United Nations Industrial Development Organization

TERMS OF REFERENCE
For Contracts for Services and Work

ARCHITECTURAL AND ENGINEERING SERVICES

ARROWROOT INDUSTRY MODERNIZATION PROJECT
ORANGE HILL
ST. VINCENT AND THE GRENADINES

SAP 180198

DECEMBER 2019

1. General Background Information

St. Vincent and the Grenadines possesses significant knowledge economies in arrowroot, having a long history of production and export, dating as far back as the mid 1800's. Arrowroot has established significant socio-economic importance in the north-eastern and northern coastal areas of St. Vincent, providing a livelihood for many farming families. It possesses favorable characteristics of high resilience to natural disasters, pests, and disease, making it highly suitable to the agro-climatic conditions of the country. The economic benefit of the commodity is very concentrated in the indigenous communities. In 2016, over 90% of the EC$1.9 million earned went directly to approximately 140 families of small producers and factory workers more than half of which are women.

Since 2012, the production of arrowroot starch has gradually increased from 27,000 lbs to its present output level of 101,000 lbs which is significantly below the industry's highest peak in 1962 of 4 million lbs. There is a resurgence that comes on the back of a series of incentives such as price increases paid to farmers which has encouraged them to cultivate fallowed land. The price of starch increased from EC$0.35/lb. to EC$0.50/lb in 2012 and up to EC$1.00/lb in 2013 and has remained at 2013 prices. It is expected that prices will be maintained as genuine St. Vincent Arrowroot starch is recognized among industry players as a premium product.

Arrowroot starch is the highest valued exported commodity of St. Vincent and the Grenadines (SVG), and, is well-positioned to contribute to boosting SVG's low terms of trade, a key ingredient for economic growth especially for a small developing island state with a small economy.
The starch is sold for US dollar 7.50/lb, about 28 % of the retail price in the United States (US) market. Presently, there is demand for SVG starch from three (3) buyers in the US market. The market for the product is large, especially given increasing global demand for gluten-free products. Additional demands exist in Europe, Caribbean Community (CARICOM), Martinique, and the domestic market.

It is the favorable characteristics of the crop and market opportunities that drive the Government of St. Vincent and the Grenadines (GoSVG) towards modernizing the industry. Two (2) recent comprehensive studies: "A Review of the Status of SVG Arrowroot Industry" prepared by GoSVG and "Arrowroot Industry: Market, Technology and Food Safety/Quality Compliance Assessment" prepared by the International Trade Centre (ITC) through financing by the Caribbean Development Bank (CDB) have provided a comprehensive assessment of the industry and market opportunities for the commodity.

The Government and industry stakeholders have recognized that the current arrowroot processing facilities are inefficient to support the proposed planned production and meet the USDA and European requirements. The sole processing plant is obsolete and experiences frequent mechanical breakdowns (and extended down-time) due to difficulty sourcing replacement parts for dated machinery and equipment. Arrowroot starch is a food product, and as such, compliance with international food safety systems is critical to the survival of the industry, particularly as the main destination markets have introduced rigorous food health and safety requirements.

1.1. Arrowroot as a Climate Resilient Crop

Arrowroot, as a crop, facilitates climate change adaptation within the farming community. The morphological features of the arrowroot crop (Maranta arundinacea) are well suited to cultivation on hilly terrain and loose volcanic soils. This is based on the ability of the fibrous root system to bind soil particles together and the speed at which the crop foliage grows and covers the soil after establishment. Importantly, harvesting activities coincide with the establishment of the new crop during the dry season. By so doing, the fragile soil is exposed only for a short period, during which the potential for soil erosion is at a minimum.

The ability to withstand extreme weather conditions makes the crop a very suitable candidate to withstand the vagaries of climate change. Comparatively, the crop can withstand dry periods more favourably than other traditional commodities. In addition, during the wet season, the crop cover prevents direct contact of rain drops with the soil, while the dead leaves acts as a trap for top soil during run-off.

Notwithstanding the suitability of the crop, the recent unseasonal weather systems have resulted in significant erosion during heavy down pours, which have been occurring in the dry season. This can potentially reduce yields. As such, some adaptation measures are needed to better predict and align cropping patterns to improve yields and prevent loss of valuable top soil.

1.2. Infrastructure

The processing technology being used to extract starch from the rhizome can be described as archaic, if not obsolete. The current factory is a used modified Potato starch factory which was commissioned in 1985. The major limitation to the technology is at the settling tank, where starch particles settle out of solution on the basis of gravity. This process is highly inefficient as the grinding and settling processes cannot be carried on simultaneously and normally requires the grinding operations to stop in order to allow the settling process to take place.

Furthermore, the equipment and building construction are not compliant to Hazard Analysis & Critical Control Points (HACCP) or Good Manufacturing Process (GMP). And therefore, urgent action is required to meet food health and safety standards as a requirement for maintaining market access.
The distance between the factory and pulverization plant also poses a risk to maintaining food health and safety standards. Constructing the rhizome processing plant adjoining the existing pulverisation plant will serve to improve the level of food health and safety at the plant. The new construction and equipment set-up must facilitate efficient and seamless flow along the processing lines between the new and old facilities.

Based on the recent study by the CDB, the hydro cyclone technology was recommended to replace the existing gravity based system. However, given the energy needs of these equipment, energy saving technology must also be integrated into the factory re-design. Consideration must be given to the use of renewable energy.

2. Aim of the Project

As a part of the "Arrowroot Industry Modernization Project" which aims to revitalize the sector with an ultimate aim to boost sustainable economic growth and reduce poverty in the country, the Government of St. Vincent and the Grenadines (GoSVG) has requested UNIDO's assistance in the design and construction of the new green processing factory shell. This construction would allow a smooth facilitation of a seamless process flow between new facilities and existing pulverization plant while reducing environmental hazards. The main goal of the proposed intervention is to increase the contribution of the Arrowroot Industry to the sustainable economic development of St Vincent and the Grenadines and enable the industry to meet international food safety standards, improve livelihoods in vulnerable communities and strengthen resilience to climate change.

Overall objective:
The overall objective of the entire project (part of which is being implemented by UNIDO by the means of the construction of the new factory shell) is to increase the contribution of the Arrowroot Industry to the sustainable economic development of St Vincent and the Grenadines.

Outcome:
The overall outcome of the overall project "Arrowroot Industry modernization Project" is to modernize the arrowroot industry to meet health and safety USDA and European requirements.

Approach and main interventions:

In line with the established objectives, the proposed project should achieve the following result: A new processing factory shell is constructed and operational, contributing to higher quality production.

3. Scope of Architectural and Engineering Services

The existing arrowroot processing plant is unable to meet the necessary food safety standards therefore a new processing plant is being constructed in order to address this problem. Consequently, it is essential to construct a factory shell to accommodate the new factory taking into account all ancillaries necessary to facilitate the processing of the rhizomes as well as the collection and removal of waste.
The objective of this contract to be awarded, as a result of this Request for Proposal (RFP) is the provision of architectural and engineering services for the design and supervision of the construction of a new factory shell at Orange Hill, St. Vincent.

