Government of Saint Lucia

Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Cooperatives

Disaster Vulnerability Reduction Project
(DVRP)

TERMS OF REFERENCE

FOR CONSULTING SERVICES

ASSESSMENT AND REHABILITATION OF MAJOR RIVERS IN SAINT LUCIA

January 17, 2020

Updated February 25, 2020

1. BACKGROUND

Saint Lucia is Small Island Developing State (SIDS), which faces many development challenges that include limited geographic space; an open, vulnerable economy; fragile ecosystems; limited human and institutional capacity; and vulnerability to natural phenomena, such as extreme weather and slow onset events. The onset of climate change has increased the frequency with which these hydrometeorological climatic events occur, with two extreme events (Hurricane Tomas, October 2010 and the Christmas Eve Trough, December 2013) striking the island within the last ten years.

The passage of these events caused severe damage to the environment, including widespread landslides and impacts to riparian zones throughout Saint Lucia. Riverbanks suffered significant deterioration, including erosion and landslides, trigged by the removal of riverbank vegetation by flood waters. The events also resulted in large sediment deposits and debris piles within river channels from landslides along riverbanks and upper watersheds. The sedimentation and debris piles significantly reduced the channel capacity of major rivers and streams, resulting in streams overflowing their banks and altering their normal paths. Consequently, this resulted in the flooding and inundation of low-lying lands which damaged road embankments, threatened communities, crippled the utility services and destroyed farms island wide.

In most instances, riverbanks have not recovered from these events and sediment deposits remain. The threat of climatic hazards and risks associated with landslides and flooding are exacerbated by unsound land use practices on slopes. For instance, there is persistent erosion along riverbanks due to intensive agriculture and cattle grazing near riverbanks.

There are four primary agencies involved in river management in Saint Lucia. The Forestry Division is responsible for riverbank management, the Department of Infrastructure, Ports and Energy (DIPE) is responsible for desilting and infrastructure along rivers, the Water Resources Management Agency (WRMA) is responsible for monitoring of water quality and levels, and the Fisheries Department is responsible for management of the aquatic resources in rivers. Management of landslides is spilt between Government agencies and private parties. The Forestry Division is responsible for landslides occurring in the Forest Reserve while landslides occurring on private forested lands are the responsibility of the owners (albeit with technical support provided by the Forestry Division). Finally, the Ministry of Agriculture, through its Engineering Division, provides some support to farmers whose farms or feeder roads are affected by landslides.

Although some assessments of rivers and riverbanks were conducted post Hurricane Tomas, the assessments were limited in nature and are now almost ten (10) years old. Through the Disaster Vulnerability Reduction Project (DVRP), it is anticipated that select rivers and riverbanks will be assessed to inform the development of much-needed rehabilitation plans, including watershed management measures and design of site-specific soil bioengineering[1] and agroforestry

[1] Soil Bioengineering - the use of living plant materials to construct structures that perform an engineering function (World Bank)

interventions to restore riverbanks and manage existing sediment deposits and ongoing sedimentation.

The Disaster Vulnerability Reduction Project (DVRP) aims to measurably reduce vulnerability to natural hazards and the adverse impacts of climate change in Saint Lucia. The DVRP is a Government of Saint Lucia (GoSL) project with financing from the International Development Association (IDA), the World Bank and the Climate Investment Fund (CIF). Funding from the CIF resulted as Saint Lucia has been selected as a pilot country to be part of the Climate Investment Fund's Pilot Program for Climate Resilience (PPCR) to implement climate change adaptation activities. The PPCR is designed to pilot and demonstrate ways to integrate climate risk and resilience into the core development planning of developing countries and provide incentives for scaled-up action and transformational change. Under the PPCR consultative process, Saint Lucia prepared a strategic document, the Strategic Program for Climate Resilience (SPCR), which details the priorities to be financed with PPCR funding.

To this end, disaster vulnerability reduction investments and the PPCR have been processed as a single project, given that the strategic climate adaptation programme areas identified in the SPCR are closely interwoven with the broader fabric of disaster risk reduction. The Project's (DVRP) Investment Plan therefore reflects activities identified under the SPCR, as well as disaster vulnerability reduction investments.

The Department of Economic Development, Transport and Civil Aviation is responsible for the implementation of the DVRP while the Department of Sustainable Development and the Department of Infrastructure, Ports and Energy (DIPE) provide technical support towards implementation of the Project. The Project Coordination Unit (PCU) is responsible for the fiduciary aspects of the Project.

