseline Assessment;	Task 1 - Universal metering – prepare tender documents and complete tendering process, assuming competitive procurement of a performance-based supply/install contractor	TBD	TBD	TBD	TBD	TBD	TBD
	Task 2 - NRW Reduction and network optimization – prepare request for proposals and Performance-Based Contract (PBC) to achieve 24/7 water supply	TBD	TBD	TBD	TBD	TBD	TBD
	Task 3 - Review and update studies, designs and tender package for the Multi-Purpose Flood Mitigation and Water Supply Reservoir at RSSP, Caparo	TBD	TBD	TBD	TBD	TBD	TBD
	Task 4 - Conduct field work for baseline assessment, prepare hydraulic model and water balance	TBD	TBD	TBD	TBD	TBD	TBD
	Task 5 - Strengthen the institutional capacity of the MPU by creating the Project Execution Unit	TBD	TBD	TBD	TBD	TBD	TBD

Project Phases	Tasks	Subtasks/Activities	Baseline	Target	Indicator	Status	Comment
The Programme, Phase I - Stabilization	Task 1 - Infrastructure Rehabilitation	1.1 Governance, Institutional Reformulation and Systemwide Change Management and Project Execution Unit	TBD	TBD	TBD	TBD	TBD
		1.2 Technical and Legal Review of Desal replacement	TBD	TBD	TBD	TBD	TBD
		1.3 Commercial Strengthening	TBD	TBD	TBD	TBD	TBD
	Task 2 - Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit (RSSP) Caparo	TBD	TBD	TBD	TBD	TBD	TBD
	Task 3 - Governance, Policy and Institutional Reformulation	3.1 Baseline Studies and Development of Smart Tools	TBD	TBD	TBD	TBD	TBD
		3.2 Water Distribution Network Optimization and Rehabilitation	TBD	TBD	TBD	TBD	TBD
		3.3 Universal Metering	TBD	TBD	TBD	TBD	TBD
		3.4 Existing Wellfield Assessment, Rehabilitation and Automation	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Phase II – Optimization and Maintenance.	TBD	TBD	TBD	TBD	TBD	TBD	TBD

TBD – To Be Determined

Evaluation of the CCLIP is expected to be results based and as such the following evaluation criteria should be considered.

1. Relevance - The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor.
2. Effectiveness - A measure of the extent to which an aid activity attains its objectives.
3. Efficiency measures the outputs - qualitative and quantitative – in relation to the inputs. It is an economic term which signifies that the aid uses the least costly resources possible in order to achieve the desired results.
4. Impact - The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended.
5. Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn.
6. Projects need to be environmentally as well as financially sustainable.

A process of both self-evaluation as well as independent evaluation should be considered to evaluate the CCLIP. The evaluability instruments, monitoring indicators, and evaluation instruments are essential tools to be drawn on as follows.

- (i) Evaluability instruments, that measure whether the evaluation and results proposed for a product are robust enough to be able to demonstrate results at completion of that intervention.
- (ii) Monitoring Indicators, a set of indicators that allows managing the product implementation, to ensure that activities and outputs are being generated in with expected costs and timeframe.
- (iii) Evaluation instruments, which define clear and objective metrics, analytics and processes by which to report results that can be independently validated.

The evaluation standards should also seek to determine if the performance activities were environmental and socially sustainable, it should evaluate the quality of work and the determine the efficient, equitable, and sustainable use of its human, financial and natural resources.

## 16 AREAS FOR FURTHER ASSESSMENT

In consideration that all the project details are not available for every project, the following guidance on areas for further assessment is not exhaustive.

Firstly, it is important for a full disaster risk assessment for flooding and seismic activity each to be carried out before undertaking planned activities at the RSSP reservoir.

Secondly, it is likely that the EMA will require an Environmental Impact Assessment be completed to support the application of a CEC.

Finally, once the activities are outlined for Phase II, there may be need for further assessment following the screening procedure.

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## 18 APPENDICES

### 18.3 Appendix 1 – Probabilistic Seismic Hazard Models showing the location of the RSSP

#### Probabilistic Seismic Hazard Assessment for the Eastern Caribbean Islands

A probabilistic seismic hazard analysis has been performed in order to compute probabilistic seismic hazard maps for the Eastern Caribbean region (10-19°N, 59-64°W), which includes in the north the Leeward Islands (from Anguilla to Dominica) and in the south the Windward Islands (from Martinique to Grenada), Barbados and Trinidad and Tobago. The analysis has been conducted using a standard logic tree approach which allowed taking into account systematically the model-based (i.e. epistemic) uncertainty and its influence on the computed ground motion parameters. Hazard computations have been performed using a grid of sites with a space resolution of 0.025 degrees covering the territory of the considered islands. Two different computation methodologies have been adopted: the standard Cornell (1968)-McGuire (1976) approach based on the definition of appropriate seismogenic zones and the zone-free approach developed by Woo (1996), which overcomes the ambiguities related with the definition of seismic sources. The interplay and complexities between shallow crustal, intraplate and interface subduction seismicity in the Caribbean region has been thoroughly investigated. By merging all available data set, a comprehensive and updated earthquake catalog for the region has been compiled. Also a thorough investigation has been undertaken to identify the most suitable ground motion prediction equations to be used in the analysis via comparison with strong motion recordings and compatible site-to-source distance definitions. Uniform hazard spectra have been calculated for the horizontal component of ground motion (rock and level site conditions), 4 return periods (95, 475, 975 and 2475 years) and 22 spectral accelerations with structural periods ranging from 0 to 3 s. Spectral accelerations at 0.2 s and 1.0 s for 2475 years return period have been calculated to allow the definition of seismic hazard in the region of study according to IBC (2009).

The seismic hazard maps have been peer-reviewed and being accepted for publication in the Bulletin of the Seismological Society of America within a joint collaboration project between the Seismic Research Centre at UWI, Trinidad and Tobago and the European Centre for Training and Research in Earthquake Engineering - EUCENTRE – Pavia, Italy.