In that context, the provision of architectural and engineering services foreseen includes three main components as distinct stages namely:

Stage 1

- The preparation of Architectural and Engineering design and drawings including their approval.

Stage 2

- The contribution to the drafting of the Terms of Reference required for the procurement of construction works.
- The provision of technical evaluation of offers. It should be noted, including while preparing the ToR, that such technical evaluation may only be based on the requirements outlined in the said ToR.

Stage 3

- The Management and Supervision services for the completion of the construction works, which shall be executed through the above mentioned separate contract.

The following should be considered and mentioned while drafting the Terms of Reference for the construction works:

1. The project aims for the involvement of women. Gender-sensitive recruitment should be practiced at all levels where possible, especially in the selection of the project staff (aiming at a goal of a 50/50 gender balance at all levels).
2. Energy efficiency solutions should be considered at all stages of the implementation and compliance to CREEBC 2018 should be observed. The use of environmentally friendly and energy efficient construction materials should be encouraged.
3. Local workforce should be employed, and where necessary be trained by the successful company.

It is to be noted that this project requires close collaboration through UNIDO with the Government counterpart and the institution/company in charge of the factory interior design and provision of machinery.

Stage 1: Preparation of Architectural and Engineering design and drawings.

Under the supervision of UNIDO at Hqs and in close coordination with UNIDO project team, the UNIDO National Coordinator and the International Construction expert, the contractor shall be responsible to:

- Conduct research and, with the support of UNIDO National Coordinator, meet with relevant government officials and institution/ company in charge of the factory interior design as well as the supply of equipment for any further information and guidance required. Prepare detailed work plan and schedule for carrying out the works;
- Conduct site investigation and data collection to accurately assess the site, the mean of access and other issues which could influence or affect the construction work and identify the need for any new additional boundary, topographical, or other survey;
- Conduct soil investigation to assess and design the foundation;
- Consult through UNIDO National Coordinator with the relevant government regulatory agencies/departments to clarify required standards and local legislation to be met by the arrowroot processing plant to be designed, in particular with regards to energy efficiency;
- Prepare concept design/ schematic drawings including outline proposals for structural design, building services systems, outline specifications and preliminary cost information. The design and drawings prepared to meet all relevant design codes, statutory requirements and best practices, while seeking to minimize negative environmental impacts and promote energy efficiency and climate resilience;

- Prepare developed design and drawings including coordinated and updated proposals for structural design, building services systems, outline specifications and cost information;
- Prepare technical design and drawings to include all architectural, structural and building services system information as well as specialist subcontractors design and specifications;
- Contribute to the finalization of documentations required for Planning Approval by the Ministry of Housing.

Stage 2: Preparation of Terms of reference required for procurement of the construction works

In close coordination with UNIDO project team, the UNIDO National Coordinator and the International Construction expert, the contractor shall be responsible to:

- Prepare Bills of Quantities/detailed cost estimates for construction of factory shell in accordance with norms, standards and best practices.
- Prepare Technical specifications for equipment, materials and workmanship in accordance with all relevant design codes, statutory requirements, local conditions including weather and soils specificity, national law and international best practices. Special attention shall be paid to:
    - Employment of local work force
    - Use of environmentally friendly and energy efficient construction materials
    - Application of innovative and resource efficient construction methods
- Compile working drawings for procurement of construction works.
- Provide technical evaluation of offers.

It should be noted that technical evaluation may only be based on the requirements outlined in the ToRs and that introduction of any new requirement at the evaluation stage is not permissible.

Stage3: Management/ Supervision services for the completion of the construction works

Directly reporting to UNIDO Hqs and in close coordination with UNIDO project team, the UNIDO National Coordinator and the International Construction expert, the contractor shall be responsible to manage, supervise and coordinate all construction works to ensure that all works comply with UNIDO requirements and are executed in accordance with the terms and conditions of the contract.
More particularly the contractor shall be responsible to:

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- Issue all detailed “For construction Drawings” and all other relevant instructions to the construction company for the proper and timely execution of the works.
- Inspect, monitor and control all construction activities to ensure that quality standards are adhered to and that all materials, equipment and workmanship comply with the specifications and terms and conditions of the contract.
- Monitor and control the construction company’s activities on site to ensure that works are executed in accordance with all statutory health, safety, security and environmental requirements.
- Coordinate with UNIDO Team “Request for Information” submitted by the construction company in a timely manner so that the works will proceed without delay and in accordance with the contract.
- Conduct and chair regular meetings including kick off meeting, progress meetings, trouble shooting, completion and handover and final sign off meetings. Prepare and circulate Minutes of these meetings to UNIDO and other project team members in a timely manner.
- Review and report on progress of works and other pertinent issues arising during the construction phase of the works.
- Analyze the construction company planned progress against actual progress using MS Project or similar software and make proactive recommendations for any corrective action that may be required if progress of the works is delayed.
- Prepare and submit monthly progress reports to UNIDO summarizing works completed, planned progress against actual progress, challenges encountered and recommendations for any corrective action. The report must include labelled and dated photographs.
- Provide required documentations to UNIDO for interim payment to the construction company in accordance with the schedule of payments as set in the the contract.
- Advise UNIDO on any possible variations that may have cost implication prior to issuance of the Variation/Change Order to the construction company. Quantify the cost implication and obtain UNIDO’s written approval for the variation/change order before proceeding with the variation instruction to the construction company.
- Conduct all inspections, supervise all testing and commissioning activities and prepare and issue all requisite documentation at “Practical Completion” including issuance of the Certificate of Practical Completion and Defects List.
- Ensure that all items on the Defects List are satisfactorily remedied in accordance with the terms and conditions of the contract.

- Prepare and issue to UNIDO all "As Built" Drawings, Testing and Commissioning reports, warranty certificates and operations and maintenance documents.
- Prepare and issue the Final Completion Certificate.

4. Minimum Requirements of the contractor

4.1 The contractor is expected to offer a highly skilled and experienced team of experts for successful accomplishment of services in each phase, and appoint a Project Manager for overall coordination who shall serve as UNIDO's day-to-day primary contact.
The contractor needs to demonstrate a high degree of technical expertise in the preparation of documents for the project by referring to previous similar projects completed during last 5 years. The contractor shall conform to existing laws, regulations and professional codes as established by St. Vincent and the Grenadines.

The contractor should include in its direct / indirect staff highly qualified architects and engineers who will be engaged in the project. CV's of personnel suggested by the contractor to be assigned to this project should be provided.

All experts, architects, engineers and quantity surveyors, involved in the project must be licensed/registered professionals in their field of expertise with a minimum of 10 years of experience in their profession. The proposal shall contain details of qualifications of staff who will be assigned to contribute to, manage and supervise the services required and include the CVs of key personnel.