2.0 OVERALL OBJECTIVE

The overall objectives of this consultancy are to:

1) Assess the extent of degradation (erosion, landslides, sedimentation and water quality impairment) occurring along and within select rivers, as a result of past natural disasters and ongoing anthropogenic practices;
2) Develop a Rehabilitation Plan to address riverbank erosion, landslides along riverbanks, sedimentation and water quality impairment for each river assessed using internationally accepted best practices
3) In keeping with the Rehabilitation Plan, prepare detailed designs for priority site-specific soil bioengineering and agroforestry interventions to restore assessed riverbanks using internationally accepted best practices.

3.0 SCOPE OF SERVICES

In general, the scope of services includes assessing select rivers and their banks and developing appropriate prescriptions, including management measures and site-specific physical interventions, for rehabilitation of the assessed systems. The assessment will involve a desk review, field reconnaissance and surveys, data collection, sample testing, use of GIS and remote sensing tools, and modelling. Physical interventions will include soil bioengineering and agroforestry approaches. The scope will include work along seven (7) major rivers in St. Lucia as listed in Table 1 below and mapped in **Appendix I – Figure 1**. Tributaries of the major rivers selected to not form part of the scope.

River	**Length (KM)**	**Primary Factors at Risk**
Fond D'or	19.19	Water Intake
Troumassee	19.54	Water Intake
Marquis	14.29	Water Intake
Cul de sac	19.12	Life and Property
Grand Riviere de Anse la Raye	8.1	Life and Property
Petitte Riviere de Anse la Raye	5.06	Life and Property
Choc	5.04	Life and Property

Table 1. Rivers within the scope of the consultancy services

Task 1 – Conduct Inception Mission

a) Upon commencement of the assignment, conduct an Inception Mission with the Client and relevant agency stakeholders to (i) review available data and information relevant to the assignment and identify data gaps, ii) make initial visits to the rivers within the scope, iii) discuss and agree capacity building/training opportunities for staff of key stakeholder agencies during the conduct of the assignment, and iv) based on the foregoing, update the detailed workplan. Available data generally includes land cover and land use maps, rainfall data as well as limited water quality and flow data for some rivers. LiDAR data is expected to become available in August/September 2020.

   An Inception Report, including the outcomes of the Inception Meeting, a desk review of available data and information, a training/capacity building plan, an Environmental Management Plan (EMP) for conduct of the assignment and an updated detailed workplan will be prepared by the Consultant and submitted to the Client.

   The EMP must address potential impacts outlined in the DVRP Environmental Assessment and Environmental Management Framework. In addition, the EMP must incorporate a health and safety section, in particular reference must be made to addressing snake bites, working at heights, working on unstable material and special provisions for work in the

Forest Reserve (EMF Annex 10 Item 19).[2] The EMP should include a prohibition on opening of new access roads or clearing of lands.

Task 2. Undertake an Assessment of Major Rivers

Collect the necessary data and undertake a detailed assessment of the selected major rivers and their banks to include:

a) A comprehensive hydrologic, hydraulic and biophysical profile of each river, including:
   - Cross-sectional profile (delivered in a GIS layer) of the course of each river, including the bathymetry of the river channel, through surveys at points of noticeable change in cross section along the river course and at a level of detail required to inform the required modelling, develop rehabilitation measures and satisfy all TOR requirements. Surveys should be done at least every 20m in areas of significant erosion and landslides along the river course. Landslides along each river are mapped in **Appendix 1 – Figure 2**;
   - Hydrologic and hydraulic modelling of river catchments to determine:
     i) hydrologic budgets/water balance;
     ii) recommended ecological flows based on a rapid profile of aquatic life;
     iii) peak river flows, volumes, water levels and velocities under a 1-yr, 10-yr, 25-yr, 50-yr, 100-yr and Hurricane Tomas-equivalent storm event;
     iv) Hydraulic constraints (including bridges and weirs for example)

     An uncertainty analysis shall be conducted for the hydrologic and hydraulic models.

   - Vegetation profile, including a GIS-based inventory of vegetation within the riparian zone, mapping dominant species, indicator and keystone species, endemic species, endangered species, exotic species and species important to riverbank stabilization. The profile should include a very detailed inventory of plant species in landslide areas along river courses;
   - Soil profile of the riverbank at segments experiencing moderate to severe erosion or landslides;
   - Geotechnical properties of riverbank and bed material in areas of severe erosion or landslides and where required to inform design of physical interventions;
   - Baseline water quality profile, including at minimum data on turbidity, total suspended solids, total dissolved solids, temperature, electrical conductivity, pH, dissolved oxygen, total oxidized nitrogen, phosphates and e-coli at the upper, middle and lower sections of each river and significant points where changes in water quality may be expected. If possible, efforts should be made to collect data that captures dry and wet season variation;
   - Land use and land tenure profile along the riverbank.