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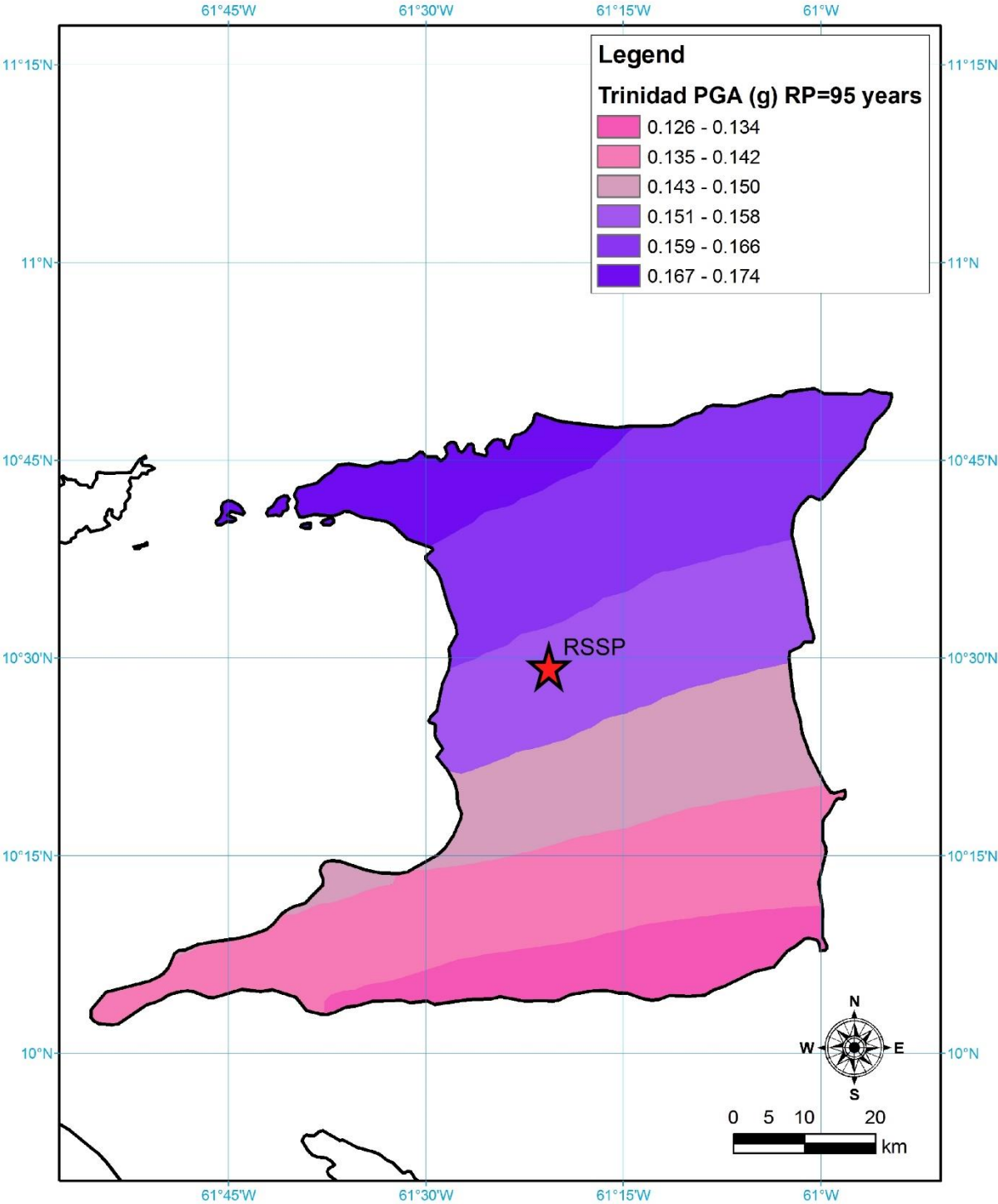
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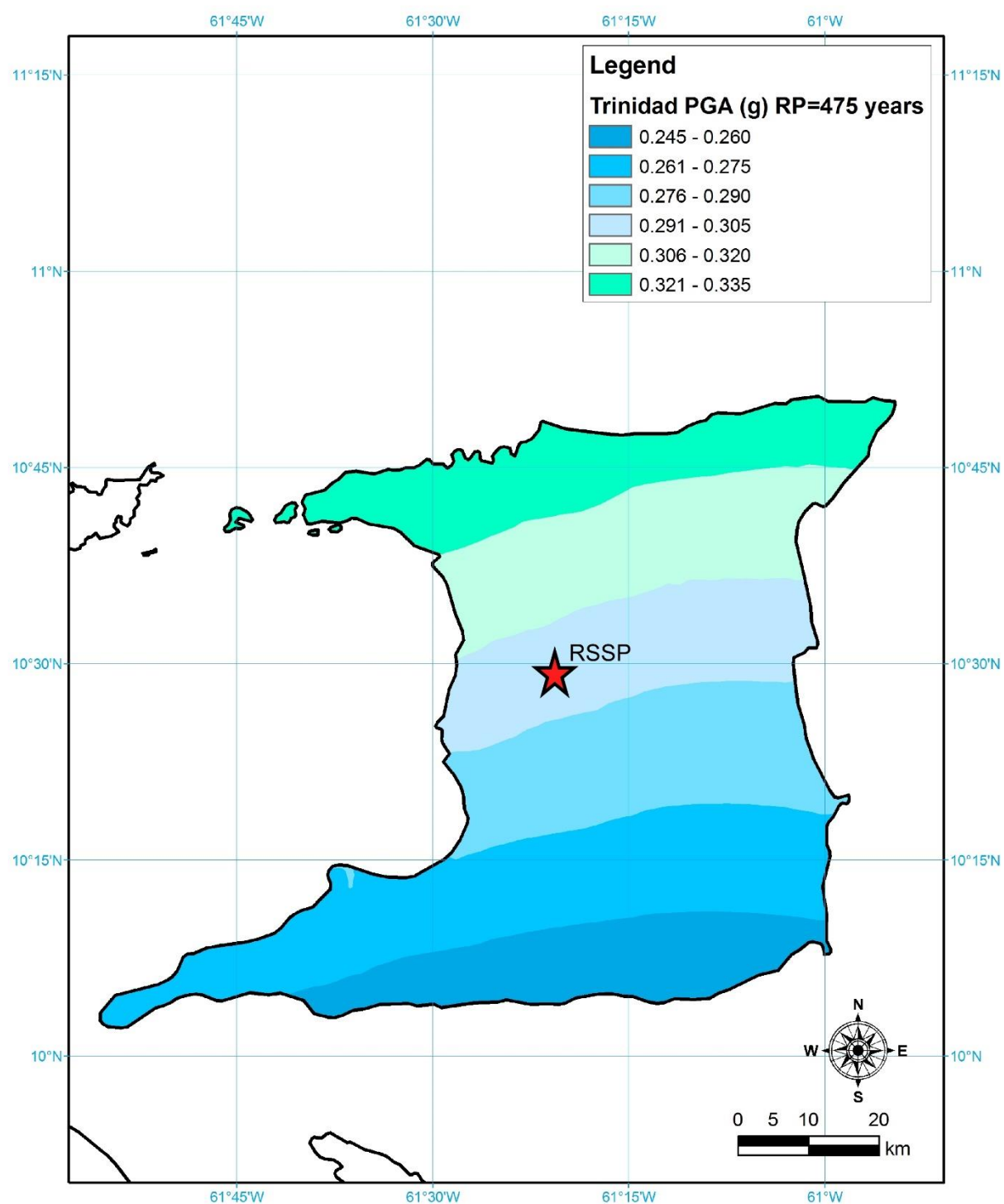