4.2 To ensure proper independent oversight of the construction works the contractor selected as a result of this tender or its personnel/experts cannot be affiliated with the construction company selected to execute the works to avoid any conflict of interest.

4.3 The contractor shall produce design and drawings with due consideration to environmentally friendly and energy efficient materials accessible in St. Vincent and the Grenadines (where possible) and upkeep with UNIDO and international environmentally friendly and energy efficient norms and standards. The construction of the factory shell should employ innovative and resource efficient methods, and materials selected for use should correspond to future weather and soil conditions.

The contractor shall prepare in close consultation with UNIDO all requisite documents necessary to obtain all approvals and permits from the building management and other relevant authorities.

The set of drawings (construction and as-built) shall be developed in consideration to the mandatory standards, relevant codes, statutory requirements and international best practices.
All drawings must be submitted to UNIDO in electronic DWG and PDF formats.

4.4 The contractor shall submit a Design report which shall sum up all design activities and provide the rationale for the optimal design made. Standards, norms and regulations used must be referenced to in the design report extensively.

The contractor is required to accept full design responsibility and liability for all designs prepared under this engagement and must ensure that these designs are in accordance with all relevant design codes, statutory requirements and international best practices.

4.5 The contractor shall assist UNIDO in the procurement process for construction work to ensure that all procurement activities are conducted in strict accordance with the guidelines and rules established for the project execution and in keeping with international best practice.

General UNIDO requirements

All work provided shall meet the standards specified herein and shall conform with approved and accepted international standards and comply with all applicable building and safety codes applicable in Saint Vincent and the Grenadines. UNIDO place a very high priority on the safety and security of workers at project-linked work sites. Specifications are provided to establish minimum design and construction standards.
The contractor will only start work upon written confirmation by UNIDO. Upon receipt of this confirmation the contractor shall confirm to start no later than one week after signing the contract.

The contractor shall guarantee the quality and completeness of all his work, supplies and services specified in this ToR and shall correct as soon as practicable any work or service non-conforming to the contract after receipt of written notice from UNIDO

The services may be provided by a single company with a lead consultant and sub-consultants.
The contractor is required to provide a single point of responsibility to UNIDO by appointing a named individual as the Team Leader for the engagement.

This Terms of Reference is intended to broadly describe the works anticipated. The items of works described in this document are to be used as a general guide and not as a prescriptive final scope of the work.

Technical Proposal

The Technical proposal should demonstrate the capacity of the contractor to provide the services requested and should present the proposed work plan and resources for carrying out the work as described in section 3 of this ToR.

Commercial Proposal

The commercial proposal must be presented in United States dollars (USD)
Bidder shall confirm that all units and Total pricing in its bid are inclusive of all labour, materials, equipment, service and any other charges required to complete the work.
Propose a lump sum cost for the work inclusive of all expenses broken down into major categories for UNIDO to understand the cost components that comprise the lump sum cost.

Please use the table below:

TO BE COMPLETED BY THE INVITEE			TO BE COMPLETED BY UNIDO (Evaluation purpose)	
Item	**Name and required parameters**	**Price in USD**	**Compliance**	**Remarks**
1. Preparation of Architectural and Engineering design and drawings				
1.1	Concept Design			
1.2	Developed Design			
1.3	Technical Design			
	TOTAL			
2. Preparation of Terms of reference required for procurement of the construction works				
2.1	Bill of Quantities and Technical Specifications			

2.2	Terms of Reference and Schedule.			
2.3	Technical evaluation			
	TOTAL			
3. Management / Supervision of the construction works				
3.1	Construction and post construction Phase			
	TOTAL			
GRAND TOTAL				

5. **Evaluation of Proposals**

Proposals from the bidders shall be evaluated through a quality and cost based approach and reviewed in accordance with UNIDO standards.
UNIDO place a very high priority on the safety and security of workers at project-linked work sites.

	Summary of Technical Proposal Evaluation	Points Obtainable
1	Expertise of the Company submitting Proposal	20 pts.
2	Proposed Work Plan and Approach	20 pts.
3	Personnel	30 pts.
	TOTAL	70 PTS.

- Only the bidders who secure 70% and above on technical score shall be evaluated further.
- Technical and Financial proposals will have 70% and 30% weight on the overall evaluation respectively.

6. **General Time Schedule**

	January– November, 2020											
	Month											Submission deadline
Activity	1	2	3	4	5	6	7	8	9	10	11	
Commence the design of the factory shell												15 January 2020
Submit a monthly report to UNIDO project manager in close collaboration with UNIDO construction expert												As of 31 January 2020
Finalize the design and present it to UNIDO Project manager and UNIDO national coordinator												15 March 2020
Actively participate in coordination meetings held during UNIDO mission to St. Vincent												As of 31 January 2020
Building of the factory shell												May 2020 Completion by November 2020
Submit monthly progress reports including technical documentation to UNIDO project manager and UNIDO national coordinator												As of April 2020
Share draft final report with UNIDO project manager for discussion												15 November 2020
Submit final completion of the work in the field report												30 November 2020

7. ANNEX: DESIGN BRIEF FOR ARROWROOT PLANT AT ORANGE HILL SAINT VINCENT

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1. PROJECT DESCRIPTION

PROJECT TITLE - Construction of arrowroot factory shell at Orange Hill

EXECUTING AGENCY – United Nations Industrial Development Organization

PROJECT SCOPE

Executive Summary

The Arrowroot Industry Association has been unable to meeting the desired food safety standards utilizing the old arrowroot processing plant at Owia. A decision was therefore taken by the Government of St.Vincent and the Grenadines (GOSVG) to construct a new processing plant at Orange Hill.

The Government has secured an initial sum of money from the Government of India to construct the factory shell at Orange Hill, next to the pulverization plant, which would accommodate the proposed new factory.

OBJECTIVE OF THE PROJECT

The objective of the project is to construct a factory shell to accommodate the new factory taking into account all ancillaries necessary to facilitate the processing of the rhizomes as well as the collection and removal of waste.

PROBLEM STATEMENT

The existing arrowroot processing plant is unable to meet the necessary food safety standards therefore a new processing plant is being constructed at Orange Hill in order to address this problem. It is therefore necessary to construct a factory shell to adequately accommodate this factory.

In order to construct the factory shell, the factory itself has to be designed to ensure that the shell can adequately house the factory.

ASSUMPTIONS

1. Acreage and productivity is expected to increase from the present 145 and 7,000 pound per acre respectively, to 280 acres and 12,000 pounds per acre respectively. This would require the processing of some 3,240,000 pounds of rhizome which would be completed in maximum of 3 months.

2. There is adequate land space to accommodate the factory and all the ancillaries.

EXPECTATION OF THE FACTORY SHELL

It is expected that the factory shell can house a factory based on the following assumptions:

1. A factory with a throughput of at least 15,000 pounds of rhizome per hour and at least 90,000 pounds of rhizomes per day.