b) A sedimentation profile of each river course:

[2] Environmental Management Framework. Project Coordination Unit, Ministry of Finance, Economic Affairs, Planning and Social Security, 5th Floor Conway Business Centre, Waterfront, Castries, Saint Lucia

- Identify and, using GIS, map the outline of areas of significant sediment deposits (defined as deposits that may have an impact on the water course, water intakes, river ecology, coastal water quality or contribute to flooding);
- Estimate the volume of mapped sediment deposits and describe/categorize the type of sediment(s) present, including through photographic documentation;
- Describe (and quantify as possible) the potential impacts of mapped sediment deposits on the water course, water intakes, river ecology, coastal water quality and flood potential for each river assessed;
- Based on the description above, assign a level of priority for removing each significant sediment deposit
- Identify and map (using GIS) the likely major point and non-point sources of sedimentation within each watershed, including the upper watershed for each river assessed.

c) An erosion profile of the riverbanks of each river:
   - Identify and map (using GIS) areas of riverbank erosion and landslides;
   - Categorize mapped areas of erosion and landslides as minor, moderate or severe (or more detailed categories as deemed appropriate). Detailed descriptions/parameters for each category used shall be provided;
   - For moderate to severe areas of erosion and landslides, identify likely direct or indirect causes of erosion.

In conducting the assessment of major rivers and riverbanks, the Canaries River can be taken as a reference of a relatively healthy river system in Saint Lucia.

Task 3. Develop a Rehabilitation Plan for each river assessed using internationally accepted best practices

Based on the outcome of the assessment in Task 2 and consultation with the Forestry Division and other key stakeholders identified during the Inception Mission, develop a Rehabilitation Plan for Major Rivers to address riverbank erosion and landslides, sedimentation and water quality degradation.

For each river assessed, the Rehabilitation Plan should:

a) Describe the present condition and issues of the river and associated impacts

b) State the rehabilitation vision, goals, objectives and rationale

c) Recommend and describe a programme of appropriate, practical and sustainable riparian and watershed **management measures** to minimize present and future degradation of the river, including riverbank erosion and landslides along riverbanks, sedimentation and water quality degradation.

   Management measures may include but are not limited to a) forestry measures such as active reforestation or protections to allow natural regeneration, b) specific land use policy

controls (and supporting monitoring and enforcement mechanisms) such as delineation and enforcement of riparian buffer zones, c) other policy and legal tools, d) focused education and awareness campaigns and e) mixed approaches.

Proposed management measures must be specific and described at a level of detail to support immediate implementation. For instance, recommendations for reforestation should identify specific areas, species, planting densities and methodologies to be used. The Plan must explain the individual and collective merits/benefits of proposed management measures and their appropriateness in relation to the issues, impacts and characteristics (including socio-economic) of the specific river and watershed under consideration. The Plan must be supported by an Implementation Strategy suited to the local context, including proposed implementation mechanisms, institutional arrangements, timeframes and costs. The Implementation Strategy should identify and propose any policy and legislative changes needed to support the Plan. The Plan should explain how the proposed management measures would intersect with existing management measures, policies and legislation.

In determining the management measures, the consultant should familiarize themselves with the Riverbank Rehabilitation Plan of 2008/2009 by way of background information.

d) Recommend a programme of appropriate, practical and sustainable **site-specific physical interventions** to address moderate to severe areas of riverbank erosion and landslides along riverbanks within the upper and middle course of each river system. Interventions may include soil bioengineering, geotextile, agroforestry or similar interventions aimed at soil stabilization while helping to regulate water resources, restore forest hydrology, reduce vulnerability in areas subject to flooding, and improve wildlife habitats.

   The programme should include a description of the system of site-specific physical interventions recommended along each river course and conceptual designs for each proposed physical intervention. The conceptual designs should consist of a description of each proposed physical intervention including its function; design sketches; basic cost-benefit analysis; description of the pros and cons, including an initial assessment of social and environmental impact based on a screening and scoping of significant issues; and any other pertinent information required for decision makers.

   The programme shall also be supported by a GIS-based map of all proposed interventions that clearly identifies each and illustrates how the inventions are suited for the specific area and how they would work together with any other existing or proposed interventions. The programme should clearly identify priority interventions for implementation.

   The programme will serve as the basis for the selection of pilot physical interventions to be designed in detail under Task 4.

