

THE GOVERNMENT OF MAURITIUS
MINISTRY OF ENERGY, WATER RESOURCES AND POSTAL SERVICES
CENTRAL WATER AUTHORITY

THE DETAILED DESIGN
ON
THE PORT LOUIS WATER SUPPLY PROJECT
IN MAURITIUS

FINAL REPORT (2)

TENDER DOCUMENTS

FOR

LOT II : CIVIL WORKS (DAM AND APPURTENANT STRUCTURES
INCLUDING CLOSURES OF DIVERSION TUNNEL)

VOLUME II

GENERAL SPECIFICATIONS
TECHNICAL SPECIFICATIONS

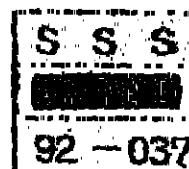
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MARCH 1992

JAPAN INTERNATIONAL COOPERATION AGENCY



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FINAL REPORT (2)

TENDER DOCUMENTS
FOR LOT II VOLUME II

MARCH 92

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GENERAL SPECIFICATIONS

**CENTRAL WATER AUTHORITY
PHOENIX - MAURITIUS**

THE PORT LOUIS WATER SUPPLY PROJECT

TENDER DOCUMENTS

FOR

**LOT II : CIVIL WORKS (DAM AND APPURTENANT STRUCTURES
INCLUDING CLOSURE OF DIVERSION TUNNEL)**

GENERAL SPECIFICATIONS

Table of Contents

<u>Clause No.</u>		<u>Page</u>
CHAPTER G1	DESCRIPTION OF PROJECT	GS-1
G1.1	General.....	GS-1
G1.2	Port Facilities.....	GS-5
G1.3	Access to the Site	GS-5
G1.4	Scope of the Works.....	GS-6
G1.5	Works by Other Contractors	GS-7
CHAPTER G2	DRAWINGS AND DOCUMENTS.....	GS-8
G2.1	Drawings to be Furnished by the PMO/Engineer.....	GS-8
G2.2	Drawings to be Furnished by the Contractor	GS-9
G2.3	Pamphlets, Diagrams and Similar Data for Plant, Equipment and Materials	GS-11
G2.4	Test Procedure Instructions for Manufactured Items	GS-11
G2.5	Instruction Manuals for Installation, Operation and Maintenance.....	GS-11
G2.6	Submission and Review or Approval of Contractor's Drawings and Documents	GS-12
CHAPTER G3	SCHEDULE AND REPORTS	GS-15
G3.1	Commencement, Carrying Out and Completion of Works	GS-15
G3.2	Liquidated Damages.....	GS-15
G3.3	Construction Programme	GS-16
G3.4	Monthly Progress Reports.....	GS-18
G3.5	Progress Photos.....	GS-20

<u>Clause No.</u>		<u>Page</u>
G3.6	Weekly and Monthly Work Schedules.....	GS-21
G3.7	Joint Meetings to Discuss Progress.....	GS-21
G3.8	Method of Performing the Works	GS-21
CHAPTER G4 GENERAL PROVISIONS.....		GS-22
G4.1	Cooperation with Other Contractors.....	GS-22
G4.2	Bench Marks	GS-22
G4.3	Sanitary Arrangements and Clearing of Site.....	GS-23
G4.4	Works to be Kept Clear	GS-23
G4.5	Precautions for Safety.....	GS-24
G4.6	Standards and Materials.....	GS-29
G4.7	Packing.....	GS-30
G4.8	Procurement and Stock of Materials.....	GS-31
CHAPTER G5 CONSTRUCTION FACILITIES		GS-32
G5.1	General.....	GS-32
G5.2	Temporary Works	GS-32
G5.3	Preparatory Works to be Transferred from the Employer for Use of the Contractors	GS-39
G5.4	Soil Testing Laboratory and Equipment.....	GS-46
CHAPTER G6 PARTICULAR ITEMS.....		GS-48
G6.1	Performance Bond and Advance Payment Bond.....	GS-48
G6.2	Insurances	GS-48
G6.3	Transportation Cost.....	GS-49
G6.4	Boreholes and Exploratory Excavations	GS-49
CHAPTER G7 GENERAL SPECIFICATIONS FOR HYDROMECHANICAL WORKS		GS-50
CHAPTER G8 PHYSICAL AND OTHER INFORMATION		GS-51
G8.1	General.....	GS-51
G8.2	Meteo-hydrological Condition.....	GS-51
G8.3	Geological Information.....	GS-53
G8.4	Concrete Aggregates.....	GS-54

LIST OF APPENDIX TO GENERAL SPECIFICATIONS

APPENDIX I	SPECIFICATIONS OF BATCHER PLANT -----	GSA-1
APPENDIX II	SPECIFICATIONS OF AGGREGATE PLANT -----	GSA-7
APPENDIX III	SPECIFICATIONS OF CEMENT SILO -----	GSA-9
APPENDIX IV	CONCRETE TESTING EQUIPMENT -----	GSA-12
APPENDIX V	METEOROLOGICAL DATA -----	GSA-14
APPENDIX VI	STREAM FLOW DATA OF TRIBUTARIES OF GRNW -----	GSA-15
APPENDIX VII	WATER QUALITY DATA -----	GSA-16
APPENDIX VIII	SOIL TESTING EQUIPMENT -----	GSA-17

THE PORT LOUIS WATER SUPPLY PROJECT
LOT II : CIVIL WORKS (DAM AND APPURTENANT STRUCTURES
INCLUDING CLOSURE OF DIVERSION TUNNEL)

GENERAL SPECIFICATIONS

CHAPTER G1 DESCRIPTION OF PROJECT

G1.1 General

The State of Mauritius comprises volcanic islands such as Mauritius, Rodrigues, Agalega and St. Brandon and located about 900 km east of Madagascar in the Indian Ocean. A total land area of the State is 2,040 km², of which the Mauritius island accounts for about 91.4% or 1,865 km².

The Project Site is located in the upper Grand River North West (GRNW) basin in the Mauritius island, approximately 11 km south of Port Louis, the capital city of Mauritius. The GRNW which is one of major rivers in Mauritius originates in the central plateau of the Mauritius island and runs northwestward till it finally enters into the Indian Ocean through the southwestern fringe of the Port Louis city area.

The PORT LOUIS WATER SUPPLY Project aims at supplying municipal and industrial water for Port Louis city from the GRNW basin by constructing a rockfill dam with a crest length of around 250 m and a height of around 80 m above river bed and its appurtenant structures as well as water supply facilities including municipal dike, transmission pipeline and treatment facilities. Hence, the Project area covers the whole basin of GRNW and Port Louis city.

The upstream reaches of GRNW are composed of such tributaries as named the Moka, Profonde, Cascade, Terre Rouge and Plaines Wilhems rivers. The proposed damsite is located on the lower reach of the Terre Rouge river, just upstream of the confluence with the Plaines Wilhems river.

Of the above project components, the Works called for the Lot II Contract cover only the dam and appurtenant structures including closure of diversion tunnel. Construction of the preparatory works and civil work construction of the diversion tunnel including hydromechanical works such as supply of diversion closing gate and supply/installation of guide metals therefore will be carried out as separate Lot I contract. Furthermore, construction of water supply facilities such as municipal dike, transmission pipeline and treatment facilities will be included in separate Lot III contract.

The following structures will be constructed under the respective contracts.

(1) Lot I (for reference only)

- Preparatory Works including;
 - Access road around the damsite, connecting the trunk highway and inlet/outlet portals of diversion tunnel on the left river bank of damsite through the Construction Facilities Area to be allocated on the right bank side of the damsite,
 - Access road along transmission pipeline,
 - Haul road connecting the quarry site and concrete aggregate area in the Construction Facilities Area,
 - Other preparatory works such as aggregate plant, concrete plant, waste water treatment facility, cement ware house, motor pool, repair shop, laboratory, utility buildings, Engineer's office/residence, etc. in and around the Construction Facilities Area,
- Single lane of diversion tunnel with a diameter of 6.8 m and a length of 515 m including the inlet and outlet portals, and supply of diversion closing gate and supply/installation of guide metals therefor, and
- Other civil works to complete Lot I Works.

(2) Lot II (to be covered by these Tender Documents)

- Main dam and cofferdams
- Spillway
- Intake facilities
- River outlet facilities
- Closure of diversion tunnel
- Repair of existing municipal dike
- Other civil works to complete Lot II works

(3) Lot III (for reference only)

- Municipal dike
- Transmission pipeline
- Treatment facilities
- Other civil works to complete Lot III works

Principal features of the Project are summarized as follows:

PRINCIPAL FEATURES OF THE PROJECT

(1) RESERVOIR

Catchment area	54.9 km ²
Annual basin rainfall	2,400 mm
Gross storage capacity	6.7 x 10 ⁶ m ³
Effective storage capacity	6.3 x 10 ⁶ m ³
Flood water level	El. 193.5 m
High water level	El. 189 m
Low water level	El. 139 m
Surface area	30 ha
Mean runoff	1.8 m ³ /s
Design flood	1,890 m ³ /s
Return period	(PMF)

(2) DAM

Type	Rockfill
Crest elevation	El. 196 m
Height (from river bed)	84 m
Crest length	250 m
Embankment volume	1,548 x 10 ³ m ³

(3) SPILLWAY

Type	Side channel
Crest elevation of weir	El. 189 m
Width of weir	92 m
Discharge	1,890 m ³ /s

(4)	RIVER DIVISION	
	Type	Tunnel diversion
	Design flood	520 m ³ /s
	Return period	(20 years)
	Discharge in tunnel	520 m ³ /s
	Number of tunnel	1
	Diameter	6.8 m
	Length	499 m
	Gate type	Sluice gate
(5)	INTAKE	
	Type	Selectable intake gate
	Discharge	1 m ³ /s
	Number of gates	3
	Dimension of gate	2,100 mm x 2,100 mm
	Gate type	Fixed wheel gate
(6)	NEW TRANSMISSION PIPELINE	
	Design discharge	660 lit/s
	Number of pipeline	1
	Diameter	800 mm
	Length of pipeline	2,100 mm
(7)	NEW TREATMENT PLANT	
	Type	Rapid sand filtration
	Capacity	30,000 m ³ /day

G1.2 Port Facilities

Port Louis is an international trade port, situated along the northeastern coast of the Mauritius island. The port is equipped with the following facilities:

- (1) Approach channel (or canal) to wharf
 - Length : 1.3 km
 - Width : 0.2 km
 - Water depth from Higher Low Tide Water Level : 12.5 m
 - Water depth from Lower Low Tide Water Level : 11.0 m
- (2) Berth capacity : 6 ships of 27,000 DWT class
- (3) Warehouse : Approximately 40,000 m² in floor area
- (4) Loading/unloading facilities
 - Equipment : 4 units of heavy-duty toplift truck
 - Capacity : 35 ton class ; 1 unit
26 ton class ; 3 units

Aside from the above information, the Contractor shall fully acquaint himself with the availability of the harbour facilities at the port of Port Louis as well as the size, and possible other limitations imposed by the authority concerned, etc. The Contractor shall take such information into account when making arrangements for handling and transporting the materials, equipment and the construction Plants.

The Employer shall make his best endeavours to assist the Contractor in securing priority in the harbour with respect to customs clearance of the Contractor's equipment, materials and goods.

G1.3 Access to the Site

There is a trunk highway in the Mauritius island, linking from Port Louis to Phoenix through plateau extending on the right bank side of the damsite. A distance of the road between Port Louis and Phoenix is approximately 20 km. A rural road branches off the road at the southwestern foot of Mt. Ory, about 11 km distant from Port Louis on the route, to pass by the Construction Facilities Area on the right bank side of the damsite.

The rural road is to be widened and improved under the Lot I Contract to use as the access road for the Project. Moreover, the Works for Lot I cover the construction of new access road to extend from the Construction Facilities Area to the inlet/outlet portals of diversion tunnel on the left bank side of the damsite as well as that running along the transmission pipeline as mentioned in Clause G1.1 hereof.

The highway section between Port Louis and its branch point with the aforesaid rural road has the following conditions:

- Effective road width : 14.0 m
- Maximum road grade : 7.0 %
- Allowable height of vehicle : 5.0 m
- Allowable load of bridges on the section : 40 - 50 ton/m²

The Contractor shall fully acquaint himself with the conditions of inland transportation to the Site.

The Contractor shall not have any adverse influence on the present traffic condition of the highway in transporting equipments, materials for the Works to the Site, since the highway is heavily used as the national trunk road. The Contractor shall use every reasonable means to ensure that all loading limits and other limitations on roads are observed, and in the event of moving any extraordinary load of equipment or pre-construction unit or part of the Works, the Contractor shall before moving such extraordinary load obtain all necessary permits and approvals from any authority and comply with all other lawful requirements.

The Contractor shall abide by all limitations, laws and regulations relating to the use of public transportation routes. He shall make any necessary repairs or replacements as the case may be to any structure on route which has been damaged by the Contractor as the result of his own negligence. Such repair or replacements shall be satisfactory to the PMO/Engineer or the appropriate government authorities.

G1.4 Scope of the Works

The Works to be carried out under the Contract shall, except as otherwise provided in the Contract, comprise the supply of all materials, labour, equipment, constructional plant and other items necessary for the execution, completion and maintenance of the Permanent Works and Temporary Works specified in Clauses G5.1 to G5.3 hereof in strict accordance with the Contract and as directed by the PMO/Engineer.

The Works to be carried out by the Contractor under the Lot II Contract are generally listed as follows, but are not necessarily limited thereto:

- (1) operation and maintenance of the Preparatory Works required for execution of the Permanent Works.
- (2) construction of the main dam including cofferdams.
- (3) construction of spillway.
- (4) construction of intake structure including river outlet works with hydromechanical works, electric works, building and building service works.
- (5) Closure of diversion tunnel
- (6) repair of existing municipal dike.
- (7) other works required to complete Lot II works.

Details of the Permanent, Preparatory and Temporary Works mentioned above are given in the Specifications and on the Drawings, which form an integral part of the Tender Documents.

G1.5 Works by Other Contractors

The Employer may arrange for, before the issuance of the Maintenance Certificate, works necessary for the completion of the Project other than that covered by this Contract, which will be executed by other contractors. In such an event, the Contractor shall cooperate with the Employer and other contractors for the following Lots to ensure the satisfactory completion of the Project as a whole.

- Lot I : Diversion tunnel and preparatory works
- Lot III : Municipal dike, transmission pipeline and treatment facilities

CHAPTER G2 DRAWINGS AND DOCUMENTS

G2.1 Drawings to be Furnished by the PMO/Engineer

(1) Contract Drawings

The Tender Drawings entitled the Port Louis Water Supply Project, consequently becoming the Contract Drawings are for tendering purposes only. Provided that after the Contract Agreement was concluded, the Contractor may use the Contract Drawings as defined above as a basis for placing preliminary orders for materials and for preparing the working drawings subject to corrections based on the further issues of the Drawings as provided hereunder, sub-clause (2) "Construction Drawings". Such Drawings further issued shall thereupon become part of the Contract.

The Contract Drawings shall not be used directly as a basis for fabrication and/or construction works.

(2) Construction Drawings

After the issuance of the Letter of Acceptance, the Construction Drawings will be issued by the PMO/Engineer to the Contractor based on the Contract Drawings which will be supplemented or superseded by further Drawings as necessary for the purpose of the proper and adequate execution of the Works. Two (2) full size prints (one reproducible) of such Drawings will be issued by the PMO/Engineer to the Contractor in accordance with the construction programme required under the provision of Clause G3.3 hereof. On receipt of these Drawings, the Contractor shall check them carefully and advise the PMO/Engineer in writing of any discrepancies, errors or omissions and full instructions will be furnished to the Contractor should any discrepancies, errors or omission be found. The Contractor shall be required to perform the work in accordance with such further Drawings. Although the Drawings are prepared to scale, work shall be based upon dimensions shown on the Drawings and not on dimensions scaled from the Drawings. The Drawings when read in conjunction with the Specifications and instructions that may be issued by the PMO/Engineer from time to time, will show sufficient dimensions, specific details and typical details to define the various features of the works, but minor details necessary for the construction of some part of the Works may not always be indicated. When the Contractor desires to prepare the supplemental drawings of such part for his construction operation, the Contractor shall prepare such drawings at his own cost.

The Contractor shall be governed by figured dimensions as given on the Drawings. Where required dimensions are not shown in figures, the Contractor shall obtain such dimensions from the PMO/Engineer before proceeding with the construction of the portion of the Works to which they refer. In every case, detail drawings shall take precedence over general drawings.

The Contractor will be issued the Construction Drawings required for construction purpose not later than one (1) month before commencement of each particular Section of the Works.

G2.2 Drawings to be Furnished by the Contractor

All of the various types of drawings to be prepared by the Contractor shall be made in a form approved by the PMO/Engineer and shall be submitted in advance so that the PMO/Engineer can review and/or approve them without any delay to the field work. These types of drawings include but are not limited to the following; however, it shall be noted that the names given to the drawings are only to provide a general description and can be changed as the PMO/Engineer deems best;

(1) Working Drawing

As mentioned in sub-clause G2.1 (2) above, the Contractor shall use the Construction Drawings as a basis for preparing his working drawings such as detailed drawings necessary for construction of the Works and any other temporary facilities, bending/cutting schedules and detailed arrangement drawings of steel bars, tunnel support drawings, concrete lift drawings and any other details which may be required. All working drawings shall be approved by the PMO/Engineer prior to the execution of the Works.

(2) Shop Drawings

Shop drawings of equipment covered by the Technical Specifications T7 "Hydromechanical Works" shall be prepared by the Contractor or the Contractor's material/equipment supplier on behalf of the Contractor to show the outline, dimensions, type of material, etc. Such shop drawings shall be submitted to the PMO/Engineer for approval. The shop drawings shall be prepared in accordance with the Specifications.

(3) Layout Drawings for the Temporary Works

Within thirty (30) calendar days calculated from the date of the PMO/Engineer's written Order to Commence, the Contractor shall submit to the PMO/Engineer for his final confirmation three (3) sets of drawings which show the layout of the Temporary Works

and the Works shown in these Specifications and Drawings. These drawings shall show the locations of the Land for the Temporary Works as agreed in sub-clause G5.2 (2) hereof and other pertinent details of the principal components of the Temporary Works which the Contractor proposes to use at the Site or other authorized areas and the Preparatory Works such as the constructional plant, offices, storage buildings, housing facilities, storage area, etc. which will be constructed by Contract Lot I and transferred from the Employer for use of other contractors. In addition, the drawings shall show the unloading facilities for the materials and equipment which the Contractor proposes to bring to the Site, and the capacity of each major constructional plant.

If any changes are made concerning the above-mentioned items during erection or after the items become operational, the Contractor must submit revised drawings showing such changes to the PMO/Engineer for his review and comments.

(4) As-built Drawings

The Contractor shall provide and keep up-to-date as-built drawings of which the original was prepared by the Contractor. These drawings shall show all changes or revisions from the original drawings and specifications, including the exact as-built locations, sizes and kind of metal work, embedded piping, if any and other concealed items of work. At the end of every month, all entries, changes or revisions made in the drawings by the Contractor shall be checked and approved by the PMO/Engineer. As the detailed work delineated on each Working or Shop Drawing is completed, the pertinent as-built drawings, after approval by the PMO/Engineer, shall be mutually signed by the PMO/Engineer and the Contractor or their representatives.