2. The factory should possess an area to accommodate the storage of at least two weeks supply of rhizomes (cold storage if possible)

3. The equipment would be operating on 220V and would include the use of solar PV to supplement the energy demand. It is anticipated that the coming on stream of the geothermal plant would further reduce the cost of energy.

4. The factory would carry one continuous process from rhizome to finished product.

5. The factory would meet the necessary food safety standards.

6. Allow for the necessary treatment of water to be used in the processing of the rhizomes.

7. Would accommodate the treatment and disposal of waste water.

2. INTRODUCTION

2.1 GENERAL

The agricultural sector is a significant contributor to employment and foreign exchange. The sector, however, faces significant challenges, ranging between vulnerability to natural hazards, pest, diseases, increasingly stringent market access issues, high labour costs and the restricted development of downstream derivatives. The arrowroot crop has attributes that with some assistance, can respond to these challenges and as such, the GOSVG has given favourable consideration to support an expansion of the industry.

A number of studies have been carried out on the industry, the latest being a study by the International Trade Center (ITC) funded by CDB in 2016. The findings of this study which included a market analysis, identified the following development actions (i) Develop a robust food safety and quality compliance program (ii) Redesign and re-engineer the process of producing arrowroot starch and (iii) create a Genuine SVG brand and market the premium quality of SVG arrowroot to professional chefs, home cooks and the health and wellness industry. Given current international market conditions and local challenges, the report goes on to recommend that the existing starch production capacity be improved from the current 110,000 pounds per year to 540,000 lbs per year.

In accordance with step 2 (above) of the ITC development plan, the GOSVG has obtained funding from the Government of India which has engaged the United Nations Development Organization (UNIDO) for the construction of a factory shell building, to commence the arrowroot industry rebuilding effort.

This design brief covers the full design requirements of the new facility.

3. SITE DESCRIPTIONS

The site chosen for the project is the Orange Hill Pulverization Plant. This selection was based on the fact that

(i) The existing pulverizing plant can be retrofitted and incorporated into the new facility
(ii) The site has access to both potable water and with some retrofitting of the aqueduct and intake, untreated stream water
(iii) Availability of space for expansion and wastewater treatment.

The following information provides only basic site parameters, the rest of which will have to be obtained by the design consultant.

3.1 LOCATION

The proposed site is located at the Orange Hill pulverizing plant location (13° 19' 4.74"N and 61° 7' 17.23"W). The site is approximately 10km south of the existing Owia plant and about a one hour drives from Kingstown.

Figure 1 Proposed Arrowroot Processing Plant at Orange Hill

3.2 AREA

The site area available is approximately 85,000 sf or about 2 acres, as shown in Appendix A. The site is gently sloping for the most part, but beyond the pulverizing plant, dips down markedly to the feeder road to the East. An updated topographic survey is being carried out at the time of writing this brief.

3.3 ACCESS AND TRAFFIC

The site is adjacent to the main Windward Highway. The road is not heavily trafficked at this extremity and is the main artery to Kingstown from the Windward coast.

The site layout should have an open turning area for easy delivery and pick up of goods.

The building itself will require separate locations for the delivery and pick up of goods.

A separate service entrance will also need to be provided for staff.

3.4 CLIMATE

Hurricanes affect Saint Vincent and the Grenadines. The most recent hurricanes are hurricanes Ivan (2004), Emily (2005) and Tomas (2010). There was a severe tropical storm in December 2013, which dumped 278mm over a three hour period in the North of the island.

Climate change may materially affect the anticipated patterns of rainfall intensity and duration and wind, requiring the necessary design adjustments in the building and external works. The Consultant will consider the increased frequency and intensity of environmental hazard events brought on by climate change.

The design of the building will need to take account of the exposed nature of the site, the corrosive maritime environment and be engineered to comply with the relevant hurricane wind loadings, earthquake codes and torrential rains.

A summary of the climate at Orange Hill is shown below. (https://en.climate-data.org/north-america/saint-vincent-and-the-grenadines/orange-hill/orange-hill-204707/#climate-graph)

ORANGE HILL WEATHER BY MONTH // WEATHER AVERAGES

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	24.6	24.5	25.1	26	26.7	26.9	26.7	26.9	26.8	26.5	25.8	25.1
Min. Temperature (°C)	20.9	20.6	21	21.7	22.6	23.1	23.1	23.1	22.8	22.5	22.1	21.5
Max. Temperature (°C)	28.3	28.5	29.3	30.4	30.8	30.7	30.3	30.8	30.8	30.6	29.6	28.8
Avg. Temperature (°F)	76.3	76.1	77.2	78.8	80.1	80.4	80.1	80.4	80.2	79.7	78.4	77.2
Min. Temperature (°F)	69.6	69.1	69.8	71.1	72.7	73.6	73.6	73.6	73.0	72.5	71.8	70.7
Max. Temperature (°F)	82.9	83.3	84.7	86.7	87.4	87.3	86.5	87.4	87.4	87.1	85.3	83.8
Precipitation / Rainfall (mm)	101	81	84	94	137	208	254	235	233	272	247	160

Between the driest and wettest months, the difference in precipitation is 191 mm. The variation in temperatures throughout the year is 2.4 °C.

3.5 ENVIRONMENTAL ISSUES

No EIA has been carried out on the site. The site however, has been used for pulverizing starch for decades with no recorded or known adverse effects. This EIA activity should form part of the design Consultants ToR. Given the nature of the project, no significant impacts are envisaged during the construction phase, and standard mitigation measures employed through an Environment Management Plan (EMP) can be developed and utilized.

In addition, the EIA should provide input into the design of the facility particularly for waste management, air emissions, and wastewater disposal.

3.6 UTILITY SERVICES

Water, electricity and telephone connections are all available along the main road adjacent to the site. The cost of electricity is high in SVG (EC$1.05 per Kwh approx.). The architectural and engineering designs will need to address this issue. The electricity supply in Saint Vincent is 230V 50Hz

3.7 SOIL CONDITIONS

There was no geotechnical study done on the site. Existing soil maps indicate Pyroclastic deposits and / or Yellow Tephra (Appendix B). The Consultant will be required to carry out a geotechnical analysis of the site (test pits) to determine the actual soil bearing capacity for the building foundations.

3.8 SECURITY

The site is located in a rural area surrounded by agricultural lands. The nature of the facility however will require a security fence around the site to prevent animals straying into the compound and to deter casual observers.

4 USER REQUIREMENTS

4.1 MAIN BUILDING

The building is expected to house the process flow as per Appendix C. The proposed equipment to be employed in this flow process is expected to produce 1000kg of starch per hour. The building design is expected to utilise and incorporate the existing pulverization facility.

Given the flow process, a preliminary estimate for the building size is 72m x 12m x 6m (length x width x eave height). The building height must be finalised based on the equipment requirements.