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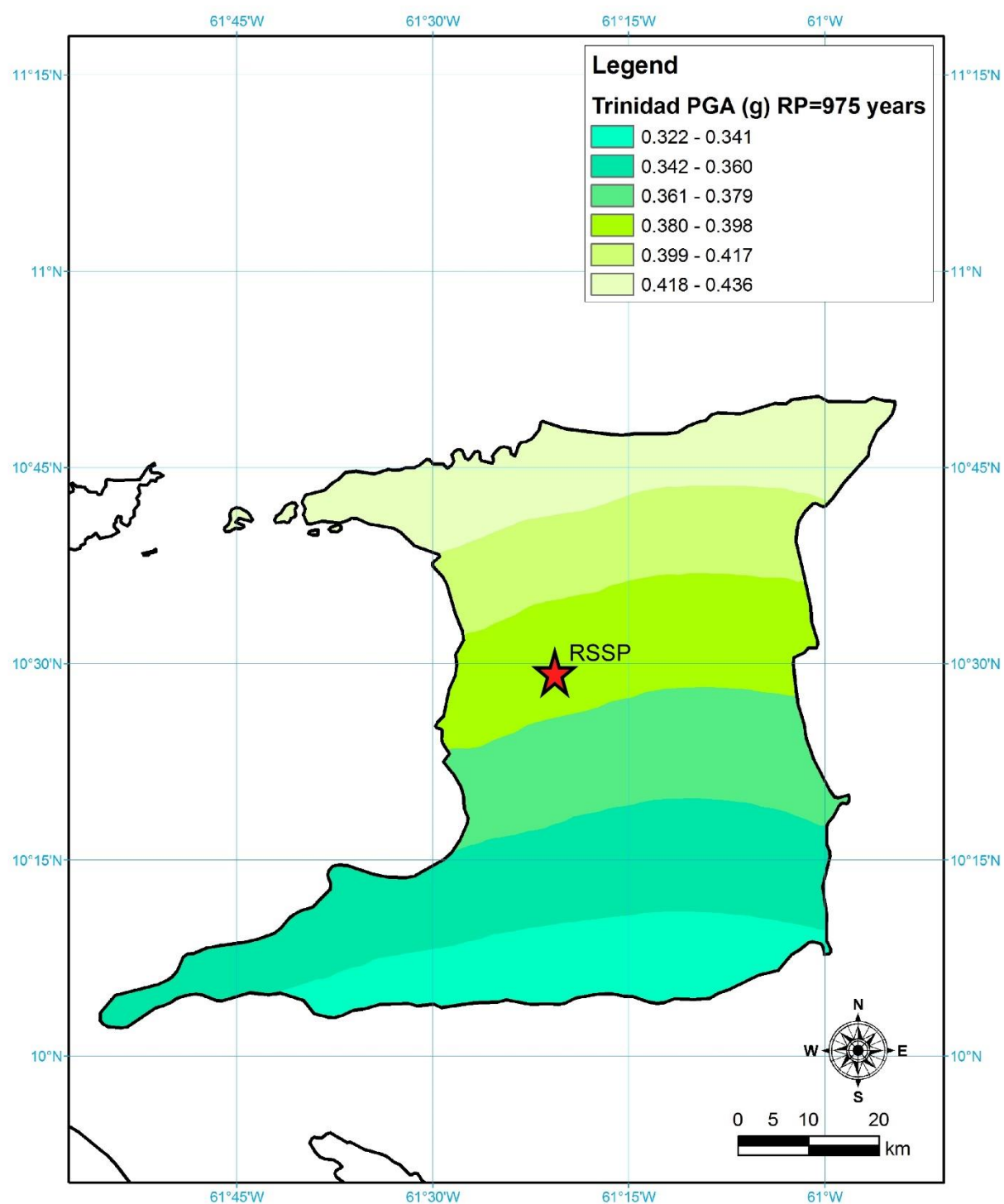
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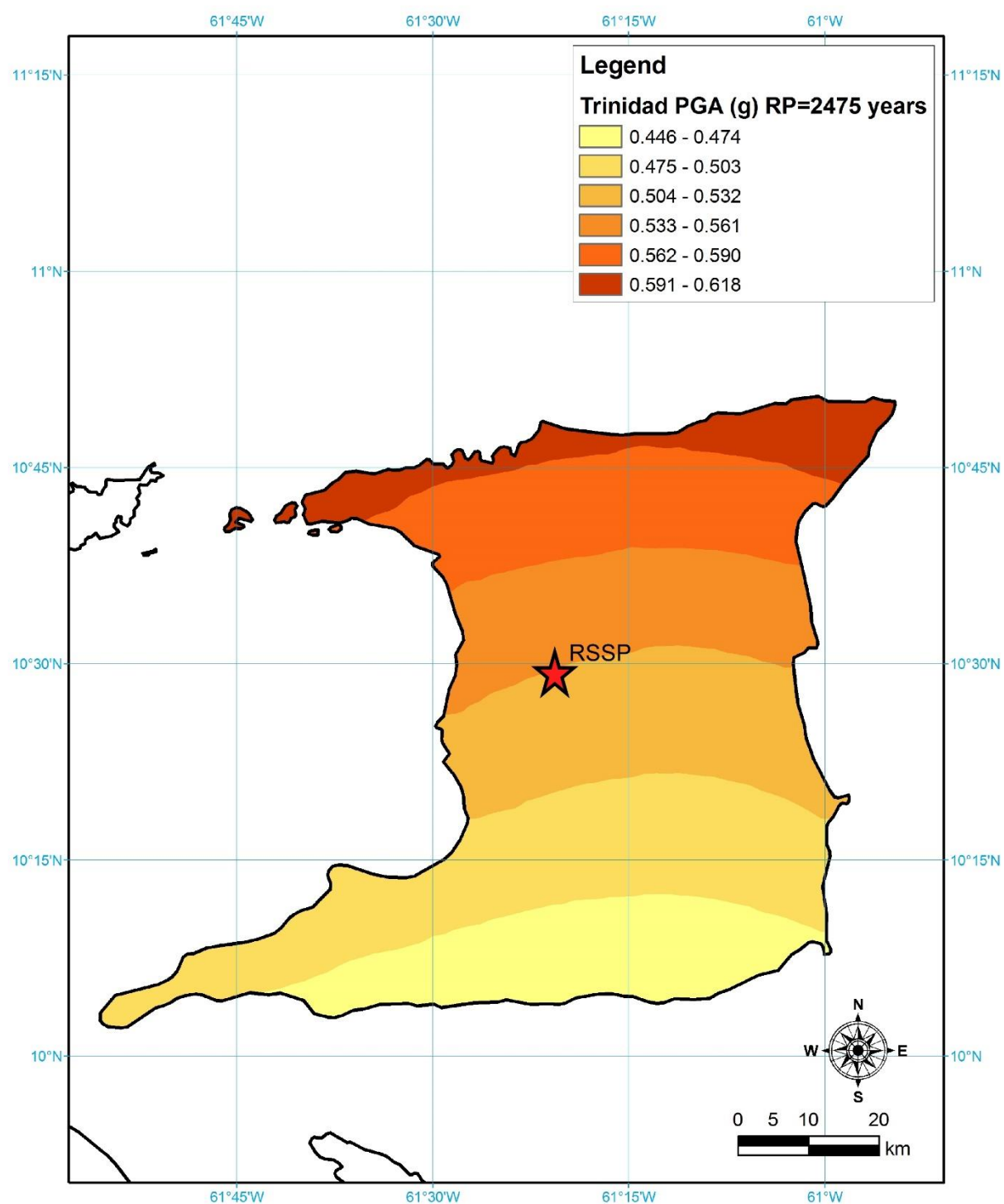