Prior to the last Final Completion of the Works under the Contract, the Contractor shall furnish the Employer one complete and duly checked set of as-built drawings consisting of one (1) reproducible copy and four (4) normal prints of each drawing.

(5) Other Drawings

Drawings other than those mentioned above, which are of a general nature such as proposed construction methods, schematic diagrams, outlines of how various types of work are to be performed, etc., must be submitted to the PMO/Engineer for his review and/or approval.

In preparing the Drawings, the Contractor shall leave a 14.5 cm x 10 cm space beside the title box for the signatures and stamps of the PMO/Engineer and the Employer.

G2.3 Pamphlets, Diagrams and Similar Data for Plant, Equipment and Materials

The Contractor shall submit to the PMO/Engineer for approval three (3) sets of applicable catalogues, pamphlets, manufacturer's specifications, diagrams, drawings or other descriptive data for all Plant, equipment and materials to be furnished under the Contract, and those which the Contractor proposes to use, within one hundred and twenty (120) calendar days after the issue of PMO/Engineer's Order to Commence the Works or as called for in the Specifications. These should be accompanied with related working and shop drawings as submitted initially. The approval by the PMO/Engineer of such descriptive data shall not relieve the Contractor of any of his responsibilities under the Contract.

G2.4 Test Procedure Instructions for Manufactured Items

The Contractor shall submit to the PMO/Engineer for approval, during or immediately following the submission of drawings, test procedure instructions describing any test which may be required during manufacture and/or tests which may have to be performed on completion.

Such instructions shall define the sequence of tests, equipment preparation, operation procedures to be followed and the detailed procedures for conducting the tests. Further details listed in the Specifications which pertain to test procedure instructions and types of tests to be performed shall be complied with.

G2.5 Instruction Manuals for Installation, Operation and Maintenance

The Contractor shall submit to the PMO/Engineer for approval instruction manuals concerning the correct manner for operation and maintenance of the Plant and equipment to be used by the Contractor mentioned in Sub-clause G1.5 hereof within thirty (30) calendar days calculated from the date of the PMO/Engineer's written Order to Commence.

The instruction manuals shall describe in detail the operation and maintenance procedures to be followed and the use of all erection equipment, measurement devices or other items. The procedures for assembling, adjusting, operating and dismantling of each component system, machine or equipment shall be clearly described and illustrated.

The maintenance to be performed for these items shall be described in detail including the recommended frequency of inspections and lubrication. The instruction manuals shall include easily

readable diagrammatic drawings of the plant and equipment to facilitate understanding of the descriptive information.

The instruction manuals shall include a complete list of all applicable drawings, spare parts lists, and a parts list for each component of each item of Plant and equipment. The parts lists shall include the manufacturer's code, serial numbers and ordering instructions and shall be detailed as far as possible for the Plant and equipment supplied referring to the manuals provided by the Employer to the Contractor.

G2.6 Submission and Review or Approval of Contractor's Drawings and Documents

The Contractor shall, except specifically noted elsewhere in the Contract, submit his drawings and documents to the PMO/Engineer for review or approval at least sixty (60) calendar days prior to the execution of the works concerned with the said drawings and documents. Shop drawings for the items which may be fabricated outside of Mauritius and shipped to the Site shall be submitted within one hundred and twenty (120) calendar days prior to shipment of the items for the approval of the PMO/Engineer.

The procedure for the submission, review and/or approval of drawings and documents shall be understood to be as follows, provided that the PMO/Engineer shall reserve the right to make any general changes to such procedure during the course of the works when the PMO/Engineer deems necessary.

When the Contractor is ready to have the PMO/Engineer review and/or approve certain drawings and documents, he will submit three (3) copies of clearly readable blueprint copies of each drawing and document by means of a standard transmittal sheet to which a log (control) number has been assigned. The format of the transmittal sheet will be approved by the PMO/Engineer. Within thirty (30) working days after receiving the prints of the drawings and documents submitted by the Contractor, the PMO/Engineer will return one copy marked and signed with one of the following classifications, depending upon whether the drawings and documents are to be "approved" or "reviewed";

(1) Drawings Requiring Approval:

- (a) "APPROVED"
- (b) "APPROVED EXCEPT AS NOTED - RESUBMITTAL NOT REQUIRED"
- (c) "RESUBMIT AFTER MAKING CORRECTIONS"

- (d) "DISAPPROVED FOR REASONS NOTED"
- (2) Drawings Requiring Reviewal:
- (a) "REVIEWED - RESUBMITTAL NOT REQUIRED"
 - (b) "REVIEWED - MUST BE RESUBMITTED FOR REASONS STATED"
 - (c) "RESUBMIT AFTER MAKING CORRECTIONS"
 - (d) "REVIEWED BUT NOT ACCEPTED FOR REASONS STATED"

Upon receipt of any drawings and documents which have been marked as shown in (1)-(a) & (b) or (2)-(a) above, the Contractor will be authorized to proceed with the work covered by such drawings and documents which may be subject to making any correction(s) if indicated thereon by the PMO/Engineer; provided that he shall first submit two (2) blueprints and one (1) reproducible copy of each drawing and document with corrections if any, to the PMO/Engineer. All the approved and reviewed Drawings must be maintained at the Contractor's office at the Site in proper order and hung in easily available "stick files" which are classified into the various Project Activities.

When the returned drawings and documents have been marked as shown in (1)-(c) or (2)-(b) above, the Contractor shall make the necessary corrections and/or revisions to the drawings and documents in a timely manner and shall resubmit them to the PMO/Engineer by logged transmittal sheet in the same manner as for new-drawings and documents, i.e. three (3) copies. When the returned drawings and documents have been resubmitted for approval, the PMO/Engineer will try to complete his review and/or approval of the drawings and documents within fifteen (15) working days; however, this will depend on the number and complexity of the corrections/revisions which have to be checked. This procedure will continue until the drawings and documents have eventually been marked as shown in (1)-(a) & (b) or (2)-(a) above, at which time they will become a part of Contract Documents.

No concrete for permanent work can be poured until the applicable drawings and documents have been approved by the PMO/Engineer. Prior to making the pour, a joint inspection will be required by the PMO/Engineer's Representative and the Contractor's Representative to ensure that the approved drawing(s) and documents and appropriate specifications have been fully complied with. Any discrepancies or deficiencies so discovered shall be corrected before the concrete pouring.

If it is necessary to make any revisions to a drawing and/or document after it has been reviewed and/or approved, the Contractor shall resubmit it to the PMO/Engineer for further approval by logged transmittal sheet in the same manner as for a new drawing and/or document.

The PMO/Engineer reserves the right to request that the Contractor shall add details and make any changes or modifications to the drawings and/or documents which are necessary to conform to the provisions and intent of the Specifications, and the Contractor shall do so without extra cost.

Any work done prior to the PMO/Engineer's approval of drawings and/or documents shall be at the Contractor's risk. Approval by the PMO/Engineer to the Contractor's drawings and/or documents shall not relieve the Contractor of his obligations such as the responsibility for complying with all the requirements of the Specifications, the correctness of his drawings and documents, for the adequacy of the method of construction, etc.

CHAPTER G3 SCHEDULE AND REPORTS

G3.1 Commencement, Carrying Out and Completion of Works

The Contractor shall commence the Works under the Contract in accordance with Clause 41 of the Conditions of Contract and shall complete a work listed in the following table within the number of months specified therein counting from the last day of the period named in the Appendix to the Tender as that within which the Works are to be commenced:

Item No.	Work	Months within which the Work is to be Completed
1.	River diversion	2
2.	Cofferdams	8
3.	Main dam	27
4.	Spillway except bridge	27
5.	Intake	21
6.	Intake trush racks, intake gate, river outlet trush rack and bulkhead	27
7.	Diversion gate and bulkhead closure	27
8.	Dam impounding	27
9.	River outlet including river outlet facilities	33
10.	Whole of Lot II works	34

In addition, the Contractor shall have an obligation to carry out the Test Operation for two (2) months after the Provisional Completion of the Works as specified in Clause 82 of the Conditions of Contract.

G3.2 Liquidated Damages

- (1) Should the Contractor have failed to complete a work and to complete the whole of the Works specified in Clause G3.1 above within the periods or such other period or the later dates for the respective works as may be allowed pursuant to Clause 44 of the Conditions of Contract, the Contractor shall pay to the Employer as fixed, agreed and liquidated damages the sums stated in the following table for each calendar day or part of a day of delay.

The accounting for liquidated damages for each work or the whole of the Works shall begin on the last day of such period or date, as the case may be, or such other period or the later dates as may be allowed pursuant to Clause 44 of the Conditions of Contract and count forward in time till the completion of that work as certified by the PMO/Engineer.

Final clean-up of the premises and any other work that does not interfere with the normal and continuous operation of the Project may be done, after the above-mentioned completion time without incurring liquidated damages. However, this will be subject to the Employer's approval, depending on the situation prevailing on the site at that time.

Item No.	Work	Liquidated Damages per Day (U.S.\$)
1.	Main dam	—
2.	Spillway except bridge	—
3.	Intake	—
4.	Intake trush racks, intake gate, river outlet trush rack and bulkhead	—
5.	Diversion gate and bulkhead closure	—
6.	Dam impounding	—
7.	River outlet including river outlet facilities	—
8.	Whole of Lot II works	—

- (2) Reduction and maximum amount of liquidated damage are described in Clause 47 of the Conditions of Contract.

G3.3 Construction Programme

The Contractor shall submit a detailed construction programme or revision of the same to the PMO/Engineer for his approval in accordance with Clause 14 of the Conditions of Contract.

The construction programme in a full detail for all the Works to be carried out during the Contract shall be submitted by the Contractor within thirty (30) calendar days calculated from the date of the PMO/Engineer's written Order to Commence the Works. The construction programme shall be submitted in conjunction with the schedule in network and bar chart forms to be complied with the provisions hereinafter

The Contractor shall describe the conditions of working shifts, if necessary to execute in night works and/or Sunday & holiday works, to be applied in the respective work progresses of his construction programme.

Whenever the Contractor proposes to change the Contractual Construction Programme, the Contractor shall immediately notify the PMO/Engineer in writing for the approval of the revisions. If such a change in the Contractual Construction Programme affects the PMO/Engineer's design and drawing programme, the Employer shall not be responsible for the consequence of the late issue of any Drawings which are attributable to that change. Notwithstanding the provisions as prescribed in Clause 6 (4) of the Conditions of Contract, the Contractor shall have no right to claim to such delay of construction progress caused by the issuance of the Construction Drawings in delay or postponement.

If the Contractor falls behind the approved Contractual Construction Programme, he shall, within fourteen (14) days of the date of such default, submit a revision of the Contractual Construction Programme allowing the proposed measure to complete the Works on time, or approval.

When requested by the PMO/Engineer, the Contractor shall promptly furnish a detailed sub-programme of the Contractual Construction Programme for particular sections of the Works.

The network referred to as "CPM Network" and bar chart to be submitted in the construction programme shall be complied with the following provisions;

- (1) Activities shown on the CPM Network and time bar-chart construction schedule shall consist of only of the actual construction operations but also will include time allowances for the preparation and approval of drawings and samples, procurement and shipping of materials and equipment, installation of special and critical items, possible delays caused by flood and/or inclement weather, religious holidays, etc. The critical path shall be clearly marked on the CPM Network. The selection of activities to be shown on the CPM Network and time bar-chart construction schedule shall be submitted within thirty (30) calendar days calculated from the date of the PMO/Engineer's Order to Commence the Works.
- (2) Both the time bar-chart construction schedule and CPM Network shall be closely monitored and kept current. In addition, they will be formally updated by the Contractor every month, or as directed by the PMO/Engineer, and submitted to the PMO/Engineer for his review and comments.

It is noted, in preparing the construction programme, that the Contractor shall make proper arrangements to commence development of the quarry site at the earliest after mobilization so that other works will not be disturbed due to delay of the development of the quarry site.

G3.4 Monthly Progress Reports

The Contractor shall, before the tenth (10) day of each month, submit three (3) copies to the Employer and two (2) copies to PMO/Engineer of monthly progress report in a format acceptable to the PMO/Engineer and without cost to the Employer, detailing the progress of the works accomplished during the preceding month. The report shall contain but are not limited to the following:

- (1) A general description of the works performed during the reporting period on each main activity to include any notable problems which were encountered.
- (2) The total overall percentage of the Works completed as well as scheduled by the CPM Network as of the end of the reporting period, with appropriate comments in writing to explain any differences.
- (3) The percentages of each main work activity completed as well as scheduled during the reporting period, with appropriate comments in writing to explain any differences.
- (4) A list of all activities of scheduled progress and actual progress during the reporting period including the Contractor's actual or forecast start date versus scheduled start date, and the actual or forecast completion date versus scheduled completion date for each activity, with appropriate remarks in writing to explain any differences.
- (5) A list of activities scheduled to be started within the next three (3) months, with expected starting and completion dates. If the expected starting and/or completion dates are different from those shown on the CPM Network schedule, an explanation is to be given.
- (6) A list of local manpower (by trade classification) employed during the reporting period.
- (7) A list of expatriate personnel (by position) employed during the reporting period.
- (8) A list of the Constructional Plant, equipment and materials presently located at the Site.
- (9) Photographs of the type called for in Clause G3.5 hereinafter.

- (10) Total quantities of aggregate produced, length of tunnel excavated, concrete poured, embankment materials placed, etc. during the reporting period. This will include, but is not limited to, the following:
 - (a) Total quantities of various classifications of aggregate produced.
 - (b) Total length of tunnel excavated.
 - (c) Total volume of embankment of dams.
 - (d) Total quantities of various classes of concrete poured for each activity.
- (11) Main items of Temporary Works performed during the reporting period.
- (12) A statement detailing the status of progress on the overall project and how to regain any lost time or set-backs which may have occurred.
- (13) A general description of the weather and water level in the rivers including the listing of rainfall (in mm) and maximum and minimum temperatures for each day throughout the month.
- (14) A listing of deadlined (inoperable) equipment, action being taken to get it back in operation and the estimated completion date of the repairs.
- (15) A statement about labour relations including shifts and hours of work executed and an explanation of any actual or potential problems.
- (16) A statement concerning the effectiveness of the safety programme and a listing of each accident involving the hospitalization and/or death of any person. Also a list of any accidents in which equipment was damaged to the extent it becomes inoperable, and any fire which occurred.
- (17) A statement concerning the effectiveness of the security programme and a listing of any major thefts.
- (18) A listing of the amount and date of each payment received as of the reporting period and the amount of any monthly invoice which has been submitted but not yet paid.
- (19) A statement of estimated amount of the Works, in both foreign currency portion and local currency portion, to be invoiced in the subsequent three (3) months.

- (20) A list of claims (if any) submitted during the reporting period to include claim amounts on cost and extension of time.
- (21) A statement concerning foreseeable problem areas and recommendations about how they should be resolved.
- (22) A statement concerning operation, maintenance and repair of the Constructional Plant and equipment in accordance with the provisions stated in the Clause G5.3 of these Specifications.
- (23) A statement concerning the consumption record of major materials during the reporting period and accumulated quantities thereof (major items).
- (24) A listing of the documents received from or submitted to the Employer and the PMO/Engineer during the reporting period.

G3.5 Progress Photos

The Contractor shall, throughout the Contract period, take colour photographs which clearly show the work progress being made. The photographs shall be taken at the start, during and at the completion of each major component of the work and at other times and places as directed by the PMO/Engineer. The major photographs shall be attached to the monthly progress report specified in Clause G3.4 hereinabove.

A brief description of the subject and date taken will be listed for each photograph, the size being post card (9 cm x 12 cm). If additional prints are required by the PMO/Engineer or the Employer, the Contractor shall submit them. The cost of such photographs shall not be paid separately and shall be deemed to be included in the Contract Price.

Upon completion of the Works, the Contractor shall submit two (2) sets to the Employer and one (1) set to the PMO/Engineer of colour photographs adequately edited and in a booklet form showing the entire sequence of the work from the start to the completion.

G3.6 Weekly and Monthly Work Schedules

(1) Weekly Work Schedule

The Contractor shall at the end of each week submit four (4) copies of a written weekly schedule listing the main work items which are to be accomplished during the successive week. The schedule shall be in a format approved by the PMO/Engineer and shall contain appropriate comments in regard to major work items to be undertaken during the week. One page of the schedule shall list each day of the week and show in the appropriate place each concrete pour which is planned to be made during the week.

(2) Monthly Work Schedule

The Contractor shall at the end of each month submit four (4) copies of a monthly bar chart type of schedule to show the work which be proposed to be accomplished during the successive month. This schedule will show, by means of bars, the days within the month which each main activity will be worked on and will indicate on which day each proposed concrete pour is to be made.

G3.7 Joint Meetings to Discuss Progress

A regular meeting between the key personnel of the PMO/Engineer and the Contractor shall be held once per week at a time agreed to by both parties, but preferably on a Friday. The purpose of these meeting will be to discuss the progress being made, the work proposed for the forthcoming week and any problems having a direct bearing on the immediate to near-term work activities. The Employer has the right to attend such meeting.

G3.8 Method of Performing the Works

As far as it is consistent with the interest of the Works and the results to be attained, the order and methods of prosecuting the Works will be left to the discretion of the Contractor, with whom ordinarily the responsibility of such order and methods shall rest, provided that the PMO/Engineer shall at any time have the right to prescribe and control such order and methods with a view to the safety, rapidity and economy of construction of the Works, and to ensure harmony and cooperation with other contractors.

Before commencing the Works or any portion thereof, the Contractor shall furnish the PMO/Engineer with full information as to his plans and methods for carrying out the Works or any portion thereof.

CHAPTER G4 GENERAL PROVISIONS

G4.1 Cooperation with Other Contractors

The Works at the Site may be undertaken also by the other contractors including the Lot I and III Contractors as specified in Clause G1.5. At such times, the Contractor shall not have exclusive occupancies of the affected localities and construction plants/facilities/equipment at the Site. The Contractor shall cooperate with other contractors doing the work in the interest of the entire Project.

Any discrepancies or conflicts, which may arise between the Contractor and other contractors with regard to their respective works, will be resolved by the Employer and the PMO/Engineer, and whose decision shall be final and binding on all parties concerned.

G4.2 Bench Marks

The PMO/Engineer has established or shall establish reference bench marks and reference survey pegs on the Site. Basic point for coordinates and elevation is STP 12 at Mount Only with the following.

X	=	998,230.23 m
Y	=	995,381.59 m
EL	=	348.874 m

The Contractor shall carry out a check survey thereon before using any of these for setting-out the Works and shall satisfy himself as to their accuracy. The Contractor may establish additional temporary bench marks for his own convenience but each temporary bench mark so established shall be of a design and in a location approved by the PMO/Engineer, and shall be accurately related to the bench marks established by the PMO/Engineer.

The Contractor shall cooperate with the PMO/Engineer in checking the setting-out and in performing surveys and measurements for record and payment purposes. The Contractor shall render all necessary assistance to the PMO/Engineer and shall provide as required by and for the sole use of the PMO/Engineer, sufficient quantities of pegs, poles, straight edges, stagings, moulds, templates, profiles and all other requisites for checking the Contractor's setting-out and the measurement of the Works. Checking by the PMO/Engineer will not relieve the Contractor of his responsibility for the accuracy of the lines and grades.

The Contractor shall carry out all additional detailed survey necessary to extend the survey network in the Site and shall establish, maintain and preserve the permanent monuments and all bench marks, reference stations and the like.