The equipment list is included in Appendix D

In addition to the flow process, the facility internal layout must provide for the following operational requirements:

- Tubers from farms have an inbound receiving and inspection / sampling area
- Provide area for the safe storage of tubers, protect from pests or contaminants
- Tuber processing should flow from “dirty” to “clean”, areas are easily accessible
- A separate area for final weighing and packaging.
- Minimising the use of powered conveyor belts
- Separate area for proper cleaning or sanitizing of utensils or small equipment.
- Storerooms for cleaning liquids, maintenance equipment, packaging etc.
- Have a clean storage area for packaging material and for holding finished goods.
- Have a changing or gowning room (with lockers) to ensure proper gowning practices.
- Laboratory for conducting both wet and dry tests.
- Maintenance shop
- Toilet Facilities
- Lunch Room
- Offices (Admin and manager. The detailed breakdown will be finalised between the consultant and the AIA). This should allow for an oversight of the entire processing plant.
- Electrical room
- At least 6 hand sanitizing stations including at least 4 sinks with hot and cold water.

4.2 ANCILLARY BUILDINGS AND STRUCTURES

Several ancillary buildings and structures are required for the project. The positioning of the main building must consider the operational connection of these facilities to maximise the efficiency of the operation. These facilities are identified as follows:

(i) Warehouse (Steel frame structure) : 500 square meters, 4 meters high
(ii) Raw material house (Steel frame construction); 300 square meters x 4m high
(iii) Boiler house: 100 square meters (subject to actual boiler size)

(iv) Slurry basin: 100 square meters, 0.8 meters deep
(v) Wastewater basin: 200 square meters, 1.2 meters deep

4.3 VEHICULAR ACCESS AND PARKING

Vehicular access will include onsite paved road in high traffic areas and turning zone for rhizome delivery vehicles. Provision will also be made for parking for visitors and staff.

5 BUILDING DESIGN CRITERIA

5.1 GENERAL

The building design should consider:

(i) Serviceability
(ii) Durability
(iii) Maintenance
(iv) Safety
(v) Ease of construction

5.2 CODES AND STANDARDS

The building will be designed according to local and international standards. The Equivalency Concept shall prevail, where standards that provide equivalent levels of performance will be acceptable, once no other safety element or system is compromised to establish equivalency.

The structural design will satisfy the provisions of the Saint Vincent Building Code and Guidelines and other relevant British Standards (BS) / US (IBC) building codes.

The heating, refrigeration, ventilation and air conditioning designs shall be governed by ASHRAE standards

Electrical design shall be governed by NEMA or IEC standards

Work safety design considerations shall be governed by OSHA standards.

5.3 MULTI-HAZARD DESIGN

Saint Vincent is very susceptible to the hazards of hurricanes, earthquake and volcanic activity. The La Soufriere volcano in the North of the island, last erupted in 1979. The site is located in the foothills of this volcano. Multi-Hazard Design shall consider

(i) The stability of both structural and non-structural elements (including equipment)
(ii) Structural connection details
(iii) Construction material choices
(iv) Roof loading to cater for ash fall and wind uplift
(v) Geometrical issues in relation to favourable shapes, soft storeys etc.

Connections are of paramount importance. The Consultant will be expected to use the latest architectural and structural detailing standards to:

(i) Prevent damage in the event of hurricanes and torrential rain.
(ii) Limit damage to repairable damage, following earthquake events.
(iii) Eliminate / minimise loss of life in all circumstances of a hazard event

The Consultant is expected to utilise advanced 3D structural software in the design of the facility.

5.4 BUILDING AESTHETICS AND BUILDING FABRIC

5.4.1 Aesthetics

It is anticipated that the building will assume a standard portal frame shape. The internal floor space may include a mezzanine.

5.4.2 Building Fabric

Building fabric and finishes must optimally be cost effective and low maintenance. The choice of materials will also take into account:

- Local availability
- Local construction skills
- Limited capacity for ongoing maintenance and repair
- Durability
- Proximity to marine environment
- Flame spread limitations
- Smoke production limitations
- Contamination control
- Compatibility with structural requirements and performance of building during hazard events
- Thermal insulation properties

5.5 BUILDING SERVICES

The building services will need to be designed in accordance with the relevant codes, general design guidelines outlined below, as well as the best international "Green Design" practice that is practical and achievable within the SVG environmental context. Section 5 sets out guidelines for green building design.

The building services engineering firm will be responsible for the design of the following systems viz. energy distribution, mechanical, lighting (natural and artificial), plumbing, communication, IT, security and alarm, fire detection, HVAC , renewable energy supply and sanitation systems.

The Consultant shall provide detailed specifications on workmanship and testing for all activities in this section.

General design guidelines follow:

5.5.1 Electrical and Mechanical systems

Electrical and mechanical systems, including lighting and HVAC, will be provided in accordance with the following design philosophical approach:

• reliability and performance;

• ease of maintenance and replacement;

• energy efficiency and cost effectiveness;

• maximizing natural lighting and ventilation, and

The building will be connected to the islands main electricity supply (230V 50Hz). The electrical system will also have a back-up power supply both with a standby generator (450 kVA with a 400 imperial gallon fuel tank) and some form of renewable energy supply, preferably a Photo Voltaic system.

The electrical system should be dual voltage (110V and 230V) in areas as agreed with the Client. The requirement for a new transformer substation to service the facility will need to be investigated. A dedicated electrical room will be required.

Surface mounted engineering services will be acceptable.

Mechanical and Electrical equipment systems will be designed to withstand earthquake forces through appropriate fixings, base isolation, flexible conduit joints, emergency shutoff valves, etc.

The building should use high-efficiency windows where air conditioning is used. The building should incorporate good passive solar design principles, including the careful orientation of windows. Window placement should maximise natural light, lessening the need for electric light during the day.

Solar water heating should be used as much as possible.

Consideration needs to be given to onsite renewable energy generation (Solar). Energy efficient lighting systems should be specified such as Light Emitting Diodes (LEDs) and/or Compact Fluorescent Lights (CFLs).

Adequate space should be provided between equipment and walls for cleaning.

The FDA requires that adequate ventilation and control equipment are in place to minimize odours and vapours (including steam and noxious fumes) in areas where they may contaminate food. It also requires that fans and other air-blowing equipment are located in a manner that minimizes the potential for contaminating food, food-packaging materials, and food-contact surfaces.

5.5.2 Fire Services

Fire escape, fire-fighting/suppression and fire detection systems will be as required. It will include provisions for:

(i) horizontal escape routes with minimum travel distances,
(ii) signage throughout building,
(iii) fire alarms,
(iv) smoke detectors,

(v) fire extinguishers,

Discussion with the local fire services will be essential regarding local equipment and practices.

5.5.3 Plumbing and Water Supply

The water supply system should be connected to a potable supply, but should also maximise on-site rain water harvesting and integrate water collected in this manner, into the building's plumbing systems as much as possible.

A water storage tank will need to be provided with a capacity of approximately 22,000 imperial gallons

Plumbing lines will be distributed throughout in areas easily accessible for repair and maintenance when necessary.

5.5.4 Sanitation and Wastewater Discharge

Sanitation systems should maximise the use of low flush toilets and urinals and low flow shower heads, using roof collected water as much as possible.

