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**Trinidad and Tobago Solid Waste management Company**

**Terms of Reference**

**WASTE QUANTIFICATION, CHARACTERIZATION AND CENTROID STUDY FOR TRINIDAD**

# 1.0 BACKGROUND

The Trinidad and Tobago Solid Waste Management Company (SWMCOL) is a wholly-owned state enterprise that was established on June 30, 1980, pursuant to a Cabinet decision to implement the Solid Waste Master Plan, 1980. To this end, SWMCOL was mandated with the responsibility for the management, collection, treatment, disposal of solid waste in Trinidad and Tobago. SWMCOL’s Mission is to provide integrated and environmentally-sound waste management solutions that promotes maximization of resource value and a culture of care for the environment. SWMCOL’s Vision is to lead the attainment of environmentally responsible waste management and be the preferred service provider in Trinidad and Tobago.

The Trinidad Solid Waste Management Program Waste Characterization and Centroid Study conducted in 2010, indicated that approximately 700,000 tonnes of waste is generated anually, 95% of which is disposed of in our landfills. The Beetham & Guanapo Landfills currently managed by SWMCOL have exceeded available capacity for landfilling and from an environmental standpoint, are at a critical phase. In this regard, and for continual fulfillment of its mandate, SWMCOL needed to designate a site that caters for the nation’s future needs regarding a sustainable, engineered sanitary landfill. Moreover, this designated site would cater for leachate collection and treatment; passive landfill gas collection; and environmental monitoring and control systems, characteristic of modernized landfills, to bridge the environmental gap between present and future landfill design, construction and monitoring & maintenance.

SWMCOL undertook a Landfill siting study conducted by Marshall Macklin Monaghan Limited in the year 2000. This study identified the Forres Park Landfill as the most feasible location for the engineered landfill site envisaged as the future of solid waste disposal & integrated waste management in Trinidad. The centroid study conducted in 2010 positioned Forres Park within the centroid for waste generation in Trinidad which further enforced the recommendation of the Landfill Siting study conducted in 2000.

The information received from this study will be the basis to undertake the necessary technical, financial, environmental, social, legal and institutional analysis required to complete the final designs for the Engineered Landfill at Forres Park.

# 2.0 Objectives

To ensure the continued development of its mandate to manage, collect, treat and dispose of solid waste, SWMCOL is conducting the necessary preliminary analysis and studies to facilitate the successful design of an Engineered Municipal Solid Waste (MSW) Landfill at Forres Park. The Forres Park Landfill was indicated in two studies to be the most suitable location for an engineered landfill based on geographic location, land availability and soil characteristics.

SWMCOL is seeking to engage an individual / company, hereinafter referred to as the Consultant to conduct a Waste Quantification, Characterisation and Centroid Study. Information obtained from these studies will assist in planning how to reduce waste, set up recycling programmes and maximize recovery of resources. In that connection, it should be noted that the new engineered landfill will be the foundation of the integrated sustainable solid waste management system, which over the medium term will include an appropriate level of materials recovery, a network of transfer stations, composting and other suitable recovery mechanisms. Accordingly, the following services are required:

* Characterize the composition and quantity of Municipal Solid Waste (MSW) generated from the source as well as impounded at SWMCOL’s Material Recovery Facilities (MRFs) and the three (3) landfills in Trinidad managed by SWMCOL – Beetham, Guanapo and Forres Park – as well as the Guapo Disposal Site, Point Fortin which is managed by the Point Fortin Regional Corporation.
* Determine per capita MSW generation for Trinidad an Tobago
* Determine Waste Source Areas (WSAs) based on waste generation rates and patterns.
* Determine any variations in the Solid Waste streams within a year to be projected over a 20-year period.
* Determine Waste Centroid (WC) locations utilizing sound technical, socio-economic, financial and environmental considerations and develop robust criteria and sound proposals for siting Transfer Stations (TSs)/Material Recovery Facilities (MRFs) and drop off depots.
* Assess the inventory, status condition and existing capacity for current MSW recycle programs in Trinidad as well as prices and markets for recyclables.
* Identify, quantify and discuss opportunities in T&T for diversion of SW from the landfill through reduction, source separation, recycle and recovery techniques, feasible for a minimum twenty (20) year period given demographic and other relevant criteria changes.