No separate payment shall be made to the Contractor for making photographic surveys for quantitative estimates, locating structures, and establishing grades or delay occurred by such checking and setting-out including those in cooperation with the PMO/Engineer's staff and no extension of time will be allowed for any delay occurred thereby. The entire cost will be included in the unit and lump sum prices for the various items stated in the Bill of Quantities.

G4.3 Sanitary Arrangements and Clearing of Site

The Contractor shall keep the Site in a clean and sanitary condition and shall provide and maintain sanitary conveniences for the use of persons employed in the Works to the extent and in the manner and at such places as approved by the PMO/Engineer and by any local or other Authority concerned, and all persons connected with the Works shall be obliged to use these conveniences.

The Contractor shall also post notices and take such other precaution as may be necessary to keep the Site clean.

Clearing by the Contractor shall not be made without written approval of the Employer and shall be kept to minimum particularly over streams and drains.

No tree felling shall be permitted outside the Land stipulated in Clause G5.2 hereof. Tree felling shall not take place without written approval of the PMO/Engineer and presence of the Employer's personnel, and shall be kept to a minimum. All timber fell shall be property of the Employer and the Contractor shall hand over the same to the Employer at the designated points, if ordered to do so.

G4.4 Works to be Kept Clear

The Contractor shall at all times keep the working and storage areas used by him free from accumulations of waste materials or rubbish and the Works well drained until the issue of the Maintenance Certificate as specified in the Conditions of Contract, and shall ensure that so far as practicable in the opinion of the PMO/Engineer all works will be carried out in the dry condition. Excavated areas are to be properly drained and kept free from standing water.

The Contractor shall construct and maintain all temporary dams, water courses and other works, and shall carry out all pumping that may be necessary for dewatering of the Works when the construction is in progress. All such temporary works shall be removed at a time approved by the PMO/Engineer.

Notwithstanding any approval by the PMO/Engineer of the arrangements made for the dewatering, the Contractor shall be responsible for the sufficiency thereof and shall be liable for keeping the Works safe during all floods and for making good, at his own expense, any damage to the Works that may be attributable to floods.

Before final inspection of the Works, the Contractor shall recover or dispose of in a satisfactory manner all excess materials, temporary structures, waste and debris, and leave the entire premises in a conditions of cleanliness satisfactory to the Employer.

No separate payment shall be made for this requirement, and the entire cost of cleaning up shall be included in the unit and lump sum prices for the various items stated in the Bill of Quantities.

G4.5 Precautions for Safety

(1) General

The Contractor shall take at all times necessary precautions against risks of loss of life or of injury to any person employed on the Works or to employees of the Employer and the PMO/Engineer or of others or to visitors or to persons having good and sufficient reasons to be about the Works, and to this end shall properly safeguard the Works to the satisfaction of the PMO/Engineer.

The Contractor shall furthermore take all necessary precautions against damage to the property of the Employer or of others located at or adjacent to the Site.

The Contractor shall at all times comply with any accident prevention regulations, any safety regulations peculiar to the various trades employed on the Works, any safety regulation published by the Government of Mauritius.

The Contractor shall report promptly to the PMO/Engineer all accidents involving the death of or serious injury to any person, on the Site or resulting from the Contractor's operations.

The Contractor shall appoint a Safety Officer. The Safety Officer shall be qualified in safety and familiar with the type of work being performed, whose assignment shall include initiation of measures for the protection of health and the prevention of accidents and who shall see, by personal inspection, that all safety rules and regulations are enforced. The Contractor shall hold regularly scheduled safety meetings at least each month with his engineers, supervisors and foremen. When directed by the PMO/Engineer, additional meetings shall be held. The Contractor shall keep the PMO/Engineer well informed as to when these meetings are to be held and shall provide the PMO/Engineer with a copy of the proposed agenda. The PMO/Engineer and the Employer reserve the right to attend any of such meetings.

(2) Explosives and Fuels

The Contractor shall make arrangements to transport, store and handle explosives and fuels in a safe manner for protecting the public in accordance with the laws and security regulations in force. In this regard, he shall submit a written program to the PMO/Engineer for approval for the safe handling and storage of explosives and fuel.

The Contractor shall obtain all necessary licenses and shall pay all fees and charges in respect of the same as may be necessary for the purpose of moving explosives and fuels from place to place and storing the same, and shall carry out all applications to obtain the approvals from the authorities concerned of the Government of Mauritius.

The Contractor shall supply and install an efficient warning system so that adequate warning may be given for all persons that may be endangered when explosive charges are to be fired. The Contractor shall ensure, prior to discharging an explosive, that the area to be blasted is clear of all residents, pedestrians and vehicular traffic. In addition, he shall post flagman on each of the roads entering to the said area so as to stop and prevent any traffic from entering into that area until the "all clear" notification is given.

Explosive magazines and above-ground storage tanks or gasoline and liquefied petroleum gas storage tanks shall not be located within the limits of the campsite or closer than 100 meters to any building in the Site. Moreover, the locations of explosive magazines shall be approved by the PMO/Engineer. The Contractor shall not make use of any explosives without the written approval of the PMO/Engineer and the Police Authority; however, it must be understood that approval by the PMO/Engineer and the Police Authority shall not relieve the Contractor of his obligations and responsibilities for all blasting operations.

(3) Temporary Fencing

The Contractor shall erect, maintain and remove on completion of the Works at his own expense suitable and approved temporary fencing to enclose such areas of the works to be carried out and all area of land occupied by the Contractor within the Site as may be necessary to implement his obligations as specified in the Conditions of Contract to the satisfaction of the PMO/Engineer.

Where any temporary fence has to be erected alongside a public road, footpath, etc., it shall be of the type required by and shall be to the satisfaction of the Authority concerned.

(4) Lighting

The Contractor shall provide sufficient lighting to ensure that security and safe working conditions are to be established, that the Works can be constructed in complete compliance with the Contract, and that a complete inspection of all Works in progress can be made by the PMO/Engineer. Unless otherwise directed by the PMO/Engineer, the minimum illumination on ground or working surfaces to be provided for the various operations or work areas shall be as follows:

Operations or Work Area	Illumination (Lux)
	Minimum value
Earthworks other than underground works	20
Access and haul roads where cross traffic or other hazardous conditions exist	10
Concrete placing	50
Underground works (working faces)	50
Workshops and auxiliary buildings	200

Illumination for areas or operation not listed above shall be as instructed by the PMO/Engineer.

All mobile equipment or plant used during night operations or in tunnel shall be equipped with sufficient lights and/or reflectors to ensure safe working conditions.

At least fourteen (14) days prior to start of the tunnelling or the night operations, the Contractor shall submit his proposals for lighting systems in the tunnel and in the areas which he proposes to work at night to the PMO/Engineer for approval. The Contractor shall

modify the proposals, if required by the PMO/Engineer, and shall not begin such operations in such places as the case may be, until the proposals for lighting systems have been approved by the PMO/Engineer.

Approval of the Contractor's proposals for lighting shall not relieve the Contractor of any of his liabilities or obligations under the Contract.

(5) Fire Fighting Service

The Contractor shall take every precaution to prevent fire from occurring on or about the Site and shall provide suitable and adequate fire fighting equipment, in the opinion of the PMO/Engineer for ready use in all structures, buildings or works under construction, including his residential quarter, labour camps and ancillary buildings. The Contractor shall maintain such equipment and such additional fire fighting equipment as may elsewhere herein be defined, in efficient condition until construction is completed and the work accepted by the Employer. The Contractor shall comply with respect to the prevention of fires. The Contractor shall be responsible for maintaining of fighting crew on the Site at all times. An efficient fire alarm system shall be installed and maintained by the Contractor.

The Contractor shall fight diligently any fire which may occur on the Site whenever the fire may originate, with regard to which he shall employ all requisite equipment and manpower up to the limit of his equipment and manpower employed at the Site, including the equipment and manpower of his Sub-Contractors.

(6) Signs

The Contractor shall provide all necessary signs for the Works. These shall include but not be limited to the following:

- (a) Standard road traffic signs
- (b) Warning signs
- (c) Danger signs
- (d) Control signs
- (e) Safety signs
- (f) Direction signs

Wording on all signs shall be in English. The size, colour, lettering and location of all signs shall be subject to approval of the PMO/Engineer and special attention shall be paid to the standard in Mauritius with respect to the signs.

The Contractor shall maintain all signs so placed as well as those placed by the Employer.

If the PMO/Engineer considers that the system of signs provided by the Contractor is inadequate to ensure safety, or unsatisfactory in other respects, the Contractor shall add to, amend, or otherwise change the system to the satisfaction of the PMO/Engineer.

The Contractor shall pay particular care on the traffic control of the public roads in which the Contractor's equipment or vehicle may frequently pass. The Contractor shall post flagman at key places on such roads in addition to the signs. Roads closed to traffic shall be barricaded and posted with adequate warning signals. Suitable red lights shall be kept on from sunset to sunrise.

(7) Accident Reports

The Contractor shall, within twenty four (24) hours of the occurrence of any accident at or about the Site or in connection with the execution of the Works, report such accident to the PMO/Engineer. The Contractor shall also report such accident to the appropriate authority in Mauritius when it is required by the law therein. The Contractor shall be required to furnish monthly reports of all accidents to staff, workmen, equipment or plant involving loss of time, giving such information as may be prescribed by the PMO/Engineer.

(8) Safety Instructions

The Contractor shall at his own cost supply and issue to all of his employees and those of his Sub-Contractors and the staff of the PMO/Engineer a printed booklet of the size approved by the PMO/Engineer in English used in his employees at the Site for instructions on safety based on good practice. Within sixty (60) days after the PMO/Engineer's Order to Commence the Works has issued, sample copies of the booklet shall be submitted to the PMO/Engineer for his approval before printing and, if necessary, amendments shall be made to the booklet to full satisfaction of the PMO/Engineer. The Contractor shall issue the booklet immediately after printing as required herein and ensure that all employees are fully conversant with the instructions. Safety instructions shall deal with all safety measures including but not limited to the following:

- (a) Protective clothing, helmet and footwear
- (b) Use of lifting equipment
- (c) Use of drilling equipment
- (d) Tunnelling
- (e) Use and storage of explosives

- (f) Compressed air
- (g) Welding
- (h) Precaution against electrical shock
- (i) Routine procedure in case of accidents, fires, etc.
- (j) Watchman, warning notices and barriers

The Contractor shall allow for at least 20 booklets including each for the PMO/Engineer and the Employer.

(9) Submission for approvals

Unless otherwise stated in particular, the Contractor shall submit drawings and documents as required in the preceding paragraphs of this Clause in such a manner as described in Clause G2.6.

(10) Payment

No separate payment shall be made for complying with the provisions of this Clause G4.5 and all costs shall be deemed to be included in the Contract unit and lump sum prices of various items in the Bill of Quantities.

G4.6 Standards and Materials

(1) Standards and Unit of Measurement

All materials, equipment and testing apparatus and methods to be furnished and executed by the Contractor under the Contract shall conform to the requirements of JIS (Japan Industrial Standards) or other equivalent standards issued by national or other widely recognized bodies which may be approved by the PMO/Engineer. Further details listed in the Technical Specifications which pertain to standards shall be complied with.

The Contractor may propose to the PMO/Engineer during the period of the Contract a standard other than the specified in the Contract, provided that he shall submit an English translation of the proposed standard and all other information in accordance with Clause G2.3 hereof and shall submit, at the request of the PMO/Engineer, written proof that his proposed standard is equivalent in all significant respects to the standard specified in the Contract.

In all correspondence, technical schedules, specifications and drawings in or under the Contract, the metric system for measurement shall exclusively be employed except as otherwise specifically provided. On drawings or printed pamphlets where other systems for measurement have been used, the equivalent metric measurement shall be marked next to it in brackets.

(2) **Substitute Materials and Inspection of Material and Equipment**

The Contractor shall make diligent efforts to procure the specified materials, but when the materials specified are unavailable for reasons beyond the control of the Contractor, substitute materials may be used, provided that no substitute materials shall be used without prior written approval of the PMO/Engineer. The unit price in the Bill of Quantities shall not be adjusted to allow for increase in cost between materials quoted for and substituted materials actually supplied.

All materials and equipment to be furnished under the Contract will be subject to inspection by the PMO/Engineer at any time and in any state of completion, both off-site and on-site. The Contractor shall promptly furnish without additional charge, all facilities, labour and materials reasonably needed for performing all inspection and tests which may be required by the PMO/Engineer. Acceptance of materials and equipment or waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing materials and equipment meeting the requirements of the Contract.

G4.7 Packing

All materials and equipment shall be properly packed for transport to the Site so that they are protected against the climatic conditions to which they may be subjected in transit and in storage at the Site. Any material or equipment which is damaged or deteriorated during transport or storage shall be rejected by the PMO/Engineer, and the Contractor shall remove such rejected materials or equipment from the Site as soon as practicably possible.

Each crate or package shall contain a packing list in a water-proof envelope. All cases, packages, etc. shall be marked carefully on the outside to indicate the total weight, to show the center of gravity and the correct position for the slings used to lift the crate or package.

G4.8 Procurement and Stock of Materials

The Contractor shall be required to keep at all time the stocks of construction materials, equipment and supplies sufficient for his construction activities. Failure to do so shall be at the Contractor's risk. Any claims or requests for the extension of time of the works due to difficulties in procuring materials, equipment and suppliers will not be considered by the Employer.

The materials to be used in the Works particularly like fuel, explosives, cement and concrete aggregates shall be well investigated by the Contractor concerning these availabilities, specifications, characteristics, qualities, capacity of procurement, etc., which materials will be purchased in Mauritius or outside of Mauritius. The Contractor shall be required to compensate such inconveniences or lacks of satisfaction for the particular materials without any extra or additional charges to the Employer.

CHAPTER G5 CONSTRUCTION FACILITIES

G5.1 General

The Construction Facilities necessary for execution of the Works are divided into Temporary Works and Preparatory Works based on the nature thereof as defined below:

- (a) Temporary Works to be removed by the Contractor from the Site on completion of the Works, unless otherwise specified in the Specifications or directed by the PMO/Engineer, such as temporary construction road, temporary building, etc. other than the construction facilities specified below as the Preparatory Works.
- (b) Preparatory Works to be transferred from the Contractor for Lot I to the Employer at the issue of the Maintenance Certificate and used by other contractors for Lots II and III such as haul road to quarry site, concrete plant, and buildings and premises, electric power and water supply system, telecommunication system, sewerage system and testing equipment for concrete test provided in and around the Construction Facilities Area to be allocated on the right bank side of the damsite as described in Clause G5.3 hereof.

The Contractor shall submit for approval of the PMO/Engineer working drawings and full particulars of the Temporary Works at least twenty (20) calendar days before he desires to commence furnishing and constructing such work. Approval by the PMO/Engineer of any such proposals of the Contractor shall not relieve the Contractor of any of his responsibility for the sufficiency of the Works for their intended purpose. The Contractor shall also obtain any necessary approval from the Employer or other Government authorities concerned before commencing construction. Such work shall not be started without prior approval of the PMO/Engineer.

G5.2 Temporary Works

- (1) Removal of Temporary Works from the Site

On completion of the Works, all Temporary Works constructed by the Contractor, unless otherwise specified in the Specifications or directed by the PMO/Engineer, shall be removed from the Site. The Contractor shall make safe all areas affected by the Temporary Works and reinstate natural drainage. The Contractor shall finish, reinstate, clean up and relinquish

parts of the Site at the end of the Period of Maintenance or such earlier times as directed by the PMO/Engineer.

(2) Land Preparation for the Temporary Work

The Employer intends to allocate the Contractor, for use by the Contractor and provision of the PMO/Engineer's office/residence, the area of land called the "Construction Facilities Area" on the right bank side of the damsite for the purpose of providing Preparatory Works mentioned in Clause G5.3, as designated in the Drawings. The Contractor will accommodate his work force and set up all services and facilities within the Construction Facilities Area provided in accordance with the Drawings. The Contractor shall not provide any temporary building within the Construction Facilities Area, unless otherwise approved by the PMO/Engineer. The Contractor shall clearly state in his Tender the location of the Temporary Works allocated in the Construction Facilities Area, provided that it is deemed by the Contractor to be necessary to provide therein the Temporary Building mentioned in sub-clause G5.2 (3) and/or other equipment and construction plant than those included in the Preparatory Works for execution of the Works.

The Contractor shall present, with his tender, drawings showing his proposed general arrangement of the Temporary Works including temporary construction roads and buildings which the Contractor proposes to use. Such drawings shall show power supply and water supply systems necessary for the temporary works. Land areas required for his Temporary Works shall also be indicated on the drawings. Prior to signing the Contract, the Contractor shall reach an agreement with the Employer concerning the final layout of lands for the Temporary Works.

No separate payment shall be made for the land preparation for the Temporary Works and all the cost shall be deemed to be included in the relevant Contract unit and lump sum prices stated in the Bill of Quantities.

(3) Temporary Buildings

The Contractor shall provide, maintain and subsequently remove such temporary buildings as the Contractor's office, workshop, camp and other buildings which are to be located outside the Construction Facilities Area, if approved by the PMO/Engineer.

No separate payment shall be made for the Temporary Buildings and all the cost shall be deemed to be included in the relevant Contract unit and lump sum prices stated in the Bill of Quantities.

(4) Medical Services

The first aid medical facilities stipulated herein as the Temporary Works cover those necessary to provide medical services at the Site including operation and maintenance of the first aid building specified as the Preparatory Works.

The Contractor shall be provided first aid medical facilities at the Site and accommodate the same in the first aid building. In addition, the Contractor shall be provided with a motor ambulance at the Site. The medical services provided by the Employer shall be available to all persons employed by him and by any Sub-Contractor employed by him on the Works including their dependents, in accordance with the terms of the Contract, the provision in force in Mauritius and all other Statutory requirements. The medical service as above mentioned shall be also made available free of charge to all the Employer's and PMO/Engineer's personnel and their dependents, who may be designated by the PMO/Engineer. In this Contract, dependents mean wives and the children being resident at the Site, and any other persons designated as dependents by mutual agreement between the Employer and the Contractor.

The Contractor shall employ a doctor, registered nurses and other qualified staff to enable him to fulfill his obligations under this Clause and required by Law. The doctor shall be adequately experienced in medicine and shall be able to speak English.

The Contractor shall operate and maintain the medical facilities throughout the duration of the Works.

Payment for operation and maintenance of the medical services and motor ambulance will be made on the basis of the unit price per month stated in the Bill of Quantities from the month when the medical services has been provided by the Employer to the Contractor, which unit price for medical services shall constitute full compensation for the cost of all medical services as prescribed in this sub-clause. The cost incurred for the operation and maintenance of the ambulance including the cost for driver, attendant, spare parts, repair shop, etc., shall be deemed to be included in the unit price of Medical Services stated in the Bill of Quantities.

(5) Temporary Water Supply System

The Contractor shall supply, install, operate, maintain and subsequently remove temporary water supply system including water for construction use at each construction site and adequate supply of drinking water for temporary buildings/facilities approved by the

PMO/Engineer such as offices and quarters, camps, other than the construction facilities included in the Preparatory Works to be supplied by water supply facility as specified in Clause G5.3.

The Contractor may install, if approved by the PMO/Engineer, distribution pipe connected with the transmission pipelines to the Construction Facilities Area, which is to be provided as the Preparatory Works as stipulated in Clause G5.3, in order to supply water to each construction site or the temporary facilities/buildings.