There are no public sewers in the area and as such, the Consultant will need to design a septic tank and soak pit system.

Hand wash stations and hand sanitizer stations must be available throughout the facility.

There should also be a shoe / boot sanitizing station (bath)

Production waste shall be treated and disposed of preferably through a ground filtration system

5.5.5 Security

The administration office should be located with a clear view of operations, entry and exit.

Locker rooms for staff shall be provided.

The site shall be protected by chain-link perimeter fencing anchored in a concrete kerb to deter animals burrowing beneath.

5.6 SUSTAINABILITY

The building will need to be designed in a way that responds to established environmental and ecological concerns and in particular ensure that:

• building structure and fabric,

• building services,

• energy use, and

• operation and maintenance,

are durable, cost effective and sustainable. Equipment and fixtures that are specified must be low maintenance and easily operated with readily available replacement parts. This will minimise the recurrent operating costs and the requirement for specialised training and maintenance personnel.

5.7 CIVIL WORKS

The following civil works are required:

• Earthworks associated with constructing the building foundations, floor slabs, car parking and road access.

• Security chain-link fencing including main entry gates.

• Sewerage treatment and disposal system

• On-site water harvesting system with back up to potable water supply.

• Connection to main electrical grid with some on-site power generation

- Surface water drainage systems
- Excavation for slurry and wastewater basins

5.8 CONTAMINATION CONTROL

The FDA requires that adequate ventilation and control equipment are in place to minimize odours and vapors (including steam and noxious fumes) in areas where they may contaminate food.

Fans and other air-blowing equipment must be located in a manner that minimizes the potential for contaminating the starch, packaging materials and starch-contact surfaces. In this regard, operations should be separated to minimize the risks of cross contamination.

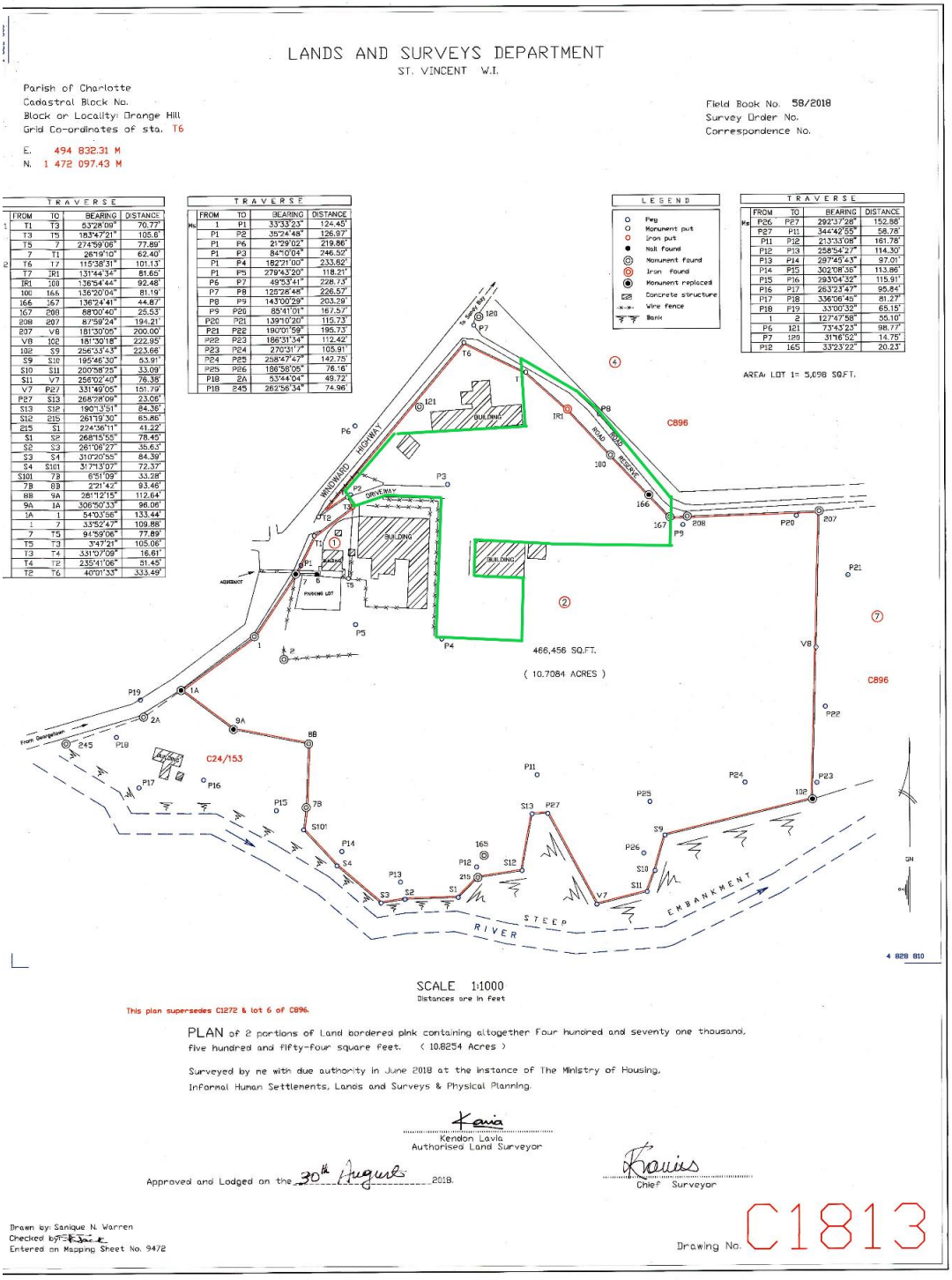
The design must mitigate the infiltration of pests into the facility, with as much sealed external surfaces as possible.

There should be a shoe / boot sanitizing station (foot bath)

5.9 Capacity of Factory

Based on projecting for future arrowroot production a capacity of 500 kg per hour of arrowroot starch is deemed adequate for the purpose (See Appendix E). With a conversion ratio of 7:1this would require 3500 kg rhizomes per hour and with a conversion ratio of 11:1 would require 5500 kg per hour rhizomes.

APPENDIX A



LANDS AND SURVEYS DEPARTMENT
ST. VINCENT W.I.

Parish of Charlotte
Cadastral Block No.
Block or Locality: Orange Hill
Grid Co-ordinates of sta. T6

E. 494 832.31 M
N. 1 472 097.43 M

Field Book No. 58/2018
Survey Order No.
Correspondence No.