Task 4. Prepare Detailed Engineering Designs for site-specific physical interventions to restore riverbanks, using internationally accepted best environmental engineering practices

a) Based on the conceptual designs in the Rehabilitation Plan developed under Task 3, and in consultation with key agency stakeholders, select up to seven (7) priority site-specific physical interventions for development of detailed designs to serve as pilot projects for riverbank rehabilitation in St. Lucia.

b) Develop preliminary detailed designs for the selected design concepts, including detailed engineering drawings, technical specifications and Bills of Quantities (BOQs). Up to seven (7) detailed designs are to be developed.

c) Conduct an Environmental and Social Impact Assessment (ESIA) and develop an Environmental and Social Management Plan (ESMP)
   - In tandem with developing preliminary detailed designs, continue the Environment and Social Impact Assessment (ESIA) process to determine potential impacts that may occur as a result of each proposed physical intervention.
     - The Environmental and Social Impact Assessment shall be conducted in accordance with the Environmental Assessment and Environmental Management Framework (EAEMF) developed for the DVRP assessible at http://www.govt.lc/media.govt.lc/www/resources/publications/slu-emf-16mar2016.pdf. The environmental assessment part of the ESIA should describe the legal framework, physical and biological setting, potential project impacts, and measures to avoid, minimize or mitigate them. Appendix 9 of the Environmental Assessment and Environmental Management Framework (EAEMF) developed for the DVRP includes an outline for an EIA report and other information that will serve as guides for this purpose.
     - The socioeconomic part of the ESIA should clearly detail the extent of the resultant impact of the works, potential impact on private property, likelihood of displacement of livelihoods and of affected persons, potential damage to crops as well as the potential social or economic benefit, areas for possible land take for the purposes of design implementation for temporary or permanent use and to facilitate compensation for acquisition of private property. For the affected households, it should include the composition of the households in terms of gender and age (noting the children and the elderly). It should reference the Resettlement Policy Framework (RPF) developed for the DVRP.
     - The ESIA shall address health and safety aspects for workers and for the nearby communities, especially as regards access across work zones, traffic safety, and safety near excavations, trenches, and slopes.

   - Based on the findings of the ESIA, develop an Environmental Management Plan (EMP) describing mitigation measures for identified impacts. The EMP should clearly describe the mitigation measures, responsibilities, supervision arrangements, and reporting requirements for the contractor, the supervising firm,

and the PCU. Chapter 7 of the DVRP EAEMF contains guidelines on how to develop the EMP. Appendix 10 of the EAEMF contains standard mitigation measures that will be expanded upon as needed, in particular, to address specific issues related to agroforestry and bioengineering interventions. These should be mainly related to methods for temporary erosion control as the bioengineering/vegetation takes hold, as well as ensuring that the source of the plants used is appropriate (non-invasive, locally derived), and that health and safety measures are adequate for labourers.

- Based on the findings of the ESIA, develop a Resettlement Action Plan to address social impacts and resettlement needs following the requirements of the DVRP Resettlement Policy Framework updated March 2016.

d) Based on stakeholder feedback and the results of the ESIA, develop final detailed designs for each physical intervention, including final detailed engineering drawings, final technical specifications and Bills of Quantities (BOQs).

4.0 DELIVERABLES

DELIVERABLE #1 - Inception Report

Within **two (2) weeks** of the contract effectiveness, the Consultant shall submit **Deliverable #1 - Inception Report** as described under Task 1. The report should be concise.

Comments in response by the Government of Saint Lucia (GoSL), should reach the Consultant no later than two weeks after receipt of Deliverable #1.

DELIVERABLE #2 - Report on Assessment of Major Rivers

Within **twenty-two (22) weeks** of the contract effectiveness, the consultant shall submit **Deliverable #2 – Report on Assessment of Major Rivers.**

The Report shall detail activities undertaken under the assessment, methodologies used, data collected, assessment and modelling results, analysis and findings/conclusions in keeping with the requirements under Task 2. This document will be descriptive, with the necessary GIS maps, figures and tables to fully present and explain all findings.

Comments in response by the GoSL, should reach the Consultant no later than two weeks after receipt of Deliverable #2.

DELIVERABLE #3 - Rehabilitation Plan for Major Rivers

Within **thirty-two (32) weeks** of the contract effectiveness, the consultant shall submit **Deliverable #3 – Rehabilitation Plan for Major Rivers** as described under Task 3.

Comments in response by the GoSL, should reach the Consultant no later than two weeks after receipt of Deliverable #3.

DELIVERABLE #4 - Preliminary Design Report and Draft ESIA and ESMP Report

Within **forty-eight (48) weeks** of the contract effectiveness, the Consultant shall submit **Deliverable #4 - Preliminary Design Report and Draft ESIA and ESMP Report.**

The Preliminary Design Report shall include an introduction and background; summary of the problem based on the results of the assessment; description of the proposed physical interventions, including their expected function and benefits; preliminary detailed engineering drawings, technical specifications and Bills of Quantities (BOQs); and draft ESIA and ESMP reports.