Payment for temporary water supply system will be made at the lump sum price of Item No. A/03 in the Bill of Quantities, which lump sum price shall include all the cost necessary to supply, install, maintain and subsequently remove the temporary water supply system.

Payment for water supply system will be made on the basis of progress rate of the Permanent Works calculated from the comparison rate between the original Contract Value and the certified progress value of the Permanent Works made up to the end of the said month in monthly basis. Payment for water supply system shall not exceed the lump sum price stated in the Bill of Quantities.

(6) Temporary Electric Power Supply System

The Contractor shall provide his own diesel power generating plants including those for emergency use to produce electric energy, both before and after installation of the power supply system included in the Preparatory Works as specified in Clause G5.3. The Contractor shall design, supply, install, operate, maintain and subsequently remove upon completion of the Works, the temporary electric power supply system required for executing the Works and temporary facilities.

The Contractor may utilize the 22 kV distribution line after completion of its construction for the temporary power supply system and for the temporary telephone system with specific permission of the PMO/Engineer.

Any extension of the branch distribution lines, provision of necessary step down transformers and construction of low voltage distribution lines for the Contractor's construction purpose shall be made by the Contractor so as to suit his construction programme. The plan and manner of construction of his distribution system shall be approved both by the PMO/Engineer and the Employer.

The Contractor shall be charged at the electricity rate specified in Clause G5.3 for consumed electricity through the branch transmission line linked with transmission line owned by CEB (Central Electric Board).

Payment for temporary electric power supply system will be made at the lump sum price of Item No. A/04 in the Bill of Quantities, which lump sum price shall include all the cost necessary to supply, install, maintain and subsequently remove from the Site the temporary electric power supply covered by this sub-clause.

Payment for temporary electric power supply system will be made on the basis of progress rate of the Permanent works calculated from the comparison rate between the original Contract Value and the certified progress value of the Permanent Works made up to the end of the said month or monthly basis. Payment for electric power supply system shall not exceed the lump sum price stated in the Bill of Quantities.

(7) Temporary Construction Roads

The Contractor shall construct and maintain the temporary construction roads for approaching to the construction sites, spoil banks and other temporary facilities. The programme for temporary construction roads including associated drainage, stream crossing facilities, bridges, etc. in and around the working sites and construction schedules shall be submitted by the Contractor to the PMO/Engineer for his approval.

The access roads around the damsite and along the transmission pipeline and the haul road to the quarry site, which are included in the Preparatory Works as mentioned in Clause G5.3, are excepted from the temporary construction roads.

The temporary construction roads herein defined contain, but not limited to, access roads for approaching to the temporary facilities and spoil banks and temporary detours on the existing public roads and the above access and haul roads included in the Preparatory Works. The temporary construction roads shall be kept in good condition by watering and grading.

The Contractor shall allow the Employer and such other contractors free and unrestricted use of all temporary construction roads as soon as they have been completed and shall not restrict the access of authorized persons to such look-outs or viewing points as may be selected by the PMO/Engineer.

No separate payment shall be made for the temporary construction roads and all the cost shall be deemed to be included in the relevant Contract unit or lump sum prices stated in the Bill of Quantities.

(8) Maintenance of Existing Public Roads

The Contractor shall be wholly responsible for the maintenance of all existing public roads within the Project Area to be used for the Works under the Contract.

The Contractor shall ascertain for himself the practicability of using the existing public roads for access. The highways, roads and bridges have widely varying load limits, and the Contractor shall be responsible for determining the load limits existing at the time and insuring that the Constructional Plant does not exceed such limits. Before moving any heavy construction traffic onto highways, roads and bridges, the Contractor shall make suitable arrangements with the appropriate authorities concerned and obtain their approval for the passage of such traffic.

The Contractor shall not travel tracked vehicles or equipment on any bituminous sealed road surface. Rubber tired vehicles conforming to applicable load restrictions will be permitted to use bituminous sealed roads.

In maintaining these roads, the Contractor shall:

- keep clear and in good working order at all times all road structures, slopes, bridges, culverts, drains and other waterways;
- patch potholes with approved materials, keep the road surface in good repair and perform any grading and necessary resurfacing;
- maintain all fender posts, guide posts, guard posts, fencing, signs, signposts and other roadside structures;
- keep the road surface and shoulder free from all rocks, fallen timber, branches, limbs, rubbish and other debris and materials removed from the drains and drainage structures;
- maintain adequate low soil banks along the top edge on all fill slopes of the road to prevent drainage from passing down the fill slope, except in drains properly constructed with stone pitching, pipe or half-round lining.

Any work, improvement or modification at the existing public roads made by the Contractor, for his own convenience, and without being ordered by the PMO/Engineer shall be at the Contractor's own risk and expense.

No separate payment shall be made for the maintenance of the existing public roads and all the cost shall be deemed to be included in the relevant Contract unit or lump sum prices stated in the Bill of Quantities.

(9) Other Temporary Facilities

Other temporary facilities, such as temporary bridges and/or river crossing facilities, if any, necessary for execution of the Works shall be constructed, operated, maintained and subsequently removed by the Contractor at his own expenses. The Contractor shall submit to the PMO/Engineer for his approval the details of such temporary facilities.

Camp amenities and recreation facilities will be permitted to construct in the Construction Facilities Area or other Project Area at the location as approved by the PMO/Engineer.

No separate payment shall be made for other temporary facilities and all cost shall be deemed to be included in the respective unit or lump sum prices stated in the Bill of Quantities.

(10) Soil Conservation

All precautions shall be taken by the Contractor to prevent the landslide and erosion of soil from any lands used or occupied by the Contractor for the purpose of the Temporary Works and of the bed or banks or any river or stream and the deposition of excavated or eroded material in any river or stream that may result from the execution of the Works.

If in the opinion of the PMO/Engineer, the Contractor's operations in areas other than the Works and the Permanent Works, cause erosion hazards after removal of such works or reinstatement to the original, the Contractor shall undertake soil conservation measures in these areas as directed by the PMO/Engineer. The method of soil conservation measures shall be submitted by the Contractor to the PMO/Engineer for his approval prior to the execution of the said works.

All soil conservation measures shall be carried out at the earliest possible time, as approved by the PMO/Engineer, to ensure that the required protection is established by the time of completion of the Works.

No separate payment shall be made for the soil conservation and such costs shall be deemed to be included in the respective unit or lump sum prices stated in the Bill of Quantities.

During the construction, the PMO/Engineer may, if he deems necessary, direct the Contractor to carry out the preventive measures for landslide in the area of the Permanent Works or other areas as directed by the PMO/Engineer. The payment will be made in accordance with the provisions of Clause 51 of the Conditions of Contract.

G5.3 Preparatory Works to be Transferred from the Employer for Use of the Contractor

(1) Construction Facilities included in Preparatory Works

The following Preparatory Works are to be transferred from the Contractor of Lot I to the Employer for use of the Contractor of Lot II.

- (a) Construction Facilities Yard including motor pool, stock and assembly yards and other yards therein,
- (b) Concrete plants such as aggregates plant, concrete batcher plant and cement silo equipment,
- (c) Buildings and premises such as utility buildings, laboratory, PMO/Engineer's office and residence, Contractors office and dormitory, first aid building, ware house, cement ware house and repair shop,
- (d) Water supply system, electric power supply system, telecommunication system, sewerage system, and
- (e) Concrete testing equipment

The Employer intends to fully use the Preparatory Works for Construction of Lot II and III works mentioned in Subclause G1.1 hereof and as shown on the Drawings. The Preparatory Works by the Contractor for Lot I will be handed over to the Employer at the issue of the Maintenance Certificate after they are completely repaired and cleaned to the satisfaction of the PMO/Engineer.

The Employer will give full instructions to the Contractor of Lot II (hereinafter referred to as "the Contractor") with respect to practical operation and maintenance of Constructional Plant, equipments and materials included in the Preparatory Works.

(2) Construction Facilities Area

The Contractor shall be provided with the Construction Facilities Area including motor pool, stock and assembly yard and other yard therein as specified in sub-clause G5.3(1).

(3) Aggregate and Concrete Plant

The Contractor shall be provided with the following plants regarding the concrete work and road work.

a. Batch plant

An unit type automatic batcher plant will be provided to the Contractor as shown on the Drawings.

The main features of the batch plant are specified in Appendix I.

The Employer will provide operators required for operation of the batcher plant not exceeding 2 persons under the normal operationla condition, one operator for each of control room and scraper.

b. Aggregate plant

The aggregate plant to be provided to the Contractor is of skid-mounted, motor-driven, washing type as shown on the Drawings.

The main features of the aggregate plant (rock crushing and screening plant) are specified in Appendix II.

The plant has the following production capacity so as to produce aggregates material, dam filter material and rock material for metalling of road from rock quarried from the specified site being composed mainly of basalt.

<u>Product size (mm)</u>	<u>Production capacity (ton/hour)</u>
80 - 40	4 - 5
40 - 20	15 - 20
20 - 5	20 - 25
5 - 0	45 - 50

c. Cement silo equipment

A set of steel plate division type cement silo equipment to be provided to the Contractor is shown on the Drawings.

The main features of the cement silo equipment are specified in Appendix III.

The Contractor shall fully acquaint himself with the conditions of the plants including the quarry site and the existing access road.

The plan of operation for the plants shall be submitted to the PMO/Engineer before commencing the work.

The cost of acquiring aggregate materials and to fulfill the requirement stated above shall be deemed to be included in the unit prices stated in the Bill of Quantities for the various items of concrete work.

(4) Water Supply System

The Employer will provide the Contractor with water supply system for drinking water and construction use in the Construction Facilities Area. Source of water to be conveyed to the Area is to be CWA's transmission pipeline for drinking water and existing reservoir for construction use including water supply for constructional Plant, laboratory, repair shop, etc. as shown on the Drawings.

The Contractor shall supply water to each construction site by means of extending distribution pipeline thereto from the Construction Facilities Area or installing temporary water supply facilities including electric pumps.

Payment for the temporary water supply system shall be referred to sub-clause G5.2(5).

(5) Telecommunication System

The Employer will have provided a private automatic branch exchange (PABX) with at least 40 extensions and therefrom telecommunication lines to various locations in the site. The PABX is such that internal call can be connected through a switchboard which an operator operates to the Public telephone station.

The Contractor shall provide all necessary facilities and materials for his telecommunication system to his buildings and working locations from terminal boxes provided by the Employer. The location of the terminal boxes and the number of lines available to the Contractor are as follows :

	<u>Location</u>	<u>Number of lines</u>
1)	Quarry site	1
2)	Aggregate plant	1
3)	Batcher plant	1
4)	Laboratory	1
5)	Dam site office	1
6)	Inlet of diversion tunnel	1
7)	Contractor's office	1
8)	Contractor's dormitory	1

The Contractor shall pay monthly to the Employer the public telephone charge for external call made through the said telecommunication system by the Contractor.

The cost for connection of telex and facsimile equipment with the telecommunication system shall be borne by the Contractor.

The Contractor shall maintain and subsequently remove upon completion of the Works the telecommunication system provided by the Contractor.

Payment for temporary telecommunication system will be made at the lump sum price of Item No. A/05 in the Bill of Quantities, which lump sum price shall include all the cost necessary to supply, install, maintain and subsequently remove the system.

(6) Waste Water Treatment and Sewerage System

The Employer will provide waste water treatment process from all constructional plant, building including houses, office, camps, etc. in the Construction Facilities Area.

The waste water treatment facilities including a tank made of steel is as shown on the Drawings to store waste water coming from Construction Facilities Area and to make the simple treatment thereof.

The waste water treatment facilities have the following specifications.

- Treatment capability of waste water : not less than 200m³/hour
- Waste water turbidity : 1,000 to 50,000 ppm
- Effluent turbidity : less than 50 ppm
- Water pump : 22 kW
- Thickener capacity : not less than 200 m³/hour
- Coagulant stock tank : 6,000 lit
- High molecular tank : 6 m³ x 2 nos.
- Intake tank : 120 m³
- Sludge discharge pump : 37 KW
- Filter press : 9.9 m³/cycle

The Contractor shall make a simple treatment for the waste water stored in the facilities and carry to the treatment facilities in Port Louis the treated water and disposals stored in septic tanks of buildings and hours in the Construction Facilities Area and simple toilet facilities mentioned below through the public or the Contractor's vacuum cars or any other means approved by the PMO/Engineer. The Contractor will be charged for treatment at the public treatment facilities at a rate of Mauritius (Rs. ___/m³). The rate will be unchanged throughout the Contract.

In addition, the Contractor shall construct, operate and maintain at the construction site simple toilet facilities complete with adequate water closet, urinals and hand-basin, septic tanks, absorption trenches or other sewerage disposal installation, for all of his personnel. The number of set and location of these facilities and their construction shall be approved by the PMO/Engineer. Sewerage from those facilities shall be disposed of in hygienic manner as approved by the PMO/Engineer.

Separate payment shall not be made for the waste water treatment and sewerage and all costs shall be deemed to be included in the lump sum prices of Items A/06 stated in the Bill of Quantities, which lump sum prices include all the cost necessary to supply, install, maintain and subsequently remove the said waste water treatment facilities and simple toilet facilities at the construction site as well as the cost for simple waste water treatment and transporting to and processing at the treatment facilities in Port Louis city the waste water stored in the waste water treatment facilities and disposals in the simple toilet facilities and septic tanks of building/houses in the Construction Facilities Area.

(7) Concrete Testing Equipment

The Employer will provide a testing laboratory available for the Works. The testing equipment and apparatus to test concrete aggregate and concrete are in accordance with the relevant clauses in the

Technical Specifications. The testing equipment and apparatus are properly arranged in the laboratory as listed in Appendix IV of this sub-clause.

For maintenance and operation of the laboratory testing, the Contractor shall despatch sufficient number of qualified supervisor and testing assistance capable for carrying out the tests. All consumables necessary to carry out the test shall also be provided by the Contractor.

The cost of operation and maintenance of the testing staff despatching from the contractor, and supply of water, fuel, electricity to the laboratory, and consumables for the test shall be deemed to be included in the unit prices for the various items stated in the Bill of Quantities.

(8) Access roads and haul road

The Employer will provide the following roads to the Contractor for his use for the Works of Lot II as shown on the Drawings.

- Haul road to the quarry site
- Access road around the damsite
- Access road along the transmission pipeline.

The Contractor can construct and maintain temporary construction roads for approaching to the construction site, spoil banks and other temporary facilities being connected with the above roads included in the Preparatory Works.

Payment for temporary construction roads shall be referred to sub-clause G5.2(7).

(9) Building to be allocated in the Construction Facilities Area

The Employer will develop and provide buildings in and around the Construction Facilities Area as listed below.

- i) Laboratory
- ii) Utility building
- iii) First aid building
- iv) PMO/Engineer's office and residence
- v) Contractor's office and dormitories
- vi) Cement ware house
- vii) Ware house

- viii) Guard house
- ix) Repair shop

The Contractor may use buildings of the above, in accordance with a consent between the Employer and him under the Contract.

(10) Electric power - supply system

The Employer will provide electric power supply system required for executing the Works as shown on the Drawings.

The electric power supply system is composed of 400 - 230 V distribution line including all the necessary electrical equipment and materials therefor such as transformer and switchgears, to connect the Construction Facilities Area and an existing 22 kV, three-phase, 50 Hz transmission line operated and maintained by Central Electricity Board (CEB) running the damsite as shown on the Drawings.

The Contractor may take electric power from this distribution line for construction of whole the Works or part of the Works by providing feeding points on the distribution line.

The supply capacity at each working area is as follows.

<u>Location</u>	<u>Capacity (KW)</u>
<u>Right bank side</u>	
i) Office and quarter area	310
ii) Concrete batch plant	500
iii) Repair shop, work shop, etc	420
iv) Quarry and borrow pit area	60
<u>Left bank side</u>	
i) Damsite, diversion tunnel, grouting work, valve & pipe site, intake gate site, etc.	460

The Contractor shall not take an electric power more than that stated above at each working area without written approval of the PMO/Engineer.

When the Contractor takes an electric power from the distribution line, all equipment and materials necessary at the feeding points and thereafter for his power supply system shall be installed, maintained and subsequently removed by the Contractor. The Contractor will be charged for

consumed electric power taken from the distribution line and shall pay monthly to the Employer at a rate of Mauritius (Rs. _____/kWh).

The rate will be unchanged throughout the Contract. For measuring electric power consumption, the Contractor shall provide appropriate measuring apparatus at the low voltage side of the feeding transformer. The Contractor shall not be entitled to claim for any delay or inconvenience incurred by him due to eventual blackout or power supply interruption caused by a failure of the distribution line. The Contractor, therefore, shall provide every necessary measures to prevent possible harm and keep safety on the Site on his own responsibility.

Emergency power sources such as stand-by generators with sufficient capacities for the execution of the construction works shall also be secured by the Contractor at places where power supply should be secured under any duration of power supply failure in the 22 kV transmission line or in the temporary power supply system to be provided by the Contractor.

Payment for the temporary electric power supply system shall be referred to sub-clause G5.2(6).

G 5.4 Soil Testing Laboratory and Equipment

There is no testing laboratory available for soil test. The Contractor shall provide the soil testing laboratory with equipment and apparatus to carry out the quality control test for the embankment materials in accordance with the relevant Sections in the Technical Specifications. For maintenance and operation of the testing laboratory, the Contractor shall despatch sufficient numbers of qualified supervisor and testing assistance capable for carrying out the test.

The laboratory equipment to be provided by the Contractor shall comprise the items as listed in APPENDIX VIII. All consumables necessary to carry out the test shall be provided by the Contractor.

The building and furnishings shall be of good quality and shall comprise a testing room having a sufficient area to allocate testing equipment, one office room of more than 15 m² floor area for the PMO/Engineer, washing room, storeroom and lavatory.

The PMO/Engineer's office room shall be the same standard as specified in paragraph G5.3 (1).

Testing equipment supplied for the Works shall be the property of the Employer and transferred by the Contractor upon completion of the Work from the laboratory to a place as directed by the PMO/Engineer.

Payment for the provision of the testing laboratory shall be made at the lump sum price stated in the Bill of Quantities as stipulated in Clause 60 of the Conditions of Contract, which price shall include the cost of construction and removal of the building and appurtenant facilities, and supply, installation and transfer of the testing equipment. The cost of operation and maintenance of the testing laboratory, staff despatching from the Contractor, and supply of water, fuel, electricity to the laboratory, and consumables for the test shall be deemed to be included in the unit price for the various items stated in the Bill of Quantities.

CHAPTER G6 PARTICULAR ITEMS

G6.1 Performance Bond and Advance Payment Bond

The Contractor shall furnish a Performance Bond and Advance Payment Bond in accordance with Clause 10 of the Conditions of Contract for the due performance of the Contract and to secure the refund of Advance Payment.

No separate payment shall be made for the cost for providing the Performance Bond and Advance Payment Bond and all the cost shall be deemed to be included in the Contract unit and lump sum prices stated in the Bill of Quantities.

G6.2 Insurances

The Contractor shall indemnify certain insurances relating to the Contract in accordance with Clauses 21, 23 and 24 of the Conditions of Contract. In handling compensation to the workmen under the above Clauses, the Contractor shall arrange for such that any compensation amount determined shall be paid without delay by the Contractor to the workmen who are entitled to such compensation whatever the time for payment of insurance amount from the insurance company to the Contractor is.

The Insurance of the works must be issued for the quantity equivalent to one hundred per cent (100%) of the Contract Price up to the issue of the Certificate of Completion.