TRAVERSE

	FROM	TO	BEARING	DISTANCE
1	T1	T3	53°28'09"	70.77'
	T3	T5	183°47'21"	105.6'
	T5	7	274°59'06"	77.89'
	7	T1	26°19'10"	62.40'
2	T6	T7	115°38'31"	101.13'
	T7	IR1	131°44'34"	81.65'
	IR1	100	136°54'44"	92.48'
	100	166	136°20'04"	81.19'
	166	167	136°24'41"	44.87'
	167	208	88°00'40"	25.53'
	208	207	8°59'24"	194.21'
	207	V8	181°30'05"	200.00'
	V8	102	181°30'18"	222.95'
	102	S9	256°33'43"	223.66
	S9	S10	195°46'30"	53.91'
	S10	S11	200°58'25"	33.09'
	S11	V7	256°02'40"	76.38'
	V7	P27	331°49'05"	151.79'
	P27	S13	268°28'09"	23.05'
	S13	S12	190°13'51"	84.36'
	S12	215	261°19'30"	65.86'
	215	S1	224°36'11"	41.22'
	S1	S2	268°15'55"	78.45'
	S2	S3	261°08'27"	36.63'
	S3	S4	210°20'55"	84.39'
	S4	S101	317°13'07"	72.37'
	S101	78	6°51'09"	33.28'
	78	88	2°21'42"	93.46'
	88	9A	26°12'15"	112.64'
	9A	1A	306°50'33"	96.06'
	1A	1	54°03'56"	133.44'
	1	7	33°52'47"	109.88'
	7	T5	94°59'06"	77.89'
	T5	T3	3°47'21"	105.06'
	T3	T4	331°07'09"	16.61'
	T4	T2	235°41'06"	51.45'
	T2	T6	40°01'33"	333.49'

TRAVERSE

	FROM	TO	BEARING	DISTANCE
Pts	1	P1	33°33'23"	124.45'
	P1	P2	35°24'48"	126.97'
	P1	P6	21°29'02"	219.86'
	P1	P3	84°10'04"	246.52'
	P1	P4	182°21'00"	233.62'
	P1	P5	279°43'20"	118.21'
	P6	P7	49°53'41"	228.73'
	P7	P8	128°28'48"	226.57'
	P8	P9	143°00'29"	203.29'
	P9	P20	85°41'01"	167.57'
	P20	P21	139°10'20"	115.73'
	P21	P22	190°01'59"	195.73'
	P22	P23	186°31'34"	112.42'
	P23	P24	270°31'7"	105.91'
	P24	P25	258°47'47"	142.75'
	P25	P26	186°58'05"	76.16'
	P18	2A	53°44'04"	49.72'
	P18	245	262°56'34"	74.96'

LEGEND

- Peg
- Monument put
- Iron put
- Nail found
- Monument found
- Iron found
- Monument replaced
- Concrete structure
- Wire fence
- Bank

TRAVERSE

	FROM	TO	BEARING	DISTANCE
Pts	P26	P27	292°37'28"	152.88'
	P27	P11	344°42'55"	58.78'
	P11	P12	213°33'08"	161.78'
	P12	P13	258°54'27"	114.30'
	P13	P14	287°45'43"	97.01'
	P14	P15	302°08'36"	113.86'
	P15	P16	293°04'32"	115.91'
	P16	P17	263°23'47"	95.84'
	P17	P18	336°06'45"	81.27'
	P18	P19	33°00'32"	65.15'
	1	2	127°47'58"	55.10'
	P6	121	73°43'23"	98.77'
	P7	120	31°16'52"	14.75'
	P18	165	33°23'22"	20.23'

AREA: LOT 1= 5,098 SQ.FT.

466,456 SQ.FT.
(10.7084 ACRES)

SCALE 1:1000
Distances are in feet

This plan supersedes C1272 & lot 6 of C896.

PLAN of 2 portions of Land bordered pink containing altogether Four hundred and seventy one thousand, five hundred and fifty-four square feet. (10.8254 Acres)

Surveyed by me with due authority in June 2018 at the instance of The Ministry of Housing, Informal Human Settlements, Lands and Surveys & Physical Planning.

Kenton Lavia
Authorised Land Surveyor

Approved and Lodged on the 30th August 2018.