The Consultant shall make a presentation of the preliminary detailed designs to all stakeholders during the week of submission. The presentation should allow for at least 25 persons to be in attendance.

Comments in response by the GoSL, should reach the Consultant no later than three (3) weeks after receipt of Deliverable #4.

DELIVERABLE #5 - Final Design Report and ESIA and ESMP Report

Within **fifty-five (55) weeks** of the contract effectiveness, the Consultant shall submit **Deliverable #5 – Final Design Report and ESIA and ESMP Report**.

The Consultant will revise the Preliminary Design Report, including detailed engineering drawings, technical specifications, Bills of Quantities (BOQs), ESIA and ESMP based on the comments received from the Client to produce the Final Design Report.

The Final Design Report should also include a summary of the activities carried under the consultancy, outputs, challenges faced and recommended next steps.

Comments in response by the GoSL, should reach the Consultant no later than two weeks after receipt of Deliverable #5.

DELIVERABLE #6 - Assessment Database

Within **fifty-five (55) weeks** of the contract effectiveness, the Consultant shall submit **Deliverable #6 – Assessment Database**.

All data collected, used or generated in relation to the assessment and the ESIA must be georeferenced where possible and collated in a well-organized geodatabase and other suitable databases for delivery to the Client. Each dataset must have accompanying metadata and attribute data and links to any site photos taken. All spatial data collected during this assignment must be guided by **Appendix II**.

Comments in response by the GoSL, should reach the Consultant no later than two weeks after receipt of Deliverable #6

5.0 REPORTING

All reports shall be submitted electronically in English in Microsoft Word and PDF format. The first submission of each Deliverable is considered a draft. Client comments on each Deliverable must be submitted to the Consultant within two weeks of submission of each Deliverable unless otherwise stated. The final version of each Deliverable addressing Client comments must be submitted within two weeks of receipt of Client comments.

In addition to electronic copies, two (2) printed copies of each final approved report shall be submitted. All reports, documents and data collected relevant to the Consultant's services shall become the property of the Government of Saint Lucia. All project data collected, used or generated should be georeferenced and collated in a well-organized geodatabase in keeping with the guidance provided at Appendix II and submitted to the Client.

6.0 WORKING ARRANGEMENTS AND LOGISTICS

The Client is the Saint Lucia Forestry Division within the Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Cooperatives. The Client is responsible for supervising the contract and in so doing the Client will:

a) Ensure timely review of reports submitted by the Consultant and facilitate the provision of feedback within two weeks of receipt of reports, unless otherwise stated.

b) Initiate the consultation and cooperation of other agencies required to provide support to the Consultant for realization of the relevant aspects of the assignment.

c) Facilitate permissions for access to sites for field study.

d) Provide access to relevant existing information, including relevant GIS data, in a timely manner.

The Consultant will:

a) Execute the tasks outlined in Section 3 above with due diligence and efficiency and in accordance with the highest standards of professional competence, ethics and integrity.

b) Be responsible for the collection and analysis of all data and information required for the timely completion of the assignment.

c) Submit reports and plans within the stipulated timeframes stated in the Terms of Reference for review by the Client. All reports must be submitted in soft copy (Microsoft Word and PDF) and at least two (2) print copies of all final accepted reports provided.

d) Submit all underlying datasets and source files used in the consultancy in agreed formats. Source files for all engineering drawings must be provided in AutoCAD DWG format.

e) Be responsible for the provision of software, equipment, materials and transportation required to undertake the consultancy.

f) Provide opportunities for staff members of the Forestry Division and other stakeholder agencies to shadow and participate in the assessment for purposes of oversight and capacity building/training. Detailed arrangements will be determined during the Inception Meeting.

g) Execute the services in accordance with the laws, customs and practices of Saint Lucia and use the appropriate international/regional standards for preparation of technical information.

6.0 DURATION

The Consultancy shall be conducted over a period not more than 13.5 months (59 weeks). The person-months for the team of experts is expected to not exceed 30 person-months.

7.0 QUALIFICATIONS

In general, the Consultant shall have:

- At least 10 years of experience in the areas of river, riverbank and slope stabilization assessments; river and riverbank rehabilitation; and landslide rehabilitation and management.
- At least one successfully completed similar assignment during the past 10 years; that is, an assignment involving assessment of rivers, hydrologic or hydraulic modelling, and rehabilitation of rivers, riverbanks and landslides using soil bioengineering or agroforestry approaches.
- Experience in small island developing states (SIDS) and the Caribbean region would be an advantage.