The Transport and Erection Insurance shall cover all the Permanent Equipment and Constructional Plant from the production or purchase site to the site of their erection and installation for the amount equivalent to one hundred per cent (100%) of the Contract Value including the final tests.

The Contractor shall subscribe a Public Liability and Hold Harmless Policy with a Surety approved by the Employer, covering damages and injuries to third parties to their goods and persons, which shall be valid to the Completion of the Works.

The amount of said insurance for the Contractor is Maurities Rupees Thirty Five Million (Rs. 35,000,000) for any one incident and unlimited number of incidents. The amounts indicated are the minimum required by the Employer and shall not limit the Contractor's responsibility.

Payment for insurances will be made at the lump sum price of Items of A/01 and A/02, which lump sum prices shall include all the costs related with the said insurances.

Payment for insurances will be made on the basis of progress rate of the Works calculated from the comparison rate between the Original Contract Value and the certified progress value of the Works made up to the end of the said month on monthly basis. Payment for insurances shall not exceed the lump sum price stated for each item in the Bill of Quantities.

G6.3 Transportation Cost

No separate payment shall be made for all the transportation costs, including those for the Constructional Plant to the Site and from the Site, which shall be deemed to be included in the relevant Contract unit and lump sum prices stated in the Bill of Quantities.

G6.4 Boreholes and Exploratory Excavations

In accordance with Clause 18 of the Conditions of Contract, the Contractor shall be required by the PMO/Engineer to make boreholes or to carry out exploratory excavations under the provisions of Clause 51 of the Conditions of Contract when it become necessary in the opinion of the PMO/Engineer. Payment for boreholes and exploratory excavations will be made in accordance with the provision of Clause 58 of the Conditions of Contract.

CHAPTER G7 GENERAL SPECIFICATIONS FOR HYDROMECHANICAL WORKS

The supply and installation of the Permanent Hydromechanical Works will be carried out in principle on the basis of lump sum contract. In this respect, some specific provisions contained in CHAPTER T7 of the Technical Specifications shall additionally be applied to this work component.

Should any difference or discrepancy be contained between the provisions in CHAPTERS G1 to G6 hereof and those in CHAPTER T7 of the Technical Specifications, the latter shall prevail specifically with regard to the Works for the Hydromechanical Works.

CHAPTER G8 PHYSICAL AND OTHER INFORMATION

G8.1 General

The information presented hereunder gives some indications of the conditions at the Site which may be useful for the Contractor to formulate the construction program, but shall not relieve the Contractor in any way of his obligation to consult all the information concerned. The Employer and the PMO/Engineer will take no responsibility whatsoever for the accuracy of the interpretation thereof and any risk consequent on the interpretation is to be entirely borne by the Contractor.

G8.2 Meteo-hydrological Condition

(1) Meteorology

From the climatical viewpoint, the year is divided into two (2) seasons, namely the summer and winter seasons. Usually, the former lasts for November to April, while the latter does from May to October, varying year by year. In general, seventy (70)% of annual rainfall occurs in the summer season.

According to rainfall records at Reduit (El. 311 m) for four (4) years of 1987 to 1990, mean monthly rainfall exceeds 250 mm for January to March. The mean annual rainfall thereat for the period is 1,519 mm/year.

The annual mean monthly temperature at Vacoas varies from 24.0°C in February to 17.9°C in August for the period in 1961 to 1980. The mean annual air temperature thereat for the period is 21.6°C.

The mean monthly relative humidity at Vacoas is comparatively constant throughout the year, ranging 85% in April to 79% in October according to the records observed between 1971 and 1980.

The Mauritius Island has been suffering damage from heavy rains and floods caused by the tropical cyclone. The tropical cyclone so often occurs in the summer season of November to April and May, but it is not free from the tropical cyclone during the rest of the year.

A summary of meteorological data is tabulated in Appendix V.

(2) Rainfall

Rainfall in the project area largely varies by ground elevation. In general, there is a tendency that mean annual rainfall increases with the ground elevation.

Mean annual rainfall at Reduit with an altitude of 311 m which is located on the left bank of the damsite is 1,519 mm, while that of Curpipe with an altitude of 564 m, located close to the northern basin boundary, exceeds 3,000 mm. As well, this tendency is observed in a heavy rainstorm caused when cyclone passes over the catchment.

In the climatically standard year, around seventy (70) % of the annual rainfall occurs during the summer season of November to April.

(3) Stream flow

The Grand River North West (GRNW) which is one of the largest rivers in Mauritius originates in the central plateau and runs northwestward till it finally flows into the Indian Ocean through the southwestern fringe of Port Louis City.

The GRNW basin occupies a catchment area of 113.21 km², collecting such five (5) main tributaries in the upper reach as named the Moka, Profonde, Cascade, Terre Rouge and Plaines Wilhem rivers. The proposed damsite is located on the lower reach of the Terre Rouge river, just upstream of the confluence with the Plaines Wilhems river.

There are six gauging stations in operation in the GRNW basin, of which five stations are on the aforesaid tributaries in the central plateau and the rest one is at Municipal Dyke on the main stream of GRNW. Mean monthly discharges at these gauging stations are listed in Appendix VI together with their catchment areas. In addition, hydrographs of mean daily discharges at Municipal Dike on the main stream of GRNW are depicted in the Drawings. It is noted that passage of the tropical cyclone thereon is responsible for the occurrence of major floods in Mauritius.

(4) Water Quality

Water of GRNW is being taken at existing Municipal Dyke situated downstream of the proposed damsite and conveyed to Pailles treatment plant for the use of municipal/industrial water supply. Hence, the measures required to retain the present condition on water quality of the river have to be taken during the construction period.

The results of water quality analysis made in the course of the feasibility study for the Project are summarized in Appendix VII. Water samples for the water quality analysis were taken from the Moka river (at Baptiste and Vocage), the Profonde river, the Cascade river, the Terre Rouge river, the Champagne river and the Valetta reservoir.

In general, water of those tributaries of the GRNW contains a considerably high content of nitrogen, of around 2 mg/l and the content ratio of phosphorus is in a range of 0.01 to 0.02 mg/l as seen in Appendix VII. The iron and manganic contents in the tributaries' water are as low as 0.15 mg/l or less and 0.02 mg/l or less, respectively.

G8.3 Geological Information

(1) Regional geology

Prominent features of the project area are a clear topographic comparison of high mountainous area and gentle flat land. The high mountainous area is composed of old volcanic series.

According to the potassium-argon dating by N. McDougal and Chamalaun, the main shield volcano composed of the older volcanic series was built between 7.8 and 6.8 million years (m.y.) ago in the early Pliocene and lavas of the younger volcanic series were erupted from about 3.5 m.y. ago to less than 0.2 m.y. ago.

The young volcanic series are composed of basaltic lavas and agglomerates, generally dipping to the north to the northwest at low angle around 5°. The old lavas dip around 10° to 15° from the south to the north or the southeast to the northwest.

The vesicles in the old lavas are generally filled with zeolites. The lavas of this series appear to be dark grayish, and fresh part is very hard with emitting clear sound by hammering. Uniaxial compressive strength of the fresh lavas is more than 1,000 kg/cm². Tuff layers and volcanic breccias intercalate with the lava layers. Weathering on the tuff layers or volcanic breccias is developed on the ground surface.

The young volcanic lavas are characteristic with frequently developed vesicular appearance. Volcanic breccias intercalate the lava layers with thickness of about 3 m to 10 m. In the upstream reaches of the Grand River North West (GRNW), hard lava layers are predominantly observed. Columnar jointed basaltic lava layers of more than 10 m in thickness expose in the river flanks, intercalating with volcanic breccias. In the middle

reaches of the GRNW volcanic breccias are observed predominantly near the existing Municipal Dyke.

(2) Geological condition of damsite area

The proposed damsite has an asymmetrical V-shaped topographic feature. The right abutment is very steep, especially the right abutment has a steep slope inclination more than 55°. The young volcanic rocks, which are composed of alternate horizontal layers of basaltic lavas and weathered volcanic breccias, with P-wave velocity of 1.8 km/sec to 2.1 km/sec, consist the dam abutments. Permeability coefficients of the rocks is in the order of $\times 10^{-4}$ cm/sec or 10 to 50 of Lugeon units. The old volcanic rocks underlie the young volcanic rocks nearly horizontally at the riverbed level in the damsite. Uniaxial compressive strength of the old volcanic rocks is more than 1,000 kg/cm², indicating very hard consolidated condition. Groundwater level in the borehole drilled in the top of the left river bank is very deep, around 115 m from the top of ground surface. Residual soil develops for about 10 m and the weathering on the young volcanic rocks reaches from 10 m to 15 m at this site.

The rather thick talus deposits and scree deposits develop on the left abutment and the some extent of the young volcanic rocks underlying these deposits is highly weathered. On the other hand, the slope of the right bank is overlain by talus deposits and scree deposits for 0 m to 5 m.

Observation of the groundwater tables in drilled boreholes had been continued in the investigation period. The groundwater table lines in the areas of the dam abutments and in surrounding areas of the reservoir decrease gradually to the damsite from the points assumed to be groundwater sources.

G8.4 Concrete Aggregates

Quarry site for concrete aggregates is located at the southern part of Mt. Ory as shown on the Drawings. The trunk expressway passes through relatively near the quarry site, about 400 m apart therefrom.

The quarry site is composed of basalt and its explanation plan is shown on the Drawings. The haul road connecting the construction facilities site on the right side bank of damsite and the quarry site will be built as shown on the Drawings.

APPENDIX TO GENERAL SPECIFICATIONS

APPENDIX I : SPECIFICATIONS OF BATCHER PLANT

I. Main Specifications

- (1) Type : Unit type fully automatic batcher plant
- (2) Mixer capacity : not less than 750 lit.
- (3) Production capacity of homogeneous fresh concrete : not less than 40 m³/hour
- (4) Maximum size of crushed aggregates usable : ø 80 mm
- (5) Scraper output : 60 m³/hour (by hand operation)
- (6) Batching control method : Ten key presetting, electronic automatic weighing
- (7) Power source : 200 V, 50 Hz
- (8) Weighing instrument/device

Material	Dial scale	Accuracy
Sand	100 kg/5 kg	Within ±3%
Cement	350 kg/1 kg	Within ±1%
Water	250 kg/1 kg	Within ±1%
Additive agent	60 kg/20 kg	Within ±3%

II. Specifications of parts

1. Mixing unit

- 1-1 Mixer : One (1) set
 - (1) Type : Stationary horizontal shaft mixer of counterflow forced agitating system
 - (2) Agitating speed : 19.5 rpm
 - (3) Electric motor : 22 kW x 4p, totally enclosed fan and cooled type geared motor
 - (4) Lining and paddle : JIS FCMW 38, lining 12 mm, paddle 25 mm
 - (5) Discharge : Mixer bottom part will be opened or closed by air cylinder. Discharge will be completed in 8 seconds.
 - (6) Lubrication : Automatic feeding of main bearing part

- 1-2 Concrete hopper (1.5 m³) : One (1) set

- (1) Type : Square shaped with a round outlet and rubber gate bottom part opened or closed by air cylinder.
- (2) Steel plate : 6 mm lining
- (3) Vibrator : 250 W-1

- 1-3 Automatic batching control board : One (1) set
- (1) Type : Stationary type with operating desk
 - (2) Control device : Punch card system full automatic electronic control
 - (3) Measuring elements : 1 kind of gravel, 2 kinds of gravel cumulative, 1 kind of sand, cement and additive agent each 2 kinds selectable, water 1 kind
 - (4) Moisture compensation : Sand-water 15%
 - (5) Change of volume : 0.75 m³, and 0.5 m³
 - (6) Circuit : Timer preset of charge and mixing. Mis-action will be avoided by an interlocking circuit.
 - (7) Manual control circuit : An individual operation of weighing or discharging will be done by a change - over switch.
- 1-4 Motor circuit board : One (1) set
- (1) Type : Stationary type
 - (2) Power source to be used : 3-phase, 200 V, 50Hz
 - (3) Switching apparatus : Cubicle type provided with main switch, electro-magnetic switches and relays, etc., which are required for the automatic operation of mixer and skip, and with included leak breaker.
- 1-5 Unit frame and batching control cabin : One (1) set
- (1) Type : Shaped steel construction of box type
 - (2) Dimensions : Width 2.32 m x height 2.5 m. x length 8.75 m
 - (3) Control cabin : The inside of the frame its partitioned for the cabin. It is equipped with wide view windows, one (1) steel door and one (1) ventilating fan.
 - (4) Main unit : Sturdy box frame of welded section steel construction, wherein mixer and control cabin equipped with each control board are arranged. On the central part at an incline of 70°, the guide rails for the skip is mounted. By placing another unit upon the main unit and joining them together, the plant body is formed.
(A rain cover or a roof is not attached except to the control cabin. Heat insulator at the back of the steel plate is as per special specification)
- 1-6 Charging chute : One (1) set
with cement dust preventing damper

2. Batching unit
- 2-1 Cement weigher : One (1) set
- (1) Dial scale : 350kg x 1kg, having an accuracy of 1/350
 - (2) Type : Single pendulum type, 300° dial indication
 - (3) Gate closing : Cone gate actuated by air cylinder
 - (4) device : COVP-N-09CB- Z75 x 100st
 - (5) Weighing accuracy : ± 1%
- 2-2 Water weigher : One (1) set
- (1) Dial scale : 250kg x 1kg, accuracy 1/250
 - (2) Type : Single pendulum type, 300° dial indication
 - (3) Water supply : Solenoid valve 2", PVS-50A-210
Fine feed valve 3/4" AD11-20A 1 pc. respectively
 - (4) Water discharge : Cell cylinder COV-03CB-50x50st
Flat Valve Z175
 - (5) Weighing accuracy : ± 1%
- 2-3 Weigher for additive agent : One (1) set
- (1) Dial scale : 6kg x 20g, accuracy 1/300
With protecting device against overweighing
 - (2) Type : Single pendulum type, 300° dial indication
 - (3) Feel in : Solenoid valve 1" cylinder valve
CVS -25A -25SWK -2sets
 - (4) Discharge : Cell cylinder
CKV-FA-32-50
 - (5) Weighing accuracy : ± 3%
- 2-4 Winch unit for hoisting an aggregate skip : One (1) set
- (1) Skip capacity : 1,500 lit.
 - (2) Hoisting force : 2,100 kg
 - (3) Electric motor : 15 kW x 4P, totally -enclosed fan -cooled type geared
motor with brake
 - (4) Wire rope : ø16, 6xFi (29) - 38 m long
 - (5) Hoisting speed : 0.52 m/sec, taking 22 secs. between above and below

2-5 Unit frame

- Type : Shaped steel construction of box type
- Dimensions : Width 2.32m x height 2.45m x length 8.0m
- Roof : 2.3 mm thick Steel plate
- Main unit : Batching unit is sturdy box frame of welded section

2-6 Factory assembly

3. Stand, legs, guide rails

- Stand & legs : Welded H-shaped steel construction
- Guide rails : Mounted at an incline of 70° in parallel with the stand brace
- Lower guide : Guide rails outside the stand are to be detached separately rails

4. Gangway & stairs

- Gangway : Brackets are bolted around each unit and handrail is attached to the 600 mm wide gangway. A gangway to inspect the surroundings of scraper is provided also.
- Stairs : To mixing unit : Two sets of 600 mm wide stairs with an intermediate landing
- To batching unit : 600 mm stairs 1
- To rooftop : Gangway ladder 1

5. Aggregate weighing device : One (1) set

- Type : Single pendulum type, 300° dial indication
- Weigh bin : 1 set for gravel 1, 1 set for sand
Capacity; Gravel 1,100 lit., Sand 1,100 lit.
- Gravel weigher : Dial scale 1200kg x 5kg ; 1 set
- Sand weigher : Dial scale 1000kg x 5kg ; 1 set
- Fed gate : For gravel ; 300mm x 325mm ; 2
- For sand ; 400mm x 325mm ; 1
- (Actuated by air cylinder, with jogging device)
- Discharge : Air cylinder, sector gate
- Vibrator : For sand 25W-2

6. Radial scraper stand

- Height : 4.9 m
Division : Five division with 6 partition walls.

The body of this stand is of welded section steel construction with 6 mm thick plate, serving as a prop for mounting the radialscraper as well as a grooved post for mounting partition walls which classify aggregates, wooden boards are inserted in the grooves of the above-mentioned post and of the stock yard supports (Wooden boards are 60mm thick which are excluded from our supply)

7. Radialscraper

- Output : 60 m³/h
Bucket capacity : 500 lit.
Boom length : 13.3 m
Electric motor : 11 kw x 4P, totally –enclosed fan–cooled type geared motor
Pulling rope : Z 146 x Fi (25) – 26 m long
Return rope : Z10 6 x Fi (25) – 37 m long
Anchor rope : Z106 x Fi (25) – 111 m long
Slewing angle : Within 230°
Total weight : 3800 kg
(Boom suspension type : special order)

8. Cement screw conveyer

- Output : 40 t/h in a horizontal position
Drive motor : 3.7 kw x 4P
Dribble feeding device : 0.4 kw x 4P with brake, feeding 2 kg/sec

9. Other equipments and installations

- 9-1 Pneumatic gate closing device : One (1) set

Including 4–way solenoid valves, oilers, regulator, filter, gauge etc. Actuated through a signal transmitted from the automatic preset board a solenoid valve operates an air cylinder.

9-2 Air compressor

Type : Reciprocating
Pressure in normal : 7 kg/cm
Drive motor : 5.5 kw x 4P
Air tank capacity : 200 lit.
Protecting cover : Sheet iron

9-3 Feed pump

Type : High pressure centrifugal pump, caliberΔ 50
Drive motor : 2.2 kw x 4P, totally –enclosed outer fan type

9-4 Pressure tank

Volume : 1000 lit.
Max. pressure in normal service : 4kg/cm
Caliber : Inlet ; 2", outlet ; 2"

9-5 Painting : One (1) set

Undercoating with anticorrosive paint once. Finishing paint in standard colour once.

9-6 Agitating tank for additive agent : One (1) set

Capacity 500 lit., geared pump
0.4 kw x 2, including wiring and piping.

9-7 Mounting and test run : One (1) set

(Dispatch of guide master to outside the country is to be counted in a special outlay, and outside the country transportation or dispatch of worker is to be counted in exclusion specifications.)

10. Aggregate weigher stand : One (1) set

Aggregate weigher stand is in a body with the skirt of section steel panel, in this case there is no need of a crate when transporting the aggregate weigher, and it can be done together with the stand.