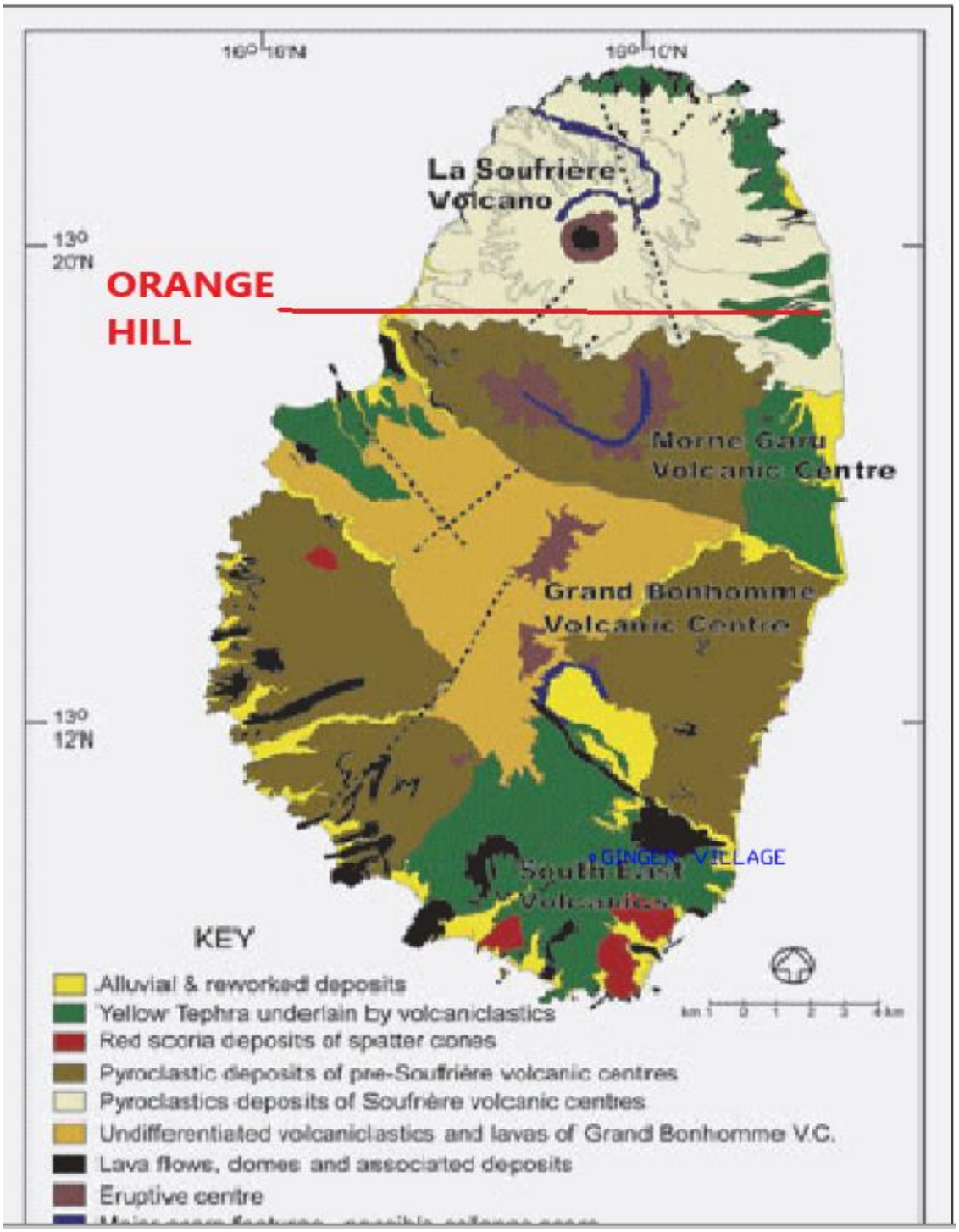
Chief Surveyor

Drawn by: Sanique N. Warren
Checked by:
Entered on Mapping Sheet No. 9472

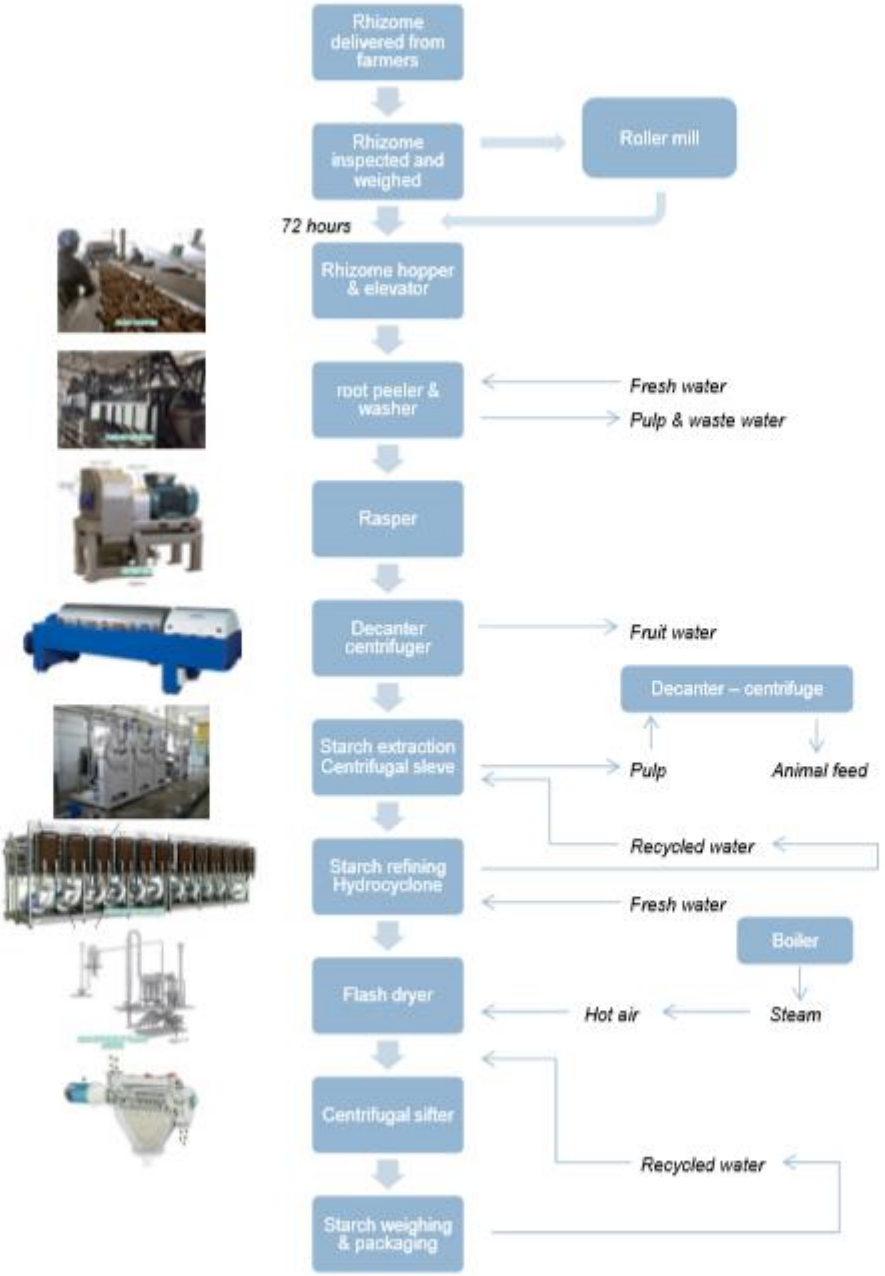
Drawing No. C1813

Site Photograph showing existing pulverization plant and other buildings on site

APPENDIX B


61°10'W
61°07'W
La Soufriere Volcano
13°
20'N
ORANGE HILL
Morne Garu Volcanic Centre
Grand Bonhomme Volcanic Centre
13°
12'N
GINGER VILLAGE
South East Volcanics
KEY
Alluvial & reworked deposits
Yellow Tephra underlain by volcaniclastics
Red scoria deposits of spatter cones
Pyroclastic deposits of pre-Soufrière volcanic centres
Pyroclastics deposits of Soufrière volcanic centres
Undifferentiated volcaniclastics and lavas of Grand Bonhomme V.C.
Lava flows, domes and associated deposits
Eruptive centre

APPENDIX C


Rhizome delivered from farmers
Rhizome inspected and weighed
Roller mill
72 hours
Rhizome hopper & elevator
root peeler & washer
Fresh water
Pulp & waste water
Rasper
Decanter centrifuger
Fruit water
Decanter – centrifuge
Starch extraction Centrifugal sieve
Pulp
Animal feed
Recycled water
Starch refining Hydrocyclone
Fresh water
Boiler
Flash dryer
Hot air
Steam
Centrifugal sifter
Recycled water
Starch weighing & packaging

APPENDIX D

Equipment List

ARROWROOT INDUSTRY: MARKET, TECHNOLOGY AND FOOD SAFETY/QUALITY COMPLIANCE ASSESSMENT

Capital Expenditure Budget

Capital Expenditure	
Item	**BUDGET**
Wastewater treatment system	**$33,000.00**
Security fence	**$10,000.00**
Rhizome hopper and elevator	**$22,000.00**
Root peeler and washer	**$42,000.00**
Rasper	**$66,000.00**
Two Decanter centrifuge	**$140,000.00**
Starch extraction centrifugal sieve	**$80,000.00**
Hydrocyclones	**$110,000.00**
Flash dryer	**$240,000.00**
Boiler	**$36,000.00**
Centrifugal sifter	**$29,000.00**
Miscellaneous equipment	**$50,000.00**
Total	**$858,000.00**

EQUIPMENT REFERENCES
Alfa Laval Inc. 5400 International Trade Drive23231 Richmond United States
Sino – Food Machinery http://www.sfm-sh.com/english/index.php
Prater Industries https://www.praterindustries.com/
G. Larsson Starch Technology AB
A: P.O. Box 89,
SE-295 21 Bromölla, Sweden