The Consultant will be required to provide a team of experts that will provide the skills mix required for the scope of services presented above, including:

Lead Consultant:

- Master's degree in the discipline of Environment, Forestry, Natural Resource Management, Environmental Engineering, Geology or Geotechnical Engineering
- At least 5 years of working experience as a team leader or technical advisor in projects related to terrestrial or aquatic ecosystem rehabilitation and slope stabilization management
- At least 5 years of experience in managing projects
- Hands on experience in management of land and river rehabilitation through bioengineering techniques
- Demonstrated experience in developing and implementing watershed management measures
- Fluency in the English language

Other Professional Requirements:

Geotechnical Engineer

- Bachelor's degree in Geotechnical Engineering
- Not less than 7 years of professional work experience as a geotechnical engineer
- Demonstrated experience in slope and embankment assessment and stabilization, including using soil bioengineering and agroforestry approaches
- Experience specific to the Caribbean would be an asset
- Fluency in the English language

Environmental Engineer

- Bachelor's degree in Environmental Engineering

- Not less than 5 years of professional work experience as an Environmental Engineer
- Demonstrated experience in designing river and riverbank rehabilitation and sediment control interventions
- Demonstrated experience in slope and embankment assessment and stabilization, including using soil bioengineering and agroforestry approaches
- Demonstrated experience in developing and implementing watershed management measures
- Demonstrated experience in conducting environmental and social impact assessments, including determining impact on livelihoods, potential resettlement requirements and other social impacts
- Experience specific to the Caribbean would be an asset
- Fluency in the English language

Hydrologist / Water Engineer

- Master's degree in Hydrology, Hydraulics or a closely related field
- Not less than 5 years of professional work experience as a Hydrologist / Water Engineer
- Previous experience undertaking hydrologic and hydraulic modeling
- A record of involvement in previous river and riverbank assessment exercises
- Experience specific to the Caribbean would be an asset
- Fluency in the English language

Ecologist

- Bachelor's degree in Ecology, Biology, Forestry, Natural Resource Management or a related field
- Not less than 5 years of professional work experience in their respective field of professional endeavor
- A record of involvement in previous river and riverbank assessment exercises
- Experience in identifying native and exotic plant and aquatic species in a tropical environment. Experience specific to the Caribbean or Saint Lucia would be an asset.
- Knowledge of vegetative types and natural plant associations as a function of site-specific edaphic factors
- Knowledge of ecosystem requirements, in particular base flows, to support various aquatic species
- Demonstrated experience in developing and implementing watershed management measures
- Experience in soil bioengineering applications, including making recommendations of suitable plant species for the purpose of land stabilization, biodiversity conservation, soil and water conservation; and livelihood support.
- Experience in river rehabilitation processes

GIS Specialist

- A minimum of a bachelor's degree in the field of Geographic Information Systems (GIS) or a bachelor's degree in related field (such as Geology) with certification in GIS.
- Not less than 5 years of professional work experience as a GIS professional.

- A track record of involvement in previous riverbank assessment and slope stabilization exercises would be an asset.