APPENDIX II : SPECIFICATIONS OF AGGREGATE PLANT

- 1 FEED HOPPER : One (1) set
Heavy-duty, steel feed hopper with min. capacity of 10m³.
- 2 GRIZZLY VIBRATING FEEDER : One (1) set
Heavy-duty grizzly vibrating feeder, 1.0 m x 3.0 m driven by variable-speed 15 kW motor.
- 3 PRIMARY JAW CRUSHER : One (1) set
Heavy-duty, single toggle jaw type crusher with 36"x24" feed opening, driven by 75 kW, 6P motor.
- 4 SURGE BIN NO.1 AND FEEDER : One (1) set
Steel surge bin with vibrating pan feeder of 700 mm x 1,500 mm, driven by 0.4 kW x 2 units vibro motors.
- 5 SECONDARY CRUSHER : One (1) set
Mechanical, spring-loaded type cone crusher having mantle diameter of 40" (1,000 mm), driven by 90 kW, 6P Motor, complete with lubrication unit and water-cooled oil cooler. Construction shall be simple for easy maintenance, therefore hydro cone type shall not be acceptable.
- 6 TERTIARY CRUSHER : One (1) set
Impact crusher, horizontal shaft type, with rotor size of ϕ 1,250 mm x 1,050 mm, driven by 110 kW motor. The hammer shall be made of chromium casting and all the hammer edges shall be serviceable for maximum service life against abrasive rocks. The crushing chamber shall consist of 3-stage repulsion plates (breaker plates) for maximum crushing effect.
- 7 VIBRATING SCREEN : One (1) set
Inclined vibrating screen 5'x14' for separation of 80 mm and 40 mm sizes, driven by 15 kW motor, equipped with spray bar.
- 8 VIBRATING SCREEN : One (1) set
Inclined Vibrating screen 5'x10' for separation of 20 mm and 5 mm sizes, driven by 11 kW motor, equipped with spray bar.
- 9 SURGE BIN NO.2 (SAND) AND FEEDER (OPTION) : One (1) set
Steel surge bin with vibrating pan feeder of 400 mm x 1,200 mm, driven by 0.13 kW x 2 units vibro motors.

10 ROD MILL : One (1) set
 Rod mill of 6'x12' driven by 150 kW slip-ring motor, for increased sand production can be offered together with other related equipment as optional equipment.

11 VIBRATING SCREEN : One (1) set
 Horizontal vibrating screen, 0.5x1.8 m for separation of 3-5 mm oversize of rod mill product, driven by 2.2 kW.

12 CLASSIFIER : One (1) set
 Rotary classifier of ϕ 3.0 x 6 m drum size.

13 BELT CONVEYORS
 Approximate conveyor size shall be as follows :

B1	Jaw crusher to surge bin	600 mm x 20 m	5.5 kW
B2	Surge bin to cone crusher	600 mm x 20 m	5.5 kW
B3	Cone crusher to impact crusher	600 mm x 20 m	5.5 kW
B4	Impact crusher to screens	600 mm x 40 m	11.0 kW
B5	Return from screens	500 mm x 40 m	7.5 kW
B6	Screen to sand surge bin	450 mm x 20 m	1.5 kW
B7	Surge bin to rod mill	350 mm x 18 m	1.0 kW
B8	Surge bin to rod mill	350 mm x 18 m	1.0 kW
B9	Return to surge bin	350 mm x 16 m	1.0 kW
B10	Reject conveyor	500 mm x 10 m	2.2 kW
B11	Product conveyors	450 mm x 15 m	2.2 kW
B12	Product conveyors	450 mm x 15 m	2.2 kW
B13	Product conveyors	450 mm x 15 m	2.2 kW
B14	Product conveyors	450 mm x 15 m	2.2 kW

APPENDIX III : SPECIFICATIONS OF CEMENT SILO

1. Cement silo : One (1) set
 - (1) Type : Steel plate division type
 - (2) Storage capacity : 100 ton
 - (3) Side plate : t=4.5mm/t=3.2mm
 - (4) Cone part : t=6mm
 - (5) Foot part : SGP 250A
 - (6) Main measure : Diameter 4000 mm
Cone part ; 3095 mm
Cylinder part ; 5800 mm
Length of foot ; 5200 mm
 - (7) Accessories : Handrail of roof, Ladder, Manhole, Air vent

2. Bucket elevator : One (1) set
 - (1) Type : Centrifugal discharge type
 - (2) Output : 40 ton / hour
 - (3) Motor : 5.5 kw x 4p x 1 /20
 - (4) Bearing box : Upper part ; UCP 316 (ø80)
Under part ; UCT 211 (ø50)
 - (5) Chain : RS 100
 - (6) Wheel : RS 100 ; NT 16
NT 30
 - (7) Case measure : 1,140 mm x 580 mm
 - (8) Bucket capacity : 0.0047 m³ (350 long x 150 wide x 160 height)
 - (9) Total length : 15.5 m
 - (10) Belt speed : 80 m / min.

3. Under screw conveyer : Each one (1) set
 - (1) Type : Pipe type
 - (2) Output : 40 ton / hour
 - (3) Motor : 3.7 kw x 4p x 1 / 10
 - (4) Bearing box : UKP 215 + H 2315 (ø 65)

- (5) Chain : RS 100
 - (6) Wheel : RS 100
 - (7) Case measure : SGP 10"
 - (8) Total length : 3.0 m
 - (9) Transports : Cement
 - (10) Blade : ϕ 240 x 200P x t 3.2
4. Feed screw conveyer with cement hopper : One (1) set
- (1) Type : Pipe Type
 - (2) Output : 40 ton/hour
 - (3) Motor : 3.7 kW x 4P x 1 / 10
 - (4) Bearing box : UKP 215 + H 2315 (ϕ 65)
 - (5) Chain : RS 100
 - (6) Wheel : RS 100 NT 15
NT 18
 - (7) Case measure : SGP 10"
 - (8) Total length : 4.0 m
 - (9) Transports : Cement
 - (10) Blade : ϕ 240 x 200p x t 3.2
 - (11) Hopper capacity : 1000 lit. with gangway
- 5 Rotary feeder : One (1) set
- (1) Type : Rotary valve type (6 blade)
 - (2) Output : 40 ton / hour
 - (3) Motor : 0.75 kw x 4p x 1 /30
 - (4) Bearing box : UKP 207 (ϕ 65)
 - (5) Chain : RS 60
 - (6) Wheel : RS 60 ; NT 15
; NT 28
 - (7) Measure : 300 x 300 x 420h
 - (8) Blade : ϕ 320 x 300 x t = 6
 - (9) Transports : Cement

- 6 Emergency gate : One (1) set
 - (1) Type : Hand operation
 - (2) Measure : 300 x 300 x 125h

- 7 Airation : One (1) set
 - (1) Power : Nozzle and element
 - (2) Accessory equipment : Solenoid, regulator, air filter and valve

- 8 Level switch : Two (2) sets
 - Type : C5 - L, long shaft type, L - 500 or the equivalent

APPENDIX IV : CONCRETE TESTING EQUIPMENT

Item	Unit	Quantity
<u>CONCRETE TESTING EQUIPMENT</u>		
- Slump Test Set	set	5
- Portable Concrete Mixer, 85 liters capacity	set	1
- Cylinder Mould (150 mm d x 300 mm h)	No.	100
- Capping Set with cylinder carrier and sulfur melting pot	set	1
- Washington Type Air Meter Set, 7 liters capacity	set	5
- Proctor Penetrometer Test Set	set	1
- Portable Compression Testing Machine (100 tons capacity)	No.	1
- Standard Test Sieve for Fineness of Cement	No.	2
- Le-Chatelier Flask	No.	2
- Vicat Apparatus	set	2
- Mortar Flow Table for cement test	set	1
- Mechaelis Cement Flexure Tester	No.	1
- Mortar Compression Testing Machine (20 tons capacity)	No.	1
- Three Gang Mortar Beam Mould	No.	6
- Aggregate Test Sieve Set (18 meshes per set)	set	2
- Wooden Frame Sieve Set (17 meshes per set)	set	2
- Specific Gravity and Absorption Test Set	set	2
- Unit Determination Test Set consisting of 2, 10 and 30 liter containers	set	1
- Los Angeles Testing Machine	set	1
- Coarse Aggregate Gravity Test Set	set	1
- Platform Scale (100 kg capacity, 50 g sensibility)	No.	1
- Platform Scale (20 kg capacity, 10 g sensibility)	No.	1
- Precision Balance (2 kg capacity, 0.1 g sensibility)	No.	1
- Aggregate Soundness Test Set	set	1
- Proving Ring for 100 tons compression testing machine	No.	1

Item	Unit	Quantity
- Dial Gauge, 30 mm	No.	4
- Magnet Stand (Dial gauge holder)	No.	4
- Stop Watch	No.	1
- Tool Set	No.	1
- Burette	No.	2
- Pepette	No.	5
- Sieve Brush	No.	10
- Mixing Plate	No.	1

APPENDIX V : METEOROLOGICAL DATA

(1) Mean Monthly Rainfall at Reduit (El. 311m) between 1887 and 1980

(Unit :mm)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
255	259	257	134	87	70	68	64	44	44	66	170	1519

(2) Mean Monthly Rainy Days at Reduit between 1961 and 1980

Rainfall (mm)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
0.1	18.9	19.0	21.3	17.0	16.9	16.3	21.5	21.0	15.5	14.0	12.3	15.5	209.2
1.0	15.3	14.9	16.9	12.6	10.7	12.6	15.7	15.0	9.9	8.6	7.9	12.2	152.3
5.0	7.9	7.8	8.9	5.5	4.5	4.5	4.7	3.7	2.0	1.9	3.0	5.7	59.9
10.0	5.0	5.5	5.0	3.5	1.7	1.7	1.1	1.4	0.9	0.9	2.1	3.8	32.6

Note : Monthly values above show average number of days per each month on which daily rainfall reached or exceeded the rainfall depths in the first column.

(3) Mean Monthly relative humidity at Vacous (El. 424m) between 1971 and 1980

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
83	84	84	85	83	82	82	81	80	79	80	81	82

(4) Mean Monthly and Monthly Maximum/Minimum Air Temperature at Vacous between 1961 and 1980

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Mean	23.9	24.0	23.9	22.7	20.8	19.1	18.3	17.9	18.7	19.9	21.6	23.1	21.2
Max.	30.8	31.0	30.8	30.0	28.3	26.9	25.7	25.5	27.3	28.3	29.9	29.7	-
Min.	20.2	20.5	20.4	19.5	17.5	15.9	15.3	14.9	15.2	16.3	17.7	19.3	-

(5) Extreme Wind (Gust) Speed Records in Mauritius in Cyclones between 1960 and 1983

(Unit: km/Hour)

Name of Cyclone	Name of Metrological Station (Election,m)							
	Medine (91)	St. Antoine (30)	F.U.E.L. (146)	Plaisance (58)	Vacoas (424)	M.D. Alma (368)	Fort William (6)	Pamps. (55)
Carol (Feb. 1960)	156	-	238	209	190	-	258	238
Jenny (Feb. 1962)	208	-	168	151	185	-	276	196
Danielle	146	-	156	219	164	-	190	159
Garuaise (Feb. 1975)	204	185	169	204	190	280	258	186
Chudetta (Dec. 1979)	173	211	200	221	175	193	258	201
Bakaly	170	117	104	134	171	197	-	131

APPENDIX VI : STREAMFLOW DATA OF TRIBUTARIES OF GRNW

- (1) Mean Monthly Discharge of the Plains Wilhems River
 Station No. : W03
 Catchment Area : 29.7 km²

(Unit : m³/s)

Hydrological Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Annual Average
1972			0.28	0.34	0.36	0.34	0.37	0.37	0.33	0.29	0.29	0.37	
1973	0.79	0.40	0.44	0.37	1.48	0.38	0.37	0.37	0.38	0.39	0.41	0.34	0.51
1974	0.15	0.17	0.19	0.35	0.38	0.37	0.34	0.37	0.35	0.31	0.37	0.23	0.30
1975	0.16	0.21	0.23	0.27	0.48	0.35	0.57	0.32	0.23	0.34	0.34	0.27	0.31
1976	0.21	0.19	0.15	1.52	0.29	0.36	0.24	0.90	0.28	0.29	0.29	0.28	0.33
1977	0.19	0.19	0.22	0.28	0.30	0.32	0.28	0.28	0.26	0.14	0.14	0.14	0.23
1978	0.10	0.24	1.32	0.14	0.09	0.43	0.17	0.18	0.16	0.16	0.16	0.14	0.27
1979	0.08	0.12	0.31	0.20	0.68	0.22	0.19	0.21	0.21	0.26	0.12	0.14	0.23
1980	0.11	0.97	12.10	1.31	3.01	1.90	0.43	0.19	0.31	0.27	0.23	0.23	1.75
1981	0.18	0.12	0.14	0.18	0.21	0.47	0.23	0.24	0.25	0.22	0.25	0.21	0.23
1982	0.20	0.24	0.26	6.03	0.33	0.26	0.85	0.30	0.54	0.40	0.26	0.27	0.83
1983	0.28	0.62	0.41	0.23	0.21	0.21	0.20	0.18	0.22	0.14	0.09	0.07	0.24
1984	0.13	3.05	0.30	0.29	0.24	0.14	0.13	0.14	0.15	0.17	0.18	0.16	0.42
1985	0.12	0.22	0.72	5.97	0.25	0.47	0.24	0.25	0.25	0.23	0.22	0.25	0.76
1986	0.19	1.14	0.30	0.31	0.32	0.30	0.25	0.23	0.16	0.21	0.15	0.18	0.31
Average	0.21	0.56	1.22	1.17	0.59	0.44	0.32	0.30	0.27	0.25	0.23	0.21	0.48
Maximum	0.79	3.05	12.10	6.03	3.10	1.90	0.85	0.90	0.54	0.40	0.41	0.34	1.75
Minimum	0.08	0.12	0.14	0.14	0.09	0.14	0.13	0.14	0.15	0.14	0.09	0.07	0.23
Var.	0.17	0.76	3.03	1.99	0.75	0.41	0.18	0.18	0.10	0.08	0.09	0.07	0.40

Var. : Standard Deviation

- (2) Mean Monthly Discharge of the Cascade River
 Station No. : W05
 Catchment Area : 20.7 (km²)

(Unit : m³/s)

Hydrological Year	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Annual Average
1966			0.67	0.47	0.45	0.19	0.12	0.57	0.21	0.37	0.15	0.12	
1967	0.09	0.46	1.02	0.26	1.27	1.15	0.35	0.46	1.08	1.01	0.48	0.44	0.67
1968	0.92	1.09	0.31	3.47	2.65	0.38	0.26	0.29	0.59	0.46	0.22	0.20	0.90
1969	0.19	0.17	0.14	0.48	0.47	1.30	0.47	0.51	0.95	0.52	0.25	0.15	0.47
1970	0.15	0.65	3.24	1.78	4.22	0.63	0.35	0.97	0.30	0.14	0.16	0.16	1.09
1971	0.15	0.15	0.16	0.68	0.23	1.23	0.67	0.48	0.48	0.21	0.16	0.15	0.40
1972	0.21	0.15	0.18	1.31	0.45	1.01	0.42	0.83	0.77	1.52	0.35	0.31	0.63
1973	0.53	0.47	0.76	0.52	1.18	0.51	0.32	0.89	0.71	1.06	0.84	0.42	0.45
1974	0.32	0.21	0.24	0.52	0.55	0.35	0.26	0.49	0.61	1.19	0.43	0.28	0.45
1975	0.26	0.30	0.20	1.05	0.83	0.51	1.33	0.73	0.52	0.44	0.45	0.31	0.58
1976	0.20	0.16	0.13	0.98	0.47	1.24	1.18	1.27	0.52	0.58	0.35	0.33	0.64
1977	0.29	0.39	1.21	0.92	0.44	0.84	0.60	0.39	0.48	0.40	0.28	0.19	0.54
1978	0.17	0.35	1.61	0.36	0.71	2.33	0.74	0.57	0.70	0.52	0.39	0.24	0.72
1979	0.22	0.17	0.56	1.27	1.61	0.71	0.42	0.39	0.33	0.68	0.24	0.20	0.57
1980	0.17	3.08	8.15	1.56	3.38	2.14	0.93	0.64	0.49	0.31	0.29	0.29	1.79
1981	0.28	0.24	0.19	0.17	0.27	2.24	0.64	0.45	0.32	0.32	0.29	0.18	0.47
1982	0.21	0.30	0.52	6.14	0.93	0.54	2.02	0.96	1.12	1.33	0.80	0.84	1.31
1983	0.82	1.19	1.56	0.7	0.41	0.38	0.24	0.25	0.30	0.22	0.15	0.17	0.54
1984	0.17	2.13	2.09	0.72	0.36	0.53	0.45	0.32	0.32	0.37	0.28	0.21	0.66
1985	0.19	0.37	2.48	6.67	1.18	1.25	0.51	0.55	0.99	0.50	0.43	0.25	1.28
1986	0.31	2.06	0.57	0.97	1.06	0.97	0.52	0.36	0.22	0.43	0.21	0.20	0.66
Average	0.29	0.70	1.24	1.48	1.10	0.97	0.62	0.59	0.57	0.62	0.34	0.27	0.73
Maximum	0.92	3.08	8.15	6.67	4.22	2.33	2.02	1.27	1.12	1.52	0.84	0.84	1.79
Minimum	0.09	0.15	0.13	0.17	0.23	0.19	0.12	0.25	0.21	0.21	0.15	0.12	0.40
Var.	0.21	0.79	1.76	1.74	1.04	0.61	0.45	0.26	0.27	0.37	0.18	0.15	0.35

Var. : Standard Deviation

APPENDIX VII : WATER QUALITY DATA

(1) In dry season

(Unit : mg/l)

Sampling place	Consumption Potassium Permanganate	T-	T-	NH4-	NO2,NO3-	PH	Turbidity	Hardness
		N	P	N	N			
Moka River (Baptiste)	1.4	2.4	0.024	0.10	2.31	7.20	0.4	39.0
" (Vocage)	1.2	2.3	0.012	0.04	2.25	7.76	0.1	46.4
Profonde River	1.4	3.4	0.022	0.10	1.57	7.80	0.2	56.5
Cascade "	1.1	2.1	0.022	0.10	1.91	7.83	0.5	47.3
Terre Rouge "	3.0	1.7	0.024	0.06	1.57	7.23	1.6	25.0
Champagne Dam Reservoir	2.8	0.4	0.022	0.08	0.34	7.03	1.6	25.0
Valetta Reservoir	9.2	0.3	0.017	0.04	0.10	7.10	3.9	22.5

Samples	Chlorine Ion	Alkalinity	Ferrum	Managanese	Evaporation Residue	BOD	Color
" (Vocage)	16.3	35.5	0.06	0.01	113	0.2	<5
Profonde River	19.1	39.0	0.06	0.01	155	0.3	<5
Cascade "	13.5	37.3	0.08	0.01	122	0.5	<5
Terre Rouge "	12.5	53.3	0.15	0.02	133	1.0	<5
Champagne Dam	9.1	22.0	0.35	0.05	71	0.2	8
Valetta Reservoir	9.1	18.1	0.27	0.03	71	0.5	13

(2) In wet season

(Unit : mg/lit.)