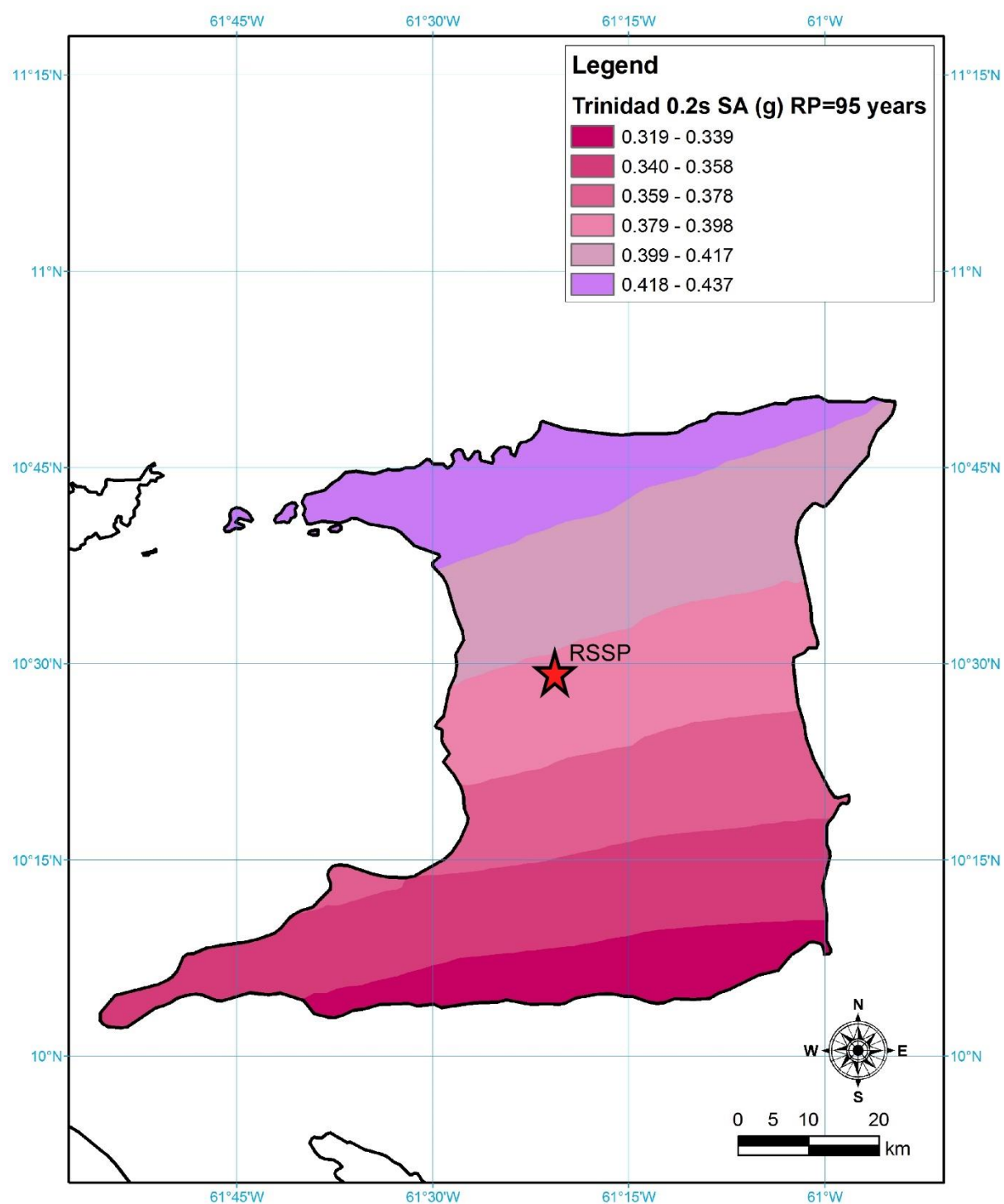


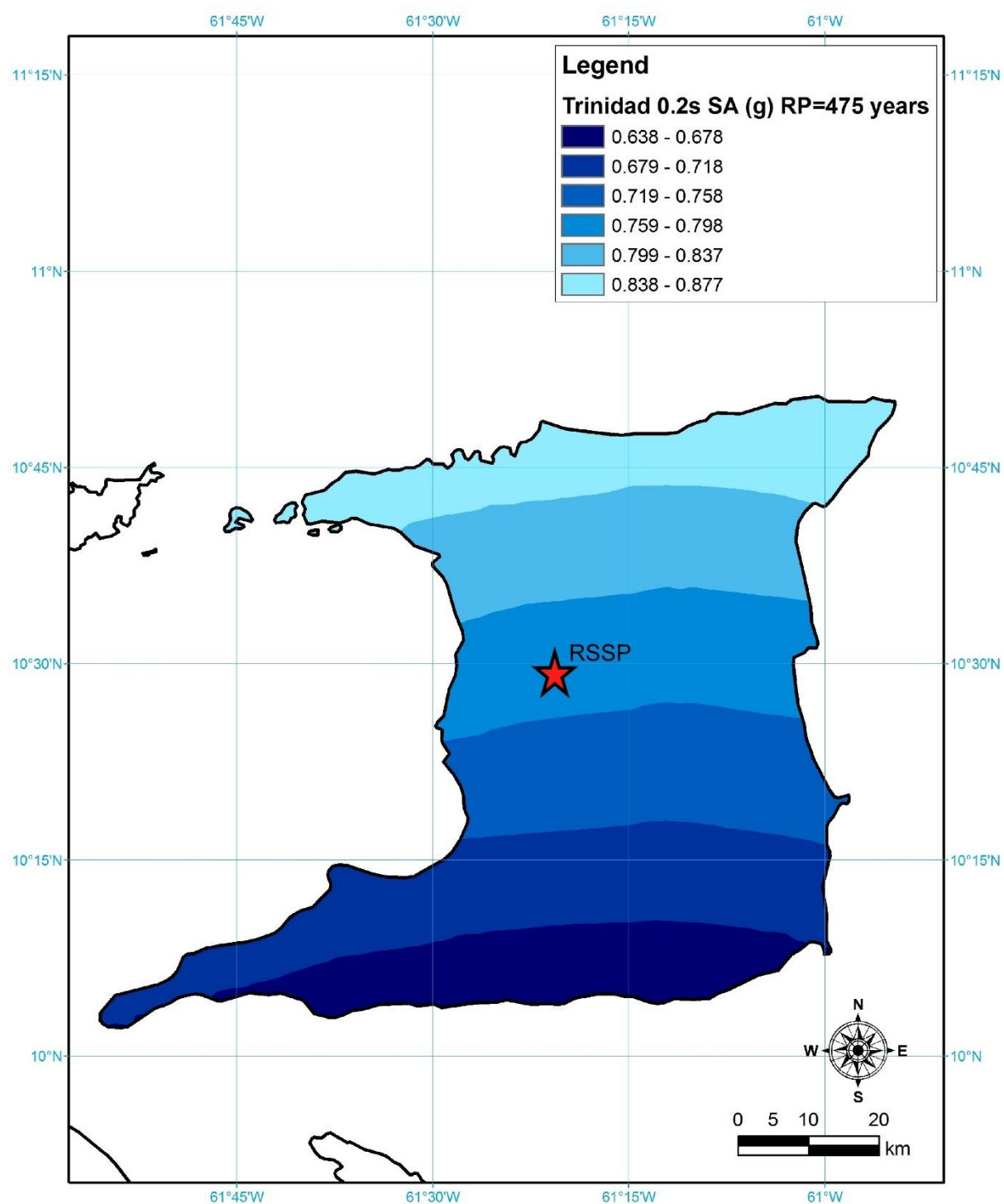


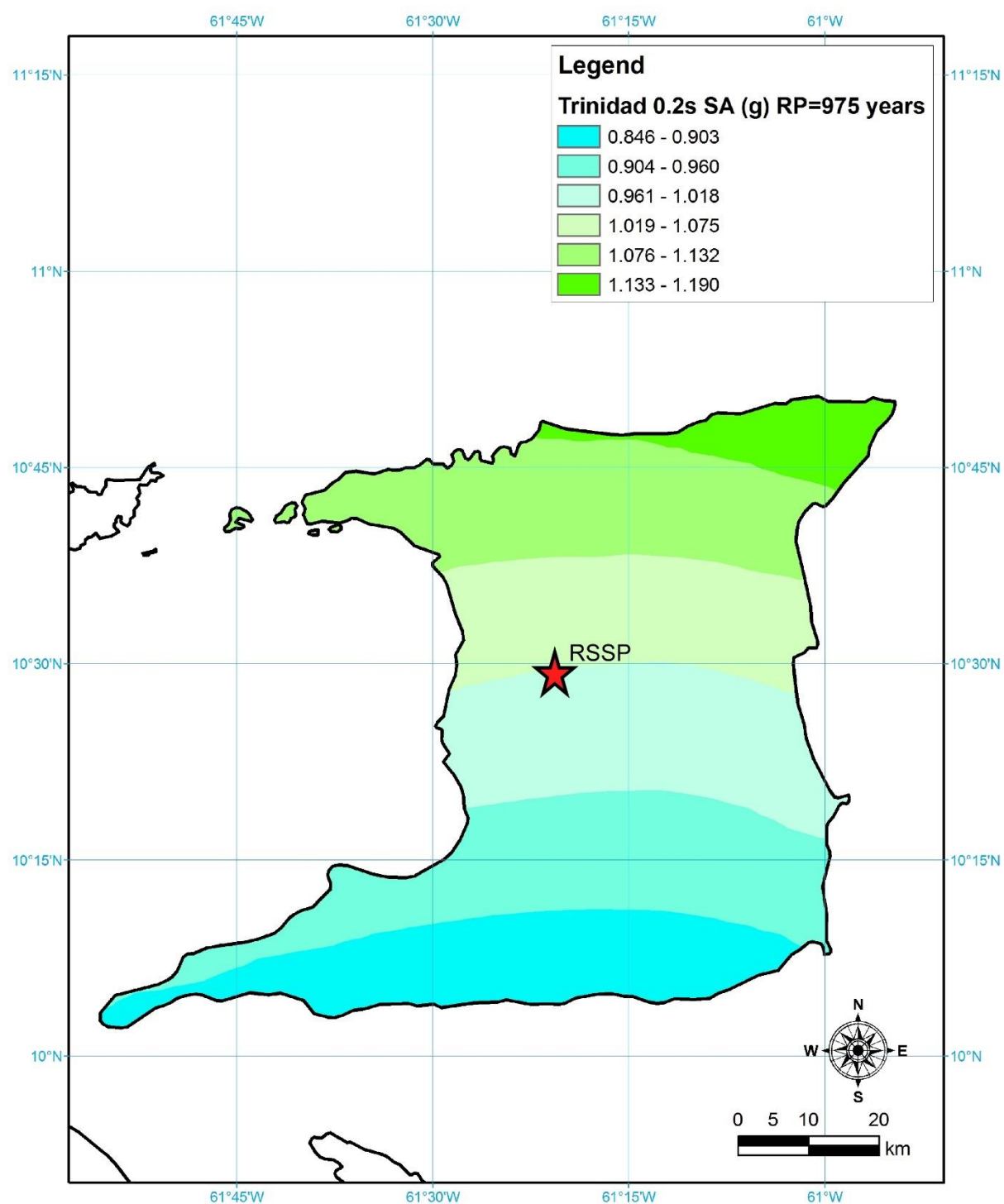


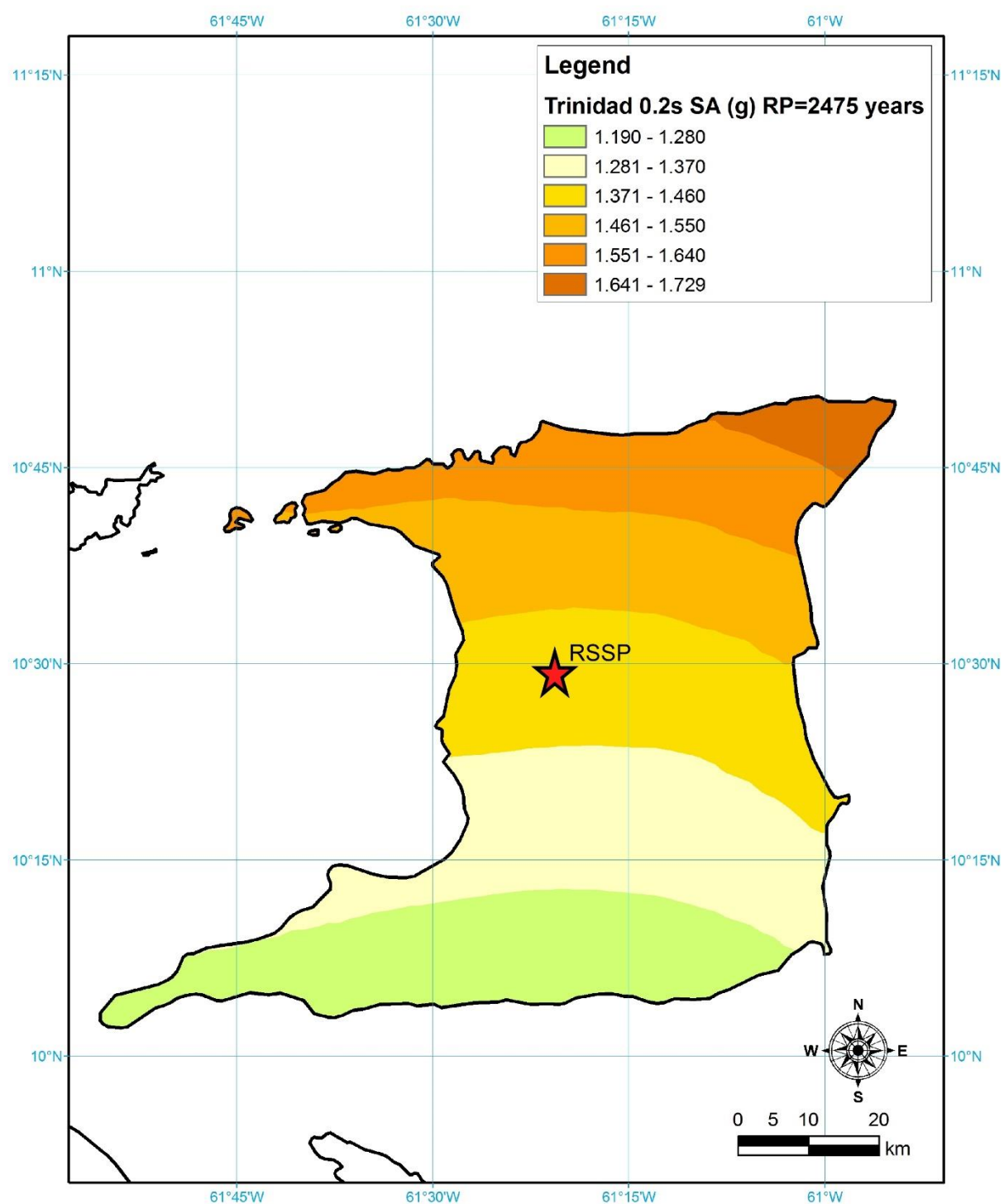


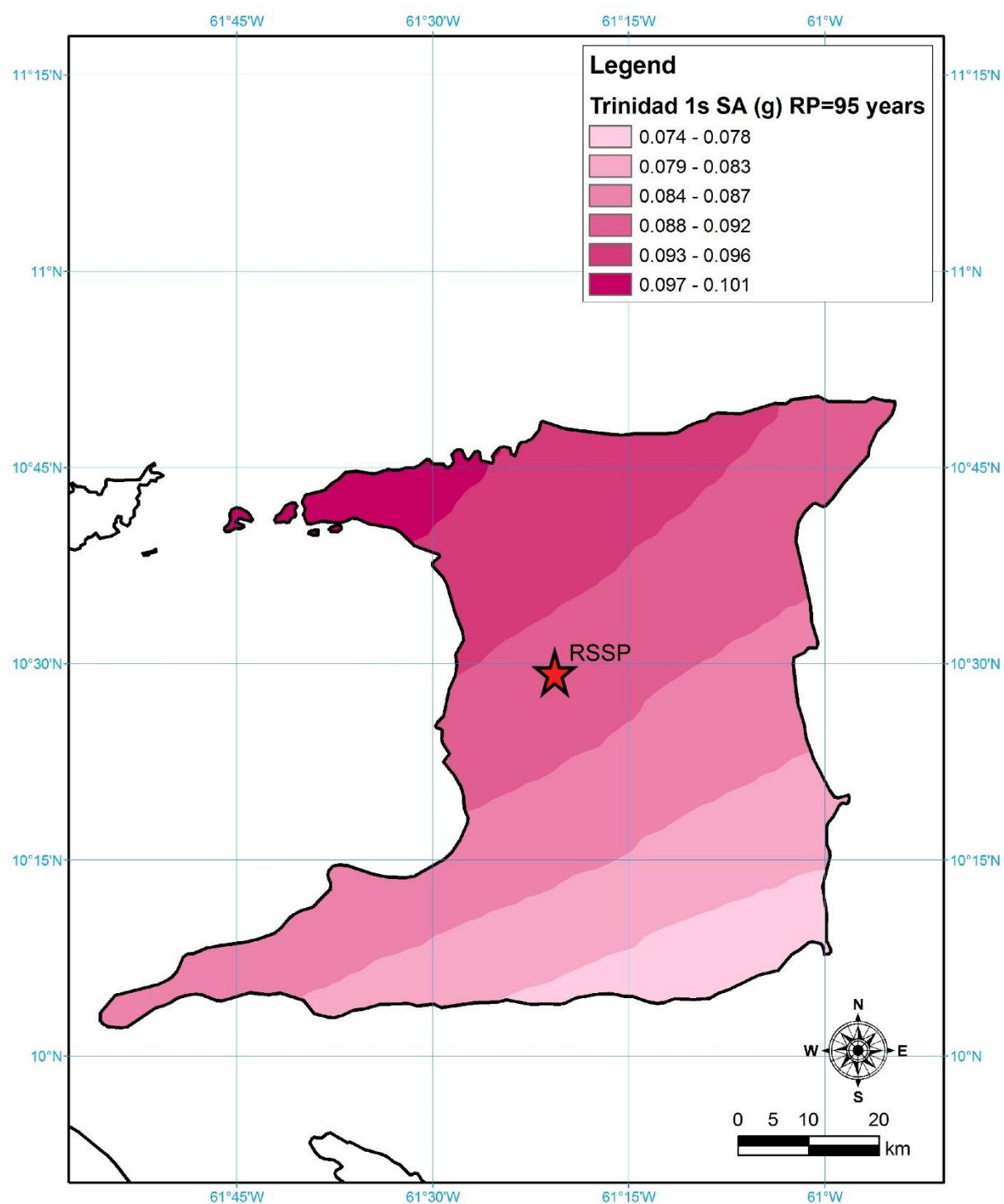


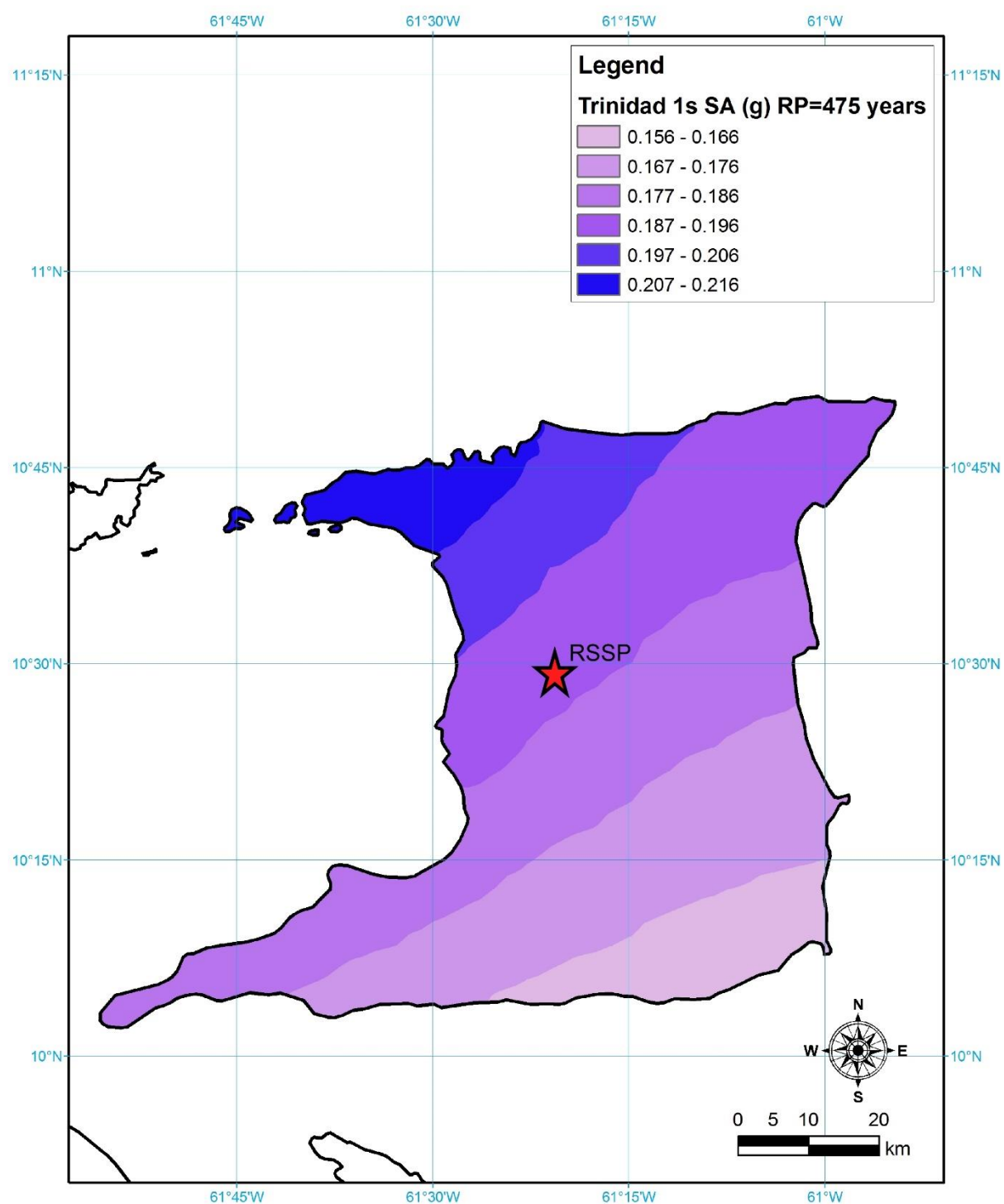




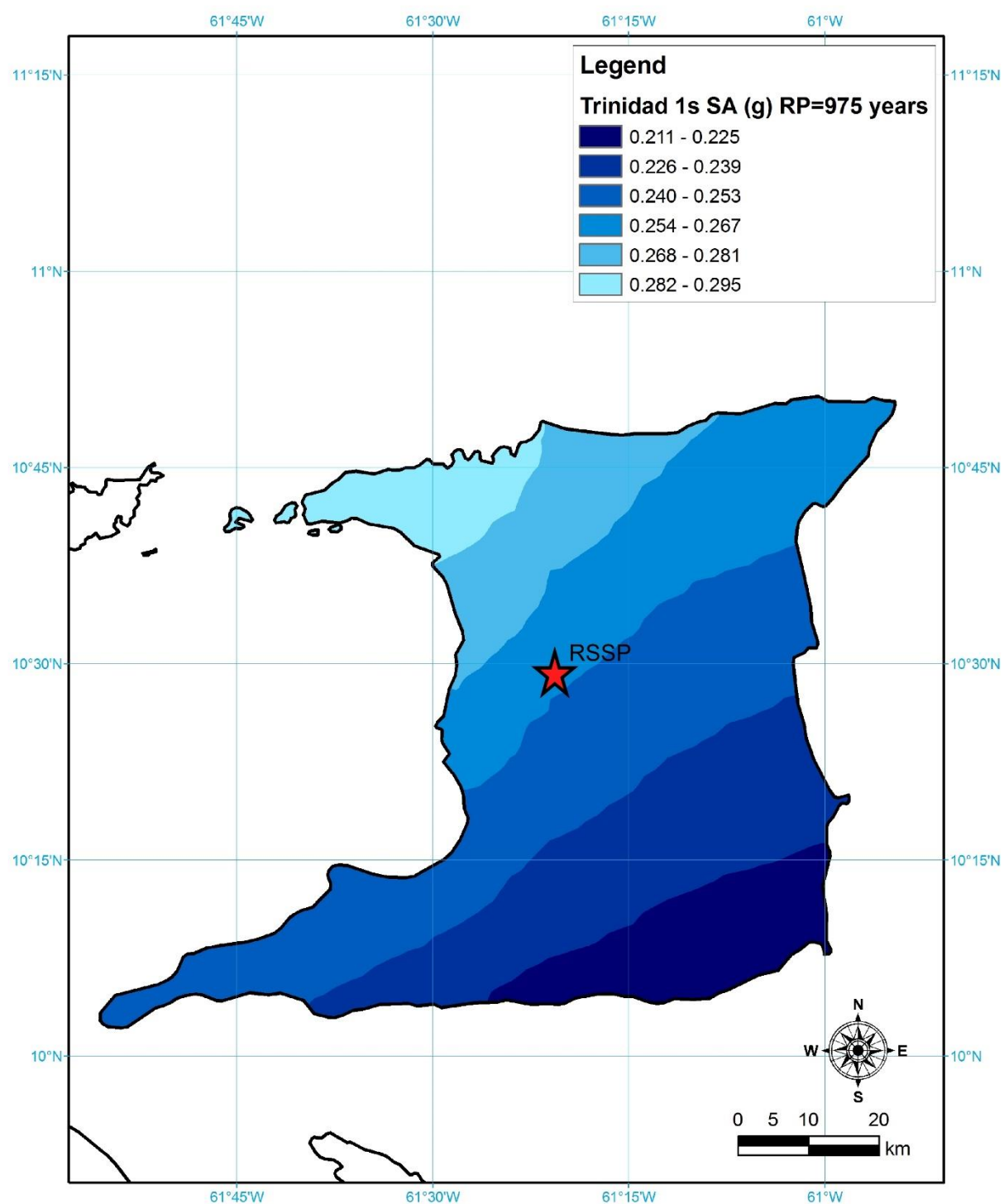


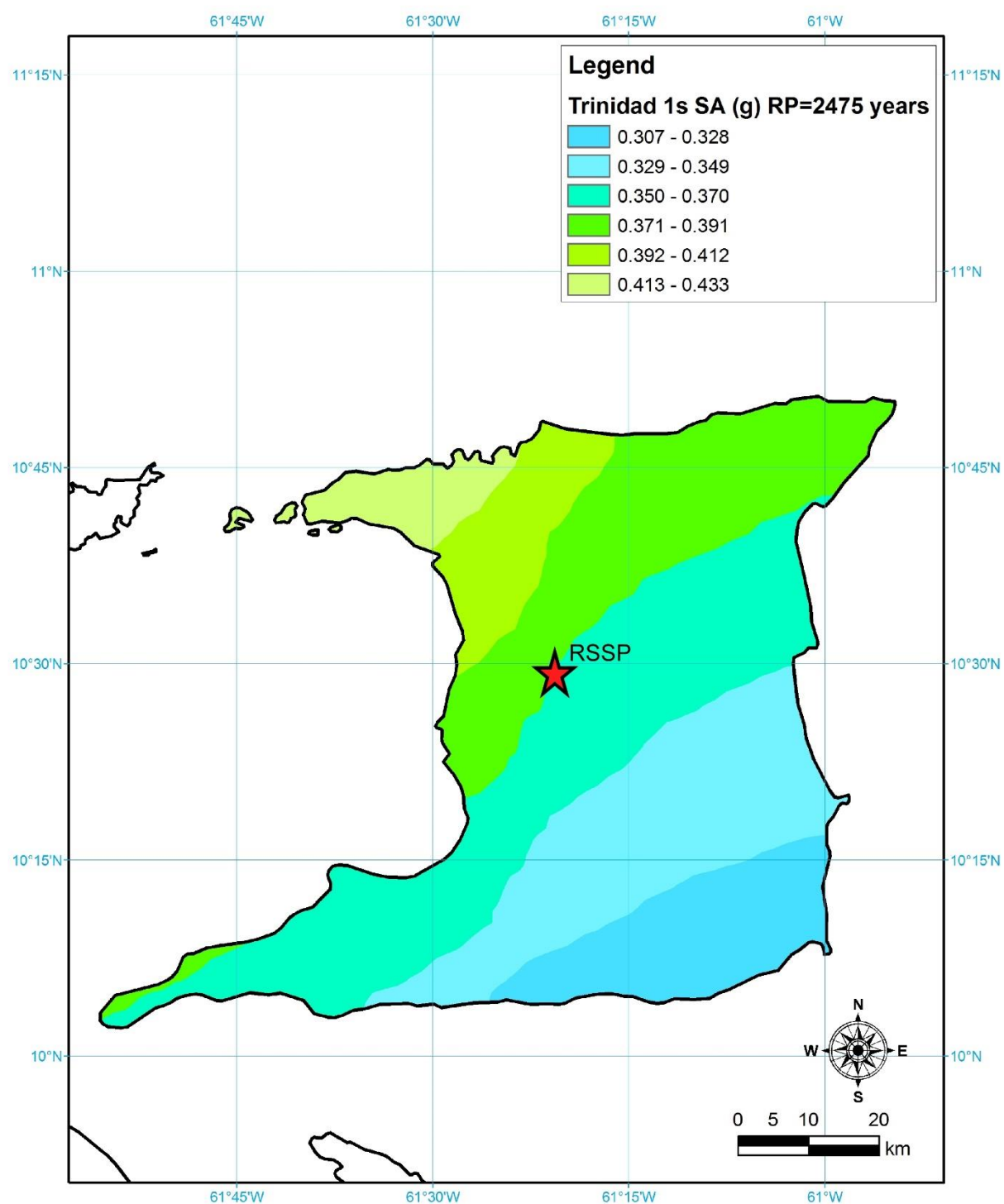












### 18.3.1 Appendix 2 1 - Grievance Collection Form

(Used by Stakeholder)