APPENDIX I

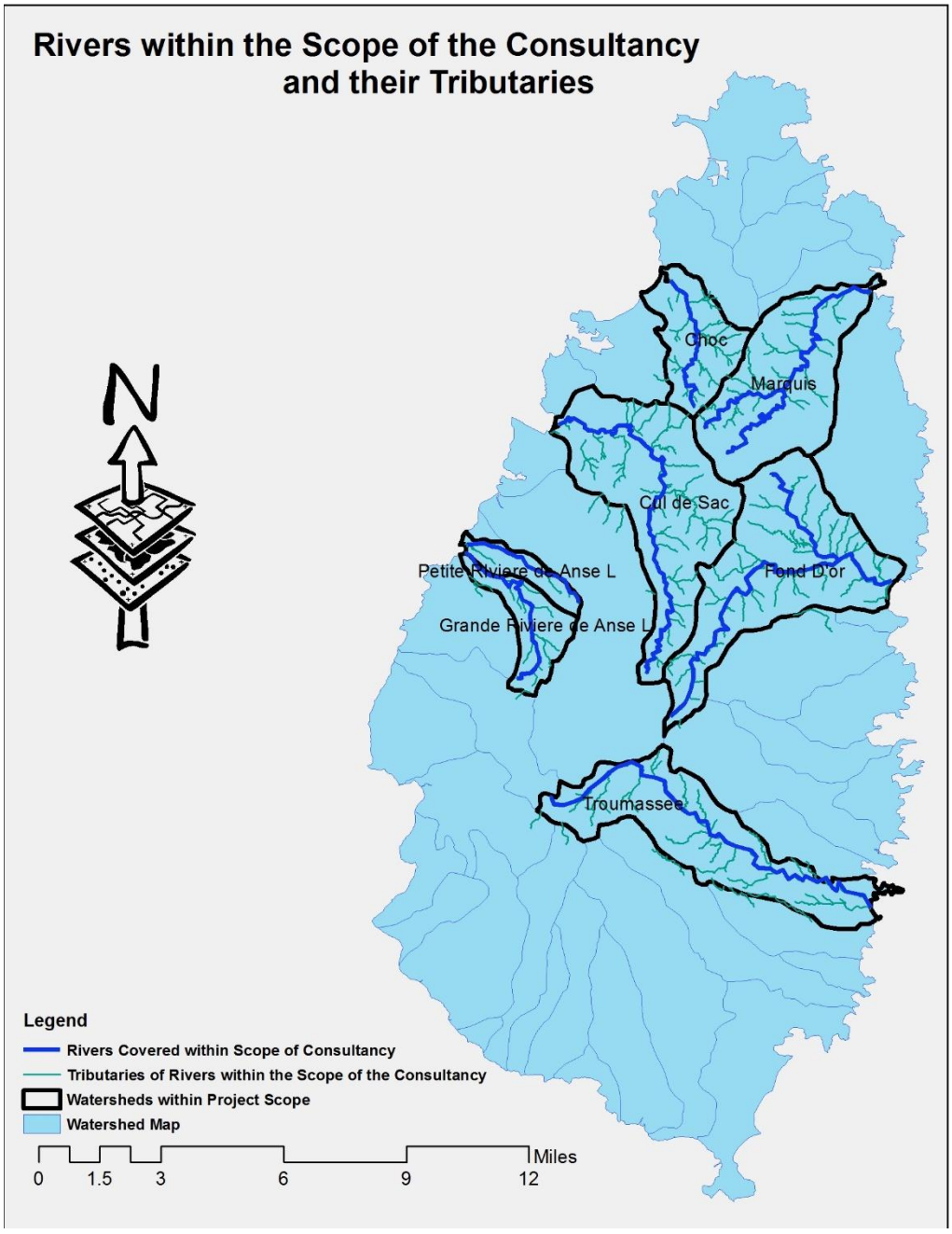

Figure 1. Major Rivers in St. Lucia within the Scope of the Consultancy and their Tributaries.

Note: Tributaries/streams do not form part of the scope of the assessment. The watershed boundaries are indicated in black outline.