Consumption of Potassium Permanganate	T-	N	T-	P	NH2-	N	NO3-	N	pH	Turbidity
Moka wo3	10.1	0.9	0.034	0.05	0.52	6.7	0.8			
Moka wo4	9.4	1.1	0.013	0.01	0.99	6.6	1.2			
Moka wo5	11.1	1.9	0.020	0.00	1.56	6.6	2.4			
Moka wo8	11.2	2.0	0.008	0.01	1.64	6.8	0.4			
Moka wo12	11.9	2.2	0.013	0.00	1.98	6.9	0.8			
Champagne Dam Reservoir	12.3	0.1	0.028	0.00	0.00	6.8	0.8			
Valetta Reservoir	12.9	0.6	0.020	0.00	0.15	6.6	4.8			
Pailbs	13.3	2.1	0.015	0.00	1.33	6.7	2.8			

	Hardness	Chlorine Ion	Alkalinity	Ferrum	Manganese	Evaporation Residue	BOD	Color
Moka wo3	71.5	18.3	59.1	0.01	0.001	119	1.5	5
Moka wo4	20.5	15.8	20.3	0.28	0.000	56	0.9	7
Moka wo5	36.5	15.6	25.7	0.33	0.003	98	0.3	7
Moka wo8	46.2	19.4	33.2	0.08	0.003	110	0.5	5
Moka wo12	41.5	16.0	26.9	0.22	0.001	107	0.2	7
Champagne Dam Reservoir	14.4	9.0	11.4	0.05	0.003	36	1.1	5
Valetta Reservoir	18.3	11.7	12.6	0.1	0.011	48	1.0	5
Pailbs	30.5	18.5	26.5	0.37	0.011	99	0.8	8

APPENDIX VIII : SOIL TESTING EQUIPMENT

(1/5)

Item	Unit	Quantity
- Iron mortar with pestle	set	2
- Sample splitter	set	1
Width of split, 25 mm		
Size, approx. 540 x 375 x 460 mm		
- Hand scoops	each	2
Round, 315 mm		
Square, 395 mm		
- Triple beam balance	set	1
Capacity, 201 g: sensitivity, 0.02 g		
- Table platform scale	set	1
Capacity, 20 kg: sensitivity, 2g		
- Platform scale	set	1
Capacity, 50 kg: sensitivity 20 g		
- Table balance	set	1
Capacity, 500 g; sensitivity 0.5 g		
- Sample pan	pcs	10
Size, less than 270 mm		
- Sample pan	pcs	10
450 x 350 x 40 mm		
- Desiccators	pcs	2
Diameter of inner plate, 360 mm		
- Pycnometer	pcs	30
Capacity, 100 cc		
- Volumetric flasks	pcs	10
Capacity, 500 cc		
- Evaporating dishes	pcs	30
Diameter: 60 mm		
- Evaporating dishes	pcs	30
Diameter: 90 mm		
- Electric ovens	set	2
Inside dimensions,		
450 x 400 x 400 mm (1 set)		
1000 x 800 x 550 mm (1 set)		
AC 220/380 V		
- Enameled ironware beaker	pcs	5
Capacity, 0.5 liter		
- Enameled ironware beaker	pcs	3
Capacity, 1.0 liter		
- Hydrometer	pcs	2
Diameter, 30 mm length, 280 m		

(2/5)

Item	Unit	Quantity
- Hydrometer jar Capacity, 1000 cc	pcs	10
- Soil analysis sieves set Sieves, diameter and depth: 200 x 60 mm, 50.8, 38.1, 25.4, 19.1, 9.52, 4.76, 2.0, 0.84, 0.452, 0.25, 0.105 and 0.074 mm with a cover and pan.	set	2
- Standard sieves set JIS nominal size, 4.76 mm & 0.074 mm with a cover & pan Diameter and depth: 200 x 60 mm	set	2
- Liquid limit set a) Base, hard rubber (1 no.) b) Dish, brass made (1 no.) With accessories	set	2
- Plastic limit set a) Ross plate, 300 x 400 x 6 mm (1 no.) b) Glass plate, 200 x 200 x 6 mm (1 no.) c) Spatula	set	2
- Compaction testing app. a) Compaction mold, all steel made Capacity, 1,000 cm ³ (3 no.s) Capacity, 2,209 cm ³ (3 no.s) b) Rammer, all steel made Ramming dia 50 mm, drop 300 (2 no.s) Ramming dia 50 mm, drop 450 (1 no.) c) Sample extruder Hydraulic jack type (1 no.) d) Spacer disc for larger mold Diameter 148 mm, height 50 mm (1 no.) e) Straightedge, 300 mm long (2 no.s)	set	1
- Automatic mechanical compactor Driving unit; Electric gear drive Motor - 400 W, AC 220 V, 3 ph, 50 Hz Speed reduction device - worm gear type Applicable mold - diameter 10 cm, 15 cm Rammer dropping device, friction cam type Rammer weight 2.5 kg - dropping height 300 mm Rammer weight 4.5 kg - dropping height 450 mm Blow rate - approx. 40/min More turn table: Automatic rotation and reciprocating mechanism by Genever gear and pneumatic cylinder Compressor, max. 5 kg/cm ² 200 W, AC 220 V, 3 ph, 50 Hz Spare parts: Friction cam	set	1

(3/5)

Item	Unit	Quantity
- Fallin Head Permeameter	set	5
Permeability mold, NK type Inside diameter 100 mm		
Cover plate, Base plate & Cylinder Transparent acrylic resin		
Stand pipe, 20 mm inside dia. 1 m long		
Overflow vessel, 330 ϕ x 45 mm depth		
Accessories: Cutter, 100 ϕ m Straightedge, 200 mm Tramping rod, 25 ϕ x 300 mm		
- Constant head permeameter	set	2
Permeability mold, inside diameter 150 mm		
Base plate with prougs		
Wire net		
Water vessel		
Graduated cylinder		
- Denver Type Consolidation Permeameter	set	3
Specimen container, Height 75 mm, Inside diameter 200 mm		
Loading device, capacity Hydraulic jack 5.10 ton Coil spring, 500, 2000, 5000 kg		
Permeation device, 30, 40, 50, 60 mm		
Measurement of settlement Dial gauge 30 mm x 0.01 mm		
- Power auger		
4 cycle gasoline engine, 7HP centrifugal clutch, gear drive transmission		
Flexible shaft for heavy load		
Drilling capacity		
38° - 150 ϕ depth 7.0 m		
200 ϕ depth 4.5 m		
300 ϕ depth 2.7 m		
400 ϕ depth 1.8 m		
- Vibrating compaction equipment	set	1
(ASTM D 2049 - 69)		
Vibratory table, steel table with a cushioned steel vibrating deck about 762 x 762 mm actuated by an electro-magnetic vibrator		
Vibration frequency 3,000/min		
- Infrared moisture meter	set	1
sample	50 g	
Measurement rage	0 - 100 %	
Measurement graduation	0 - 20 %	
IR heater	500 W	

(4/5)

Item	Unit	Quantity
- Sand density apparatus	set	3
Jar	4 liter, 200 m height	
Attachment	funnel shaped lower end with valve	
Base plate	300 mm disc with 162 mm center hole	
Glass plate	200 x 200 6 mm	
- Mechanical Analysis Stirrer	set	1
Potation speed, 10,000 rpm (no load)		
Dispersion cup, type A		
- Unconfined Apparatus, Hand Operated	set	1
Loading capacity:	50 kg	
Applicable specimen:	35 ϕ x 70 mm 50 ϕ x 100 mm	
Proving ring:	50 kg	
Dial gauge, range:	30 mm Grad. 0.01	
Accessories:	Miter box, 35 ϕ x 70 mm 1 (no.) Miter box, 50 ϕ x 100 mm 1 (no.) Celluloid plate 5 (no.s) Trimmer 1 (no.) Wire saw 1 (no.) Straightedge, 30 cm 1 (no.) Vinyl sheet 5 (no.s) Wooden case 1 (no.)	
- Pinhole Testing apparatus	set	1
Pinhole test mould;		
Nipple;		
Needle;		
Stand pipe;		
Head tank;		
Plastic cylinder;		
Graduated cylindrical measuring flask:		
(Capacity, sizes, dimensions, etc of the above are referred to "PINHOLE TEST FOR IDENTIFYING DISPERSIVE SOILS" by James L. Sherard, Lorn P. Dunningan, Rey S. Decker, and Edgar F. Steele. Proceedings of the American Society of Civil Engineers, Vol. 102, No. GT 1, January, 1976.)		
- Specific Gravity Apparatus	set	1
Electric heater	: 1.0 kW, AC 220 V (1 no.)	
Vacuum pump	: (1 no.)	
Desiccator	: 240 mm diameter (1 no.)	
Mercury manometer	: (1 no.)	
Pycnometer flask	: Gay-Lussac type, 50 cc (20 no.s)	
Volumetric flask	: 100 cc (5 no.s)	
Chemical balance	: capacity 200 gr. sensitivity 0.001 gr. (1 no.)	
Termometer	: 0°C - 100°C, gradation 1°C (1 no.)	
- Driving tube sampler with sample extruder	set	1
Corps of Engineer type or equivalent		

(5/5)

Item	Unit	Quantity
<u>MISCELLANEOUS</u>		
- Recording hygro-thermometer one (1) week wind up type	set	1
- Vernier caliper 300 mm	pcs	1
- Wire scratch brush	pcs	5
- Wooden hammer	pcs	2
- Convex rule Length: 2 m	pcs	5
- Stop watch 30 seconds or 60 seconds	pcs	3
- Abrasive charges set	set	1
- Loading attachment For compression and bending of mortar specimens	set	1
- Flow scale 300 mm	pcs	1
- Thermometers Gradation : 0°C - 100°C, alcohol type	pcs	1
- Automatic distillation apparatus Capacity : 3 liters/hour Power : 2 kW, AC 220 V with mercurial relay type of thermostat	set	1
- Flow cone for grouting material	set	1

TECHNICAL SPECIFICATIONS

CENTRAL WATER AUTHORITY
PHOENIX - MAURITIUS

THE PORT LOUIS WATER SUPPLY PROJECT

TENDER DOCUMENTS

FOR

LOT II : CIVIL WORKS (DAM AND APPURTENANT STRUCTURES
INCLUDING CLOSURE OF DIVERSION TUNNEL)

TECHINICAL SPECIFICATIONS

Table of Contents

<u>Clause No.</u>		<u>Page</u>
CHAPTER T1	DEWATERING, CONSTRUCTION OF COFFERDAM AND RIVER DIVERSION	TS - 1 - 1
T1.1	General.....	TS - 1 - 1
T1.2	Dewatering during Construction.....	TS - 1 - 2
T1.2.1	General.....	TS - 1 - 2
T1.2.2	Measurement and payment.....	TS - 1 - 3
T1.3	Construction of Cofferdams.....	TS - 1 - 3
T1.3.1	Cofferdam constituting main dam.....	TS - 1 - 3
T1.3.2	Cofferdam as temporary facilities.....	TS - 1 - 4
T1.3.3	Measurement and payment.....	TS - 1 - 4
T1.4	River Diversion.....	TS - 1 - 5
T1.4.1	Diversion scheme.....	TS - 1 - 5
T1.4.2	Measurement and payment.....	TS - 1 - 6
T1.5	Removal of Cofferings and Facilities for Care of Water.....	TS - 1 - 7
CHAPTER T2	EARTHWORK	TS - 2 - 1
T2.1	General.....	TS - 2 - 1
T2.2	Clearing and Stripping.....	TS - 2 - 1
T2.2.1	General.....	TS - 2 - 1
T2.2.2	Execution of work.....	TS - 2 - 2
T2.2.3	Measurement and payment.....	TS - 2 - 2
T2.3	Explosives and Blasting.....	TS - 2 - 3

	T2.3.1	Explosives.....	TS - 2 - 3
	T2.3.2	Planning of blasting.....	TS - 2 - 3
	T2.3.3	Pre-splitting.....	TS - 2 - 4
	T2.3.4	Safety programme for handling explosives and blasting.....	TS - 2 - 4
T2.4		Open-Cut Excavation.....	TS - 2 - 5
	T2.4.1	General.....	TS - 2 - 5
	T2.4.2	Classification of excavation material.....	TS - 2 - 6
	T2.4.3	Seams and other defects.....	TS - 2 - 7
	T2.4.4	Execution of work.....	TS - 2 - 8
	T2.4.5	Stockpiling and disposal.....	TS - 2 - 10
	T2.4.6	Measurement and payment.....	TS - 2 - 10
	T2.4.7	Trench excavation.....	TS - 2 - 11
T2.5		Underground Excavation.....	TS - 2 - 12
	T2.5.1	General.....	TS - 2 - 12
	T2.5.2	Design section.....	TS - 2 - 12
	T2.5.3	Excavation procedure.....	TS - 2 - 13
	T2.5.4	Steel support.....	TS - 2 - 14
	T2.5.5	Temporary support.....	TS - 2 - 15
	T2.5.6	Measurement and payment.....	TS - 2 - 15
	T2.5.7	Disposal or use of materials from excavation.....	TS - 2 - 16
T2.6		Embankment.....	TS - 2 - 18
	T2.6.1	General.....	TS - 2 - 18
	T2.6.2	Impervious core zone (Zone 1) for dam embankment.....	TS - 2 - 22
	T2.6.3	Fine filter zone (Zone 2) and coarse filter zone (Zone 3) for dam embankment.....	TS - 2 - 28
	T2.6.4	Rock zone (Zone 4) for dam embankment.....	TS - 2 - 32
	T2.6.5	Riprap (Zone 5) for main dam embankment.....	TS - 2 - 33
	T2.6.6	Trial embankment.....	TS - 2 - 34
	T2.6.7	Tests on embankment materials.....	TS - 2 - 38
	T2.6.8	Operation of borrow area.....	TS - 2 - 40
	T2.6.9	Operation of quarry site.....	TS - 2 - 42
	T2.6.10	Operation of crushing plant.....	TS - 2 - 44
T2.7		Backfill and Miscellaneous Embankment.....	TS - 2 - 45
	T2.7.1	General.....	TS - 2 - 45
	T2.7.2	Free draining backfill.....	TS - 2 - 46
	T2.7.3	Random fill and backfill.....	TS - 2 - 46
	T2.7.4	Miscellaneous embankment.....	TS - 2 - 46

	T2.7.5	Gravel bedding and gravel metalling.....	TS - 2 - 48
	T2.7.6	Measurement and payment.....	TS - 2 - 48
T2.8		Gabion Mat	TS - 2 - 48
	T2.8.1	General.....	TS - 2 - 48
	T2.8.2	Material.....	TS - 2 - 49
	T2.8.3	Measurement and payment.....	TS - 2 - 49
T2.9		Drainage.....	TS - 2 - 50
	T2.9.1	General.....	TS - 2 - 50
	T2.9.2	Materials.....	TS - 2 - 50
	T2.9.3	Measurement and payment.....	TS - 2 - 53
T2.10		Slope Protection.....	TS - 2 - 54
	T2.10.1	General.....	TS - 2 - 54
	T2.10.2	Sod facing.....	TS - 2 - 54
	T2.10.3	Grouted anchor bar.....	TS - 2 - 55
	T2.10.4	Stone pitching.....	TS - 2 - 55
	T2.10.5	Measurement and payment.....	TS - 2 - 56
T2.11		Removal of Concrete.....	TS - 2 - 57
CHAPTER T3		DRILLING AND GROUTING.....	TS - 3 - 1
T3.1		General.....	TS - 3 - 1
T3.2		Grout Material.....	TS - 3 - 3
T3.3		Equipment.....	TS - 3 - 3
	T3.3.1	Drilling equipment.....	TS - 3 - 3
	T3.3.2	Water pressure testing equipment.....	TS - 3 - 3
	T3.3.3	Grout plant.....	TS - 3 - 4
T3.4		Backfill Grouting.....	TS - 3 - 4
	T3.4.1	General.....	TS - 3 - 4
	T3.4.2	Steel pipe for backfill grouting.....	TS - 3 - 5
	T3.4.3	Grouting operation.....	TS - 3 - 5
T3.5		Consolidation Grouting.....	TS - 3 - 5
	T3.5.1	General.....	TS - 3 - 5
	T3.5.2	Drilling grout holes.....	TS - 3 - 6
	T3.5.3	Grouting operation.....	TS - 3 - 6
	T3.5.4	Concentration of grout.....	TS - 3 - 7
	T3.5.5	Time of completion.....	TS - 3 - 7
	T3.5.6	Rejection of prepared grout.....	TS - 3 - 7
	T3.5.7	Treatment of grout leakage.....	TS - 3 - 7

T3.6	Curtain Grouting	TS - 3 - 8
	T3.6.1 General	TS - 3 - 8
	T3.6.2 Drilling grout hole	TS - 3 - 8
	T3.6.3 Grouting operation.....	TS - 3 - 9
	T3.6.4 Rim grouting	TS - 3 - 10
	T3.6.5 Curtain grouting for foundation of existing municipal dike	TS - 3 - 10
T3.7	Contact Grouting	TS - 3 - 11
	T3.7.1 General.....	TS - 3 - 11
	T3.7.2 Contact grouting for backfill and plug concrete.....	TS - 3 - 11
T3.8	Blanket Grouting	TS - 3 - 13
	T3.8.1 General.....	TS - 3 - 13
	T3.8.2 Drilling grout hole.....	TS - 3 - 13
	T3.8.3 Grouting operation	TS - 3 - 13
	T3.8.4 Concentration of grout.....	TS - 3 - 13
	T3.8.5 Time of completion.....	TS - 3 - 14
	T3.8.6 Treatment of grout leakage.....	TS - 3 - 14
	T3.8.7 Rejection of prepared grout and treatment of grout leakage.....	TS - 3 - 14
T3.9	Check Hole	TS - 3 - 14
T3.10	Water Pressure Test.....	TS - 3 - 15
T3.11	Drilling Holes for Piezometer Installation.....	TS - 3 - 16
T3.12	Measurement and Payment.....	TS - 3 - 16
	T3.12.1 Drilling grout hole	TS - 3 - 16
	T3.12.2 Core drilling test hole.....	TS - 3 - 17
	T3.12.3 Water pressure test in borehole.....	TS - 3 - 17
	T3.12.4 Furnishing and setting up packer.....	TS - 3 - 18
	T3.12.5 Curtain, blanket and consolidation groutings.....	TS - 3 - 18
	T3.12.6 Grout material	TS - 3 - 18
	T3.12.7 Contact grouting.....	TS - 3 - 19
	T3.12.8 Backfill grouting	TS - 3 - 19
	T3.12.9 Curtain grouting for repair of existing municipal dike	TS - 3 - 19
T3.13	Drilling Drainage Holes	TS - 3 - 19
	T3.13.1 Drilling operation.....	TS - 3 - 19
	T3.13.2 Measurement and payment	TS - 3 - 20
CHAPTER T4	CONCRETE WORK.....	TS - 4 - 1
	T4.1 Mass and Reinforced Concrete	TS - 4 - 1
	T4.1.1 General.....	TS - 4 - 1

	T4.1.2	Materials.....	TS - 4 - 1
	T4.1.3	Mix proportions	TS - 4 - 6
	T4.1.4	Tests of concrete and concrete material	TS - 4 - 8
	T4.1.5	Batching.....	TS - 4 - 10
	T4.1.6	Mixing	TS - 4 - 12
	T4.1.7	Transportation.....	TS - 4 - 13
	T4.1.8	Placing of concrete.....	TS - 4 - 14
	T4.1.9	Curing and protection of concrete.....	TS - 4 - 17
	T4.1.10	Construction joints	TS - 4 - 18
	T4.1.11	Contraction joint and waterstop	TS - 4 - 18
	T4.1.12	Formwork	TS - 4 - 19
	T4.1.13	Finishes and finishing.....	TS - 4 - 23
	T4.1.14	Damaged or defective concrete surface.....	TS - 4 - 25
	T4.1.15	Reinforcing bars	TS - 4 - 26
	T4.1.16	Concrete in tunnel.....	TS - 4 - 27
	T4.1.17	Concrete in blockouts.....	TS - 4 - 29
	T4.1.18	Measurement and payment.....	TS - 4 - 29
T4.2		Shotcrete.....	TS - 4 - 32
	T4.2.1	General	TS - 4 - 32
	T4.2.2	Material	TS - 4 - 32
	T4.2.3	Mix proportion.....	TS - 4 - 32
	T4.2.4	Preparation for spray.....	TS - 4 - 33
	T4.2.5	Placing and curing.....	TS - 4 - 33
	T4.2.6	Test.....	TS - 4 - 34
	T4.2.7	Measurement and payment.....	TS - 4 - 34
T4.3		Cooling of Concrete.....	TS - 4 - 34
	T4.3.1	Cooling operation.....	TS - 4 - 34
	T4.3.2	Embedded pipe for cooling system.....	TS - 4 - 35
	T4.3.3	Measurement and payment.....	TS - 4 - 36
CHAPTER T5		ROAD WORK.....	TS - 5 - 1
	T5.1	Scope of Work	TS - 5 - 1
	T5.2	Access Roads	TS - 5 - 1
	T5.2.1	General	TS - 5 - 1
	T5.2.2	Subbase course.....	TS - 5 - 2
	T5.2.3	Base course	TS - 5 - 3
	T5.2.4	Surface course	TS - 5 - 4