Case No. \_\_\_\_\_

Applicant's Name \_\_\_\_\_

Sex: [Male] [Female]

Age: \_\_\_\_\_

- ☐ I wish to submit complaint anonymously
- ☐ I demand that my personal details not be disclosed without my consent

Address: \_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_

Email: \_\_\_\_\_

Description of Comment/Complaint: *(Subject of case, when did it occur, location, who is involved, effects of situation)*

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date of Incident: \_\_\_\_\_

- ☐ One-time incident/complaint (date \_\_\_\_\_)
- ☐ Happened more than once (indicate how many times: \_\_\_\_\_)
- ☐ Ongoing (a currently existing problem)

According to the applicant, what measures would provide solution to the problem?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Note: Please forward this form to: Project Office - Implementing Agency

Water and Sewerage Authority

Head Office: Farm Road, St. Joseph

Trinidad and Tobago

Telephone: \_\_\_\_\_

Email: \_\_\_\_\_

### 18.3.2 Appendix 3 - Grievance Monitoring Form

(Used by Grievance Manager)

This Form is the responsibility of the Grievance Officer.

Case No. \_\_\_\_\_

Applicant's Name \_\_\_\_\_

Sex: [Male] [Female]

Age: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_

Email: \_\_\_\_\_

Complaint

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Root Cause Analysis

- List all the possible contributing factors
- Identify most probable reason

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Corrective Action

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Preventative Action if problem can re-occur

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