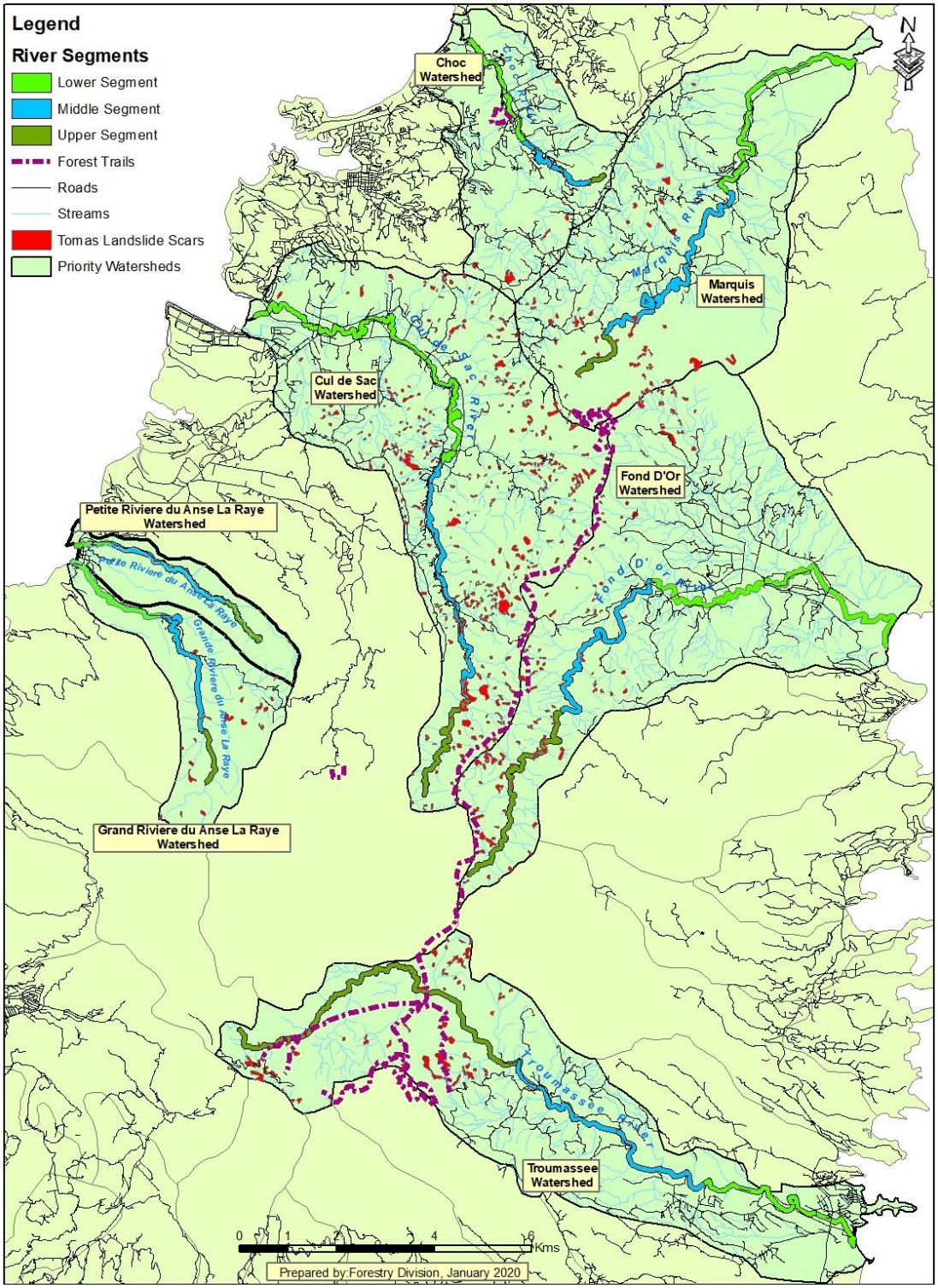

Figure 2. Landslides along the course of Major Rivers in St. Lucia within the Scope of the Consultancy

APPENDIX II

Terms of Geospatial Data Delivery and Sharing

Freely accessible data and analysis is a core component of this project. Therefore, all geospatial data collected and created by project activities must be preserved, consolidated and transferred to the Government of Saint Lucia upon project completion, in a well-known or standard electronic format. Specifically, the following terms apply:

Licensing: All data procured and developed for this project is done on behalf of the Government of Saint and therefore all licensing agreements must be made similarly. In keeping with the World Bank commitment to open data, it is recommended that this license be under Creative Commons CC-BY-SA where possible and appropriate. See: http://creativecommons.org/licenses/by-sa/2.0/ for more detail.

Vector data: Geospatial vector data must be converted into a standard OGC format or well-known format and must be compatible to Saint Lucia's existing data format, geo-referenced with each theme on a different layer. This list includes, but is not limited to, shape file format. Additional formats may be delivered with prior approval and in consultation with the Ministry of Physical Development, Housing and Urban Renewal (MPDHUD). All files must include projection parameters and must be done to Saint Lucia 1955 British West Indies Grid and WGS84 in consultation with the Survey and Mapping Unit, MPDHUD. Vector data must adhere to topological standards.

All CAD files should be in AutoCAD DWG format, the version of the file format shall be discussed and decided with the MPDHUD

Raster data: Geospatial raster data must be converted into a standard OGC or well-known format and must be geo-referenced and compatible to Saint Lucia's existing data format. Data formats include, but is not limited to, GeoTiff format. Additional formats may be delivered with prior approval. All files must include projection parameters and must be done to Saint Lucia 1955 British West Indies Grid and WGS84 in consultation with the Survey and Mapping Unit, MPDHUD.

Tabular data: Tabular data must be converted into a readily accessible or well-known format. This list includes, but is not limited to, CSV, tab delimited text file, or spreadsheet. Additional formats may be delivered with prior approval.

Media/method of transfer: All data sets must be transferred on media such as a flash drive, hard drive or solid-state drive, as agreed by the Government of Saint Lucia.

Metadata: Detailed documentation needs to be provided for each data set. This metadata must include description, source, and contact, spatial and attribute keywords, date, accuracy, restrictions. A description of attributes should to be provided for vector and tabular data sets. Spatial data must include details of projection. Metadata should conform to ISO Metadata standards and consistent with standards used with ESRI software such as ARCGIS. Ministry of

Physical Development, Housing and Urban Renewal must be consulted to maintain consistency in map scales, resolution and projection in Saint Lucia's context.

Derived data: All derived data generated for this project belongs to the Government of Saint Lucia and must be transferred under these terms.

Periodic updates: Ongoing updates of this data during the project made by the selected consultant must be provided as they are created.

Disposal of data: The selected firm is free to maintain copies of data collected and developed in this project, without conflicting the terms of any license agreements. Ownership remains with, and must be stated as, the Government of Saint Lucia. Further data sharing is only permissible with approval of the Government of Saint Lucia and only if the data is made available free of cost.