The Consultant is therefore invited to submit a detailed proposal illustrating the intended **methodologies, sampling and statistical analysis, resources and project management plan inclusive of detailed costing** of services in order to achieve not only the aforementioned “Objectives” but additionally the Scope Of Services and Intended Deliverables that will be outlined further in the document.

# 3.0 Scope of Works

The scope of works entails the conduction of comprehensive waste characterization and centroid study of the various municipal solid waste streams generated at the source as well as those entering the Beetham, Forres Park, Guanapo & Guapo Landfills and various MRFs within Trinidad. This information will be used to develop conceptual and final designs which include but are not limited to the following:

* Review of existing data inclusive of relevant studies, proposals and reports concerning solid waste management particularly in Trinidad & Tobago. The source agencies to obtain this data may include the Environmental Management Authority (EMA), Ministry of Planning and Development (MPD), the Ministry of Rural Development and Local Government, SWMCOL and any other relevant organizations,
* Preparation of baseline data on waste characterisation and centroid studies for non-objection by SWMCOL showing the following;
	+ Proposed base maps of Trinidad and Tobago to be used in shaping the collection zones, and waste source areas based on demographic data of population density and road networks in various Municipal Corporations
	+ Procedure to be utilised in determining the feasibility of waste combination or waste source separation areas or a combination of facilities around Trinidad and Tobago,
	+ Procedure to be utilised for the characterization and classification of waste streams in Trinidad and Tobago,
	+ Proposed timeframes to be utilised to collect data on waste streams,
	+ Statistical procedure to be utilised for the sampling and determining the quantification and classification of waste streams at households, disposal sites and Material Recovery Facilities (MRFs)
	+ Models to be utilised to analyse existing and proposed collection routes and collection frequencies from information collected.
* Determination and projection over a 20-year period of demographic data on the location and distribution of the population within the various Municipal Corporations Develop base maps of Trinidad and Tobago to be used in the shaping of collection zones, waste source areas and centroid locations for a 20-year period.
* Review of the road network to identify and determine the shortest travel distances to the closest current and proposed material recovery facilities, transfer stations or disposal facility,
* Determination of waste source areas and centroids within Trinidad and Tobago to be used in the estimation for the locations of TSs and MRFs based on availability of land space and suitability of waste treatment facilities to co-exist with surrounding land usage.
* Determination of the types of municipal solid waste generated in Trinidad and Tobago, including but not limited recyclable and non-recyclable waste from residential, institutional, commercial and industrial sources.
* Analysis and quantification of the solid waste streams generated at households as well as waste streams deposited at the disposal sites and MRFs during specific peak and non-peak times and periods over 12 months to ascertain the characteristics in terms of types, volumes and weight. The waste to be analysed should include but not limited to waste from residential, institutional, commercial, industrial and construction & demolition sources
* Estimation of the average daily, monthly, yearly as well as projects and special periods quantities of waste generated in Trinidad and Tobago over a 12-month period.
* Quantification in terms of types, volumes, mass and characteristics of solid waste from source separated recycling and recovery programs from both public and private enterprises in terms of but not limited to waste types, quantities, locations, communities/groups and their demographic sectors, markets and specifications,
* Recommendations on the type, sizes and characteristics required for the MRFs, TSs and proposed engineered landfill.

## 3.1 Scope of Services

The activities required entail the following:

* To conduct desktop studies by reviewing existing data, studies or reports from source agencies such as SWMCOL, Environmental Management Authority (EMA), Ministry of Local Government (MoLG), Ministry of Planning and Development (MPD) and other relevant agencies. This data should include but not limited to the following;
	+ Conceptual report, design and schematic drawings,
	+ Trinidad Solid Waste Management Program Waste Characterization and Centroid Study (2010),
	+ Solid Waste Management Strategic Plans for Trinidad and Tobago (2017),
	+ Integrated Solid Waste Management Policy for Trinidad and Tobago (2013),
	+ National Waste Recycling Policy (2015),
	+ Trinidad and Tobago National Environment Policy (2018),
	+ The Environmental Management (Amendment) Bill (2020),
	+ The Beverage Container Deposit Refund System Legislations (2020)
	+ Data from the Central Statistical Office (CSO) on population trends and their demographic distributions,
	+ Topographical data from the Lands and Surveys Division of the Ministry of Agriculture Lands and Fisheries,
	+ Waste collection routes and waste collection frequency data from the Municipal Corporations and SWMCOL.
* Use of base maps to subdivide the country into waste source areas, based on but not limited to waste generation patterns, population densities and municipal boundaries for further determination of waste centroids in each area or combination of areas,
* To determining the feasibility of setting up waste consolidation, source separation or a combination of these activities in specific areas over a 20-year period based on
	+ Population densities and proposed growth rates,
	+ Waste composition,
	+ Waste generation patterns,
	+ Waste collection frequency,
	+ Waste collection routes and
	+ Other relevant data,
* To determine quantities and locations of waste centroids within each waste sources areas using sound technical, socio-economic, financial and environmental considerations.
* To determine the most feasible waste collection frequency and routes per waste source area based on the proposed location of waste centroids,
* To categorise the recyclable and non-recyclable municipal solid waste (MSW) streams by types inclusive of but not limited to:
	+ Residential,
	+ Institutional,
	+ Commercial,
	+ Industrial and
	+ Construction & Demolition,
* To conduct sampling, weighing and classifications of solid waste streams over a one-year period at households as well as waste entering the Beetham, Forres Park, Guanapo & Guapo Landfills and MRFs considering peak and non-peak periods. These periods must include the following;
	+ Divali,
	+ Christmas,
	+ Carnival,
	+ Easter
	+ Special Projects/Events and
	+ A minimum of two (2) non-peak periods, preferably in wet and dry season.
* To estimate quantities and composition of waste stream generation rates for Trinidad and Tobago by waste source area for a 20-year period given demographic and other relevant criteria changes,
* To identify opportunities in Trinidad and Tobago for diversion of solid waste from landfill through reduction, source separation, recovery and recycling techniques which would be feasible for a twenty (20) year period given demographic, commodity market and other relevant criteria changes.

# 4.0 Deliverables

The Consultant shall undertake the relevant studies over a twelve (12) month period with data being collected strategically to capture variances in waste generation patterns during the wet and dry seasons.

The Consultant shall provide the following:

* A Waste Characterisation and Centroid Study proposal for non-objection by SWMCOL prior to the commencement of works which should include but not be limited to
	+ Recommendations on the data required to be reviewed or obtained,
	+ Recommendations on the most effective timeframes to determine peak and non-peak periods that will be required to conduct the waste characterisations at the households, landfill and MRFs,
	+ Procedure to be utilised for the collection of the data required for the waste characterisation from residential as well as ICI sources and at the disposal sites,
	+ Procedure to be utilised for the collection of demographic data to determine the waste source areas and centroid development,
	+ Models to be utilised to analyse the information collected to determine the location of the TSs and MRFs facilities, and number and capacity of transfer trailers required to service the transfer stations/MRFs;
	+ Gaps identified if any to formulate the data for the waste quantification and characterization as well as the centroid development.
* Mapping and modelling of data for Trinidad clearly delineating the road network and settlements within each Municipal Cooperation Boundary to determine
	+ Most efficient routes for waste collection services and number and type of collection vehicles in each Municipal Corporations,
	+ Waste collection frequency and zones within each Municipal Cooperation, and also the need for communal storage bins, if required;
	+ Patterns for waste haulage based on terrain and accessibility.
* Waste centroid study report projected over a 20-year period indicating the feasibility of source separation of waste, waste combination facility, waste separation facility or combinations of the facilities in Trinidad and Tobago. The report should include but not be limited to;
	+ Location of the proposed facilities based on existing conditions, location of waste source areas, accessibility, socio-economic conditions, environmental conditions etc,
	+ Type, size and conceptual designs of the recommended facilities.
* Waste quantification and characterization report for recycling and disposal in Trinidad and Tobago which is to be provided to a 95% level of confidence This information should include but no be limited to;
	+ Information on total tonnage estimated during each peak and non-peak period at each disposal site and MRF,
	+ Information of total annual tonnage of waste received at each disposal site and MRFs,
	+ Information on annual tonnage of waste streams collected in Trinidad and Tobago. These waste streams should include but not be limited to
		- Paper
			* Clean uncoated corrugated including Kraft and lineboard
			* High grade paper (white ledger paper, manila or stationary grade paper and other Office paper)
			* Newspaper
			* Textbooks
			* Magazines
			* Phonebooks
			* Mixed paper (low grade recyclable paper e.g. books, catalogues construction paper and glossy coated paper)
			* Soiled paper that would be recyclable if clean
			* Other non-recyclable mixed paper (clean, non-tissue, no beverage container).
		- Beverage Containers inclusive of but not limited to
			* Clear and coloured (blue, green, black, other) PET containers
			* Clear and coloured (blue, green, black, other) HDPE containers
			* Clear and coloured (blue, green, brown other) Glass
			* Tetra Packs
			* Aluminium Cans
			* Metal (Tin/Steel) Cans
		- Plastics
			* Non-Beverage Container Recyclables - #1 to #7,
			* Mixed plastics
		- Yard Waste
			* Grass
			* Leaves
			* Brush/Pruning’s
			* Branches and stumps
		- Organic Waste
			* Compostable food
			* Non-Compostable Food,
			* Manures large quantities from domestic farms etc
			* Textiles (made with thread) e.g. Clothes, fabric, yarn etc
			* Other textiles e.g. carpets
			* Miscellaneous/Composite Organic e.g., diapers, feminine hygiene products, small wood products, agricultural crop residue, animal faeces from small household pets etc
		- Glass
			* Non-beverage Container Clear and Coloured (green brown, other) recyclable glass bottles and containers,
			* Other non-recyclable glass e.g., flat, pressed and blown glass materials, mirrors, light bulbs etc.
		- Metals
			* Tin/steel cans (non-beverage container) e.g. canned foods, paint, spray cans etc
			* Aluminium cans (non-beverage container) e.g. Pet food and meat cans,
			* White waste (not electronics) e.g. major appliances
			* Ferrous metals (non-tin/metal cans) e.g. Clothes hangers, steel beams, stainless steel cookware etc
			* Other non-ferrous e.g. aluminium foil, aluminium window frames, brass pipes, copper wire etc
			* Remainder/Composite/Bi-metals metal (non-electronic appliances) e.g. toasters, hair dryers, insulated wire etc
		- Waste Electrical and Electronic Equipment/ E-waste
			* Large and small household appliances e.g. large cooling appliances, refrigerators, wash machines and dryers' vacuum cleaners, toasters etc,
			* IT and Telecommunication equipment e.g. personal computers, laptops, notebooks and notepad computers, printers, calculators etc.,
			* Consumer Equipment and Photovoltaic Panels e.g. television sets, radio sets, video cameras etc,
			* Lighting Equipment e.g. Non household luminaries for fluorescent lamps, straight and compact fluorescent lamps low pressure sodium lamps etc
			* Electrical and Electronic Tools (non-large scale) stationary industrial tools) e.g., drills, saws, sewing machines
			* Medical Devices e.g. Radiotherapy cardiology and dialysis equipment, lab equipment etc,
			* Monitoring and Control Instruments e.g., smoke detectors heating regulators thermostats etc
			* Automatic Dispensers e.g. Automatic dispensers for hot, cold drinks, solid products and money etc,
		- Construction and Demolition Waste e.g. Concrete, paving, wood, pallets, structural steel and high tensile and low tensile steel, rock, gypsum, etc
		- Household Hazardous Waste
			* Paint/Solvent/Fuel
			* Batteries (both dry cell, rechargeable and lead acid) e.g. Car batteries, flashlight, small appliance etc,
			* Healthcare Waste
			* Used Oil e.g. lubricating oils such as crankcase, transmission, gear and hydraulic oil.
			* Remainder/ Composite Household Hazardous e.g. pesticides caustic cleaners, thermometers, sharps etc
		- In-organic non-hazardous
	+ Determination of bulk density per waste stream categorization listed above.
	+ Estimation of an overall Municipal Solid Waste (MSW) bulk densities for Trinidad and Tobago as well as estimation of bulk densities from residential as well as industrial, commercial & institutional (ICI) and construction & demolition sources.
	+ Overall moisture content of the MSW.
	+ Overall calorific value of Municipal Solid Waste (MSW)
	+ Overall C/N ratio
	+ Projection of waste quantities by type generated in Trinidad and Tobago over a 20-year period.
	+ Projection of waste quantities to be disposed of at the proposed final disposal site if waste separation and waste recycling efforts are achieved.
	+ Recommendations on the type and size of engineered landfill required at Forres Park for a 20-year period with and without various percentages of achievable waste diversion practices.
* Notes, Sample Calculations and Information pertinent to the project.

Draft reports should be submitted after each sampling events for information and review by SWMCOL. A first draft of the Final Report will be submitted to SWMCOL within one (1) month of completion of the project. SWMCOL will review and return to the Consultant within one (1) month for the completion of the Final Report.

# 5.0 Schedule and Methodology

The Consultant must submit a methodology detailing how and when all investigations will be conducted, including the intended methodologies to be employed in conducting the relevant desk studies. The Project Plan should highlight time schedules in the form of a Gantt Chart for the following:

* Mobilization and demobilization
* Desktop Studies or Feasibility Reports
* Field Work/Testing
* Analysis
* Interim Reports
* Submission of Final Report

Manpower and resources to be deployed for the various elements of the job should be submitted.

The Consultant will supply a Field Procedural Manual summarising planned field operation. This document will detail the procedures for conducting the on-site work. It should include the specific procedures to gather samples, sorting, weighing of trucks and samples, data recording and analysis of type of samples in a standard statistically sound manner.

The Consultant will be required to make amendments to the waste characterisation and centroid study report, if necessary, within two (2) weeks of receiving official instruction from SWMCOL. The Consultant should note that amendments are required to any report shall not result in delays in the schedule or any additional costs to SWMCOL,

Key personnel and their responsibilities are to be identified such as: Site Coordinator, Site Supervisors and site sorters, as well as, general safety procedures, hazards and protective equipment.

Survey forms are to be developed to capture all necessary data inclusive of the respective landfill in use, the truck registration number, the tare mass, the loaded mass, the origin of the collected waste [and the estimated number of persons generating the MSW] and the time in and out of the landfill.

All project deliverables must be submitted within fifteen months (15) after the initiation of the project.

Equipment Listing

Consultant must indicate in their proposal the type and number of equipment inclusive of accessories and facilities they intend to use to facilitate the works. The equipment must be in good working condition during the period of the contract. Valid calibration certificates must also be submitted for each equipment.

The Consultant is responsible for the testing and verification for accuracy of all equipment prior to and during the proposed service period.

If the operations are producing unsatisfactory results, or delayed due to any fault of the equipment, the Client has the right to instruct the Consultant to replace a part or all the equipment and operations at the Consultant’s cost.

# 6.0 Cost Proposal

The cost proposal should be in form of a Bill of Quantities (BOQ) with the following headings Tasks, Duration in days, Rate and Total Cost. The proposal should be quoted in Trinidad and Tobago dollars. The rates developed should include the cost for rain-off or stand down days as no consideration will be given to the Consultant for time lost due to standby occasioned by equipment breakdown or inclement weather.

The cost proposal should highlight each of the major items as indicated in the Scope of Works for example;

* Preliminary investigations
* Mobilization & Demobilization
* Field Works
* Testing
* Calculations and report generation

The proposal should also cost for as separate line items for any additional works inclusive but not limited to the following:

* Quality Assurance and Quality Control,
* Health Safety and the Environment,
* Security Cost,
* Material,
* Supervision,
* Consumables,
* Miscellaneous etc.

A comprehensive payment schedule and preliminary budget should also be submitted within this proposal.

# 7.0 Consultant Requirements.

Company Profile

The Consultant must submit the following;

* Company Profile inclusive of
	+ Company’s Registered Address
	+ Telephone Contact
	+ Mobile Contact of principle person(s) including principle directors, principle site staff, etc.
	+ Company email address
	+ Company Incorporation Certificate
	+ VAT Registration Number
	+ Company Organizational Structure
	+ Workmen’s compensation
	+ NIS Certificate
* Past Projects
	+ A listing of past projects undertaken by the company within the last ten (10) years relevant to the proposed project
* Recommendations of References
	+ Recommendations or references from a minimum of two (2) companies for whom similar studies were undertaken.
* Company Curriculum Vitae

Project Team

The Consultant must provide a project specific organizational chart showing the reporting relationship within the project team.

It is expected that the core specialist inputs will include but are not limited to the following disciplines:

* Natural Science
* Environmental Science / Environmental Management
* Environmental Engineering/ Civil Engineering / Chemical Engineering
* Waste Specialist
* Population Specialist
* Land use Planner
* Statistician
* Information Technology

The signed and dated curriculum vitae for all pertinent members of the project team must be submitted.