	T5.2.5	Measurement and payment.....	TS - 5 - 6
	T5.2.6	Roadway accessories.....	TS - 5 - 7
	T5.2.7	Measurement and payment.....	TS - 5 - 8
	T5.2.8	Replacement of existing channel.....	TS - 5 - 8
CHAPTER T6		BUILDING WORKS.....	TS - 6 - 1
	T6.1	General.....	TS - 6 - 1
	T6.1.1	Scope of work.....	TS - 6 - 1
	T6.1.2	General.....	TS - 6 - 1
	T6.2	Earthwork.....	TS - 6 - 2
	T6.2.1	General.....	TS - 6 - 2
	T6.3	Concrete and Formwork.....	TS - 6 - 2
	T6.3.1	General.....	TS - 6 - 2
	T6.4	Masonry Works.....	TS - 6 - 2
	T6.4.1	Concrete block masonry.....	TS - 6 - 2
	T6.4.2	Measurement and payment.....	TS - 6 - 3
	T6.5	Bituminous Waterproof Roofing.....	TS - 6 - 3
	T6.5.1	Built-up roofing.....	TS - 6 - 3
	T6.5.2	Materials.....	TS - 6 - 4
	T6.5.3	Application.....	TS - 6 - 4
	T6.5.4	Alternative system.....	TS - 6 - 5
	T6.5.5	Measurement and payment.....	TS - 6 - 5
	T6.6	Terrazzo Works.....	TS - 6 - 5
	T6.6.1	Materials.....	TS - 6 - 5
	T6.6.2	Application.....	TS - 6 - 6
	T6.6.3	Measurement and payment.....	TS - 6 - 6
	T6.7	Tile Works.....	TS - 6 - 7
	T6.7.1	Material.....	TS - 6 - 7
	T6.7.2	Ceramic tile, and porcelain tile.....	TS - 6 - 7
	T6.7.3	Measurement and payment.....	TS - 6 - 8
	T6.8	Plastering Works.....	TS - 6 - 8
	T6.8.1	Cement screed and plaster.....	TS - 6 - 8
	T6.8.2	Waterproof cement mortar.....	TS - 6 - 9
	T6.8.3	Expanding grout.....	TS - 6 - 9
	T6.8.4	Application.....	TS - 6 - 9
	T6.8.5	Measurement and payment.....	TS - 6 - 10
	T6.9	Painting Works.....	TS - 6 - 10

	T6.9.1	Materials.....	TS - 6 - 10
	T6.9.2	Application.....	TS - 6 - 10
	T6.9.3	Measurement and payment.....	TS - 6 - 12
T6.10		Carpentry and Joinery Works.....	TS - 6 - 12
	T6.10.1	Materials and workmanship.....	TS - 6 - 12
	T6.10.2	Measurement and payment.....	TS - 6 - 12
T6.11		Interior Finishing Works.....	TS - 6 - 13
	T6.11.1	Materials.....	TS - 6 - 13
	T6.11.2	Installation	TS - 6 - 13
	T6.11.3	Measurement and payment.....	TS - 6 - 15
T6.12		Wooden Doors.....	TS - 6 - 15
	T6.12.1	General	TS - 6 - 15
	T6.12.2	Wooden door leaves.....	TS - 6 - 15
	T6.12.3	Hardware	TS - 6 - 16
	T6.12.4	Measurement and payment.....	TS - 6 - 16
T6.13		Steel Doors and Frames, and Rolling Shutter	TS - 6 - 16
	T6.13.1	General	TS - 6 - 16
	T6.13.2	Hollow steel door leaves.....	TS - 6 - 17
	T6.13.3	Steel door frames	TS - 6 - 17
	T6.13.4	Hardware	TS - 6 - 18
	T6.13.5	Measurement and payment.....	TS - 6 - 18
T6.14		Aluminium Door, Windows and Louvers and Frames.....	TS - 6 - 18
	T6.14.1	General	TS - 6 - 18
	T6.14.2	Materials and workmanship.....	TS - 6 - 19
	T6.14.3	Measurement and payment.....	TS - 6 - 20
T6.15		Glazing Works	TS - 6 - 20
	T6.15.1	Glass.....	TS - 6 - 20
	T6.15.2	Glazing.....	TS - 6 - 20
	T6.15.3	Measurement and payment.....	TS - 6 - 20
T6.16		Miscellaneous Metal Works.....	TS - 6 - 21
	T6.16.1	Materials.....	TS - 6 - 21
	T6.16.2	Materials and installation.....	TS - 6 - 21
	T6.16.3	Measurement and payment.....	TS - 6 - 22
T6.17		Miscellaneous Works.....	TS - 6 - 23
	T6.17.1	Materials.....	TS - 6 - 23
	T6.17.2	Materials and installation.....	TS - 6 - 23
	T6.17.3	Measurement and payment.....	TS - 6 - 24

T6.18	Plumbing Works.....	TS - 6 - 24
	T6.18.1 General.....	TS - 6 - 24
	T6.18.2 Plumbing materials and installation.....	TS - 6 - 27
T6.19	Air Conditioning and Ventilation Systems.....	TS - 6 - 34
	T6.19.1 General.....	TS - 6 - 34
	T6.19.2 Air conditioning system.....	TS - 6 - 36
	T6.19.3 Ventilation system.....	TS - 6 - 37
T6.20	Fire Protection System.....	TS - 6 - 38
	T6.20.1 General.....	TS - 6 - 38
	T6.20.2 Fire extinguisher.....	TS - 6 - 38
T6.21	Measurement and Payment for Plumbing Works, Air Conditioning and Ventilation and Fire Protection Systems.....	TS - 6 - 38
	T6.21.1 General.....	TS - 6 - 38
	T6.21.2 Measurement and payment.....	TS - 6 - 39
CHAPTER T7	HYDROMECHANICAL WORKS.....	TS - 7 - 1
T7.1	General.....	TS - 7 - 1
	T7.1.1 Scope of works.....	TS - 7 - 1
	T7.1.2 Permanent electricity supplies.....	TS - 7 - 2
	T7.1.3 Instruction to project staff.....	TS - 7 - 3
	T7.1.4 Standards.....	TS - 7 - 3
	T7.1.5 Working stresses and design.....	TS - 7 - 4
	T7.1.6 Unit of measurement.....	TS - 7 - 5
	T7.1.7 Tropicalization.....	TS - 7 - 5
	T7.1.8 Grounding.....	TS - 7 - 6
	T7.1.9 Change to material or equipment.....	TS - 7 - 6
	T7.1.10 Labels and plates.....	TS - 7 - 6
T7.2	Drawings and Documents to be Supplied by the Contractor.....	TS - 7 - 6
	T7.2.1 Drawings and documents for approval.....	TS - 7 - 6
	T7.2.2 Procedure for submission of drawings and documents for approval.....	TS - 7 - 7
	T7.2.3 For work drawings.....	TS - 7 - 8
	T7.2.4 Final drawings and documents.....	TS - 7 - 8
	T7.2.5 Required numbers of drawings and documents.....	TS - 7 - 9
	T7.2.6 Target on submission of drawings and documents.....	TS - 7 - 10
T7.3	Instruction Manuals.....	TS - 7 - 11
	T7.3.1 Operating and maintenance instructions.....	TS - 7 - 11

	T7.3.2	Instructions for erection works.....	TS - 7 - 12
	T7.3.3	Test procedure instructions.....	TS - 7 - 12
T7.4		Mechanical and Structural Works.....	TS - 7 - 12
	T7.4.1	General.....	TS - 7 - 12
	T7.4.2	Castings.....	TS - 7 - 13
	T7.4.3	Forgings.....	TS - 7 - 14
	T7.4.4	Floor plate.....	TS - 7 - 14
	T7.4.5	Walkways, ladders and handrails.....	TS - 7 - 14
	T7.4.6	Machine work.....	TS - 7 - 14
	T7.4.7	Balancing.....	TS - 7 - 15
	T7.4.8	Small bore piping.....	TS - 7 - 16
	T7.4.9	Joint of structural members.....	TS - 7 - 16
	T7.4.10	Embedded steelwork, opening, etc.....	TS - 7 - 17
	T7.4.11	Welding.....	TS - 7 - 17
	T7.4.12	Lubrication.....	TS - 7 - 19
	T7.4.13	Protection, cleaning and painting.....	TS - 7 - 19
	T7.4.14	Mechanical equipment and parts.....	TS - 7 - 23
T7.5		Electrical Equipment and Parts.....	TS - 7 - 26
	T7.5.1	Motors.....	TS - 7 - 26
	T7.5.2	Motor brakes.....	TS - 7 - 27
	T7.5.3	External electric cables and wiring.....	TS - 7 - 27
	T7.5.4	Equipment wiring and wiring accessories.....	TS - 7 - 28
	T7.5.5	Motor starters.....	TS - 7 - 29
	T7.5.6	Control cabinet and panel.....	TS - 7 - 29
	T7.5.7	Power distribution panel.....	TS - 7 - 29
	T7.5.8	Conduits.....	TS - 7 - 30
	T7.5.9	Enclosures.....	TS - 7 - 30
	T7.5.10	Convenience outlets.....	TS - 7 - 30
	T7.5.11	Limit switches.....	TS - 7 - 30
	T7.5.12	Indicating lights.....	TS - 7 - 31
	T7.5.13	Lighting fixtures.....	TS - 7 - 31
	T7.5.14	Electrical relays.....	TS - 7 - 31
	T7.5.15	Terminal strips.....	TS - 7 - 31
	T7.5.16	Indicating instruments.....	TS - 7 - 32
T7.6		Packing, Delivery and Storage.....	TS - 7 - 33
	T7.6.1	Packing.....	TS - 7 - 33
	T7.6.2	Delivery.....	TS - 7 - 34

	T7.6.3	Storage at site.....	TS - 7 - 34
T7.7		Test and Inspection.....	TS - 7 - 35
	T7.7.1	General.....	TS - 7 - 35
	T7.7.2	Material inspection and test.....	TS - 7 - 36
	T7.7.3	Tests at manufacturer's shop.....	TS - 7 - 36
	T7.7.4	Tests at site.....	TS - 7 - 37
	T7.7.5	Tests on completion.....	TS - 7 - 37
	T7.7.6	Test and inspection reports.....	TS - 7 - 38
T7.8		Spare Parts.....	TS - 7 - 38
T7.9		Maintenance Equipment and Tools.....	TS - 7 - 38
T7.10		Measurement and Payment.....	TS - 7 - 39
T7.11		Loads to be Considered.....	TS - 7 - 41
	T7.11.1	General.....	TS - 7 - 41
	T7.11.2	Gate leaf, valve and trash rack.....	TS - 7 - 41
	T7.11.3	Hoist.....	TS - 7 - 42
	T7.11.4	Other equipment.....	TS - 7 - 43
T7.12		Materials.....	TS - 7 - 43
	T7.12.1	General.....	TS - 7 - 43
	T7.12.2	Castings.....	TS - 7 - 44
	T7.12.3	Forgings.....	TS - 7 - 44
	T7.12.4	Rubber seals for gates.....	TS - 7 - 45
	T7.12.5	Miscellaneous materials.....	TS - 7 - 46
T7.13		Design Conditions.....	TS - 7 - 46
	T7.13.1	Structural steel members for gate and valve leaves, trash racks and other steel structures.....	TS - 7 - 46
	T7.13.2	Bar element of trash rack.....	TS - 7 - 48
	T7.13.3	Machine parts.....	TS - 7 - 49
	T7.13.4	Concrete stress.....	TS - 7 - 49
	T7.13.5	Combined allowable stress and overloading condition.....	TS - 7 - 49
	T7.13.6	Minimum thickness.....	TS - 7 - 50
	T7.13.7	Critical slenderness ratio.....	TS - 7 - 51
	T7.13.8	Maximum deflection.....	TS - 7 - 51
	T7.13.9	Corrosion allowance.....	TS - 7 - 51
	T7.13.10	Coefficient of friction.....	TS - 7 - 52
	T7.13.11	Mechanical efficiency.....	TS - 7 - 52
T7.14		Detailed Specifications of Intake Gates and Hoists.....	TS - 7 - 53
	T7.14.1	General.....	TS - 7 - 53

	T7.14.2	Design stresses.....	TS - 7 - 53
	T7.14.3	Design data.....	TS - 7 - 53
	T7.14.4	Gate details.....	TS - 7 - 55
	T7.14.5	Guide frames details.....	TS - 7 - 58
	T7.14.6	Hoists details.....	TS - 7 - 60
	T7.14.7	Control and wiring.....	TS - 7 - 61
	T7.14.8	Shop assembly and tests.....	TS - 7 - 63
	T7.14.9	Installation and tests at site.....	TS - 7 - 64
	T7.14.10	Tests on completion.....	TS - 7 - 65
T7.15		Detailed Specification of Intake Trash Racks.....	TS - 7 - 66
	T7.15.1	General.....	TS - 7 - 66
	T7.15.2	Design stresses.....	TS - 7 - 67
	T7.15.3	Design data.....	TS - 7 - 67
	T7.15.4	Trash racks details.....	TS - 7 - 68
	T7.15.5	Shop assembly and tests.....	TS - 7 - 69
	T7.15.6	Installation and tests at site.....	TS - 7 - 69
	T7.15.7	Tests on completion.....	TS - 7 - 69
T7.16		Detailed Specifications of Water Supply Facilities.....	TS - 7 - 69
	T7.16.1	General.....	TS - 7 - 69
	T7.16.2	Design stresses.....	TS - 7 - 70
	T7.16.3	Design data.....	TS - 7 - 70
	T7.16.4	Steel conduit details.....	TS - 7 - 74
	T7.16.5	Fabrication of steel conduits.....	TS - 7 - 75
	T7.16.6	Discharge valve details.....	TS - 7 - 78
	T7.16.7	Guard valve details.....	TS - 7 - 80
	T7.16.8	Tests and inspections for conduit.....	TS - 7 - 82
	T7.16.9	Shop assembly and test for valves.....	TS - 7 - 84
	T7.16.10	Installation at site.....	TS - 7 - 87
	T7.16.11	Test on completion.....	TS - 7 - 88
T7.17		Detailed Requirement of Operation and Control.....	TS - 7 - 89
	T7.17.1	General.....	TS - 7 - 89
	T7.17.2	Control cabinet details.....	TS - 7 - 90
	T7.17.3	Oil pressure unit details.....	TS - 7 - 94
	T7.17.4	Wiring.....	TS - 7 - 96
	T7.17.5	Piping.....	TS - 7 - 96
	T7.17.6	Shop assembly and test.....	TS - 7 - 97
	T7.17.7	Installation at site.....	TS - 7 - 98

	T7.17.8	Tests on completion.....	TS - 7 - 98
T7.18		Detailed Specifications of River Outlet Inlet Bulkhead Gate.....	TS - 7 -100
	T7.18.1	General.....	TS - 7 -100
	T7.18.2	Design stresses.....	TS - 7 -100
	T7.18.3	Design data.....	TS - 7 -100
	T7.18.4	Gates details.....	TS - 7 -102
	T7.18.5	Guide frames details.....	TS - 7 -103
	T7.18.6	Shop assembly and test.....	TS - 7 -103
	T7.18.7	Installation and tests at site.....	TS - 7 -104
	T7.18.8	Tests on completion.....	TS - 7 -104
T7.19		Detailed Specifications of River Outlet Trash Racks.....	TS - 7 -104
	T7.19.1	General.....	TS - 7 -104
	T7.19.2	Design stresses.....	TS - 7 -105
	T7.19.3	Design data.....	TS - 7 -105
	T7.19.4	Trash racks details.....	TS - 7 -106
	T7.19.5	Shop assembly and tests.....	TS - 7 -107
	T7.19.6	Installation and tests at site.....	TS - 7 -107
	T7.19.7	Tests on completion.....	TS - 7 -107
T7.20		Detailed Specifications of River Outlet Facilities.....	TS - 7 -107
	T7.20.1	General.....	TS - 7 -107
	T7.20.2	Design stresses.....	TS - 7 -108
	T7.20.3	Design data.....	TS - 7 -108
	T7.20.4	Steel conduit details.....	TS - 7 -110
	T7.20.5	Fabrication of steel conduits.....	TS - 7 -111
	T7.20.6	Discharge valve details.....	TS - 7 -111
	T7.20.7	Guard valve details.....	TS - 7 -111
	T7.20.8	Tests and inspections for conduit.....	TS - 7 -111
	T7.20.9	Shop assembly and test for valves.....	TS - 7 -112
	T7.20.10	Installation and tests at site.....	TS - 7 -112
	T7.20.11	Tests on completion.....	TS - 7 -112
CHAPTER T8		ELECTRICAL WORKS.....	TS - 8 - 1
	T8.1	Scope of Work.....	TS - 8 - 1
	T8.2	General.....	TS - 8 - 1
	T8.2.1	Standards.....	TS - 8 - 1
	T8.2.2	Working drawings and catalogues.....	TS - 8 - 2
	T8.2.3	Electrical and mechanical design.....	TS - 8 - 2

	T8.2.4	Measuring instruments.....	TS - 8 - 2
	T8.2.5	Indicating lamp assemblies.....	TS - 8 - 3
	T8.2.6	Nameplates and escutcheon plates.....	TS - 8 - 3
	T8.2.7	Painting.....	TS - 8 - 3
T8.3		Wiring.....	TS - 8 - 4
	T8.3.1	General.....	TS - 8 - 4
	T8.3.2	Phase arrangement.....	TS - 8 - 4
	T8.3.3	Wiring color code.....	TS - 8 - 5
	T8.3.4	Phase and polarity color code.....	TS - 8 - 5
T8.4		Terminal Blocks.....	TS - 8 - 5
T8.5		Tests.....	TS - 8 - 6
T8.6		Lighting and Receptacle Systems.....	TS - 8 - 6
	T8.6.1	Scope of work.....	TS - 8 - 6
	T8.6.2	Electrical apparatuses and materials.....	TS - 8 - 7
	T8.6.3	Installation.....	TS - 8 - 10
	T8.6.4	Tests.....	TS - 8 - 13
T8.7		Power Receiving and Power Distribution Systems.....	TS - 8 - 13
	T8.7.1	General.....	TS - 8 - 13
	T8.7.2	Conductor and cables.....	TS - 8 - 14
	T8.7.3	Insulators and fittings.....	TS - 8 - 15
	T8.7.4	Supports.....	TS - 8 - 17
	T8.7.5	Step-down transformers and other equipment.....	TS - 8 - 21
	T8.7.6	22kV cubicles including 75kVA transformer.....	TS - 8 - 24
T8.8		Emergency Power Supply System.....	TS - 8 - 26
	T8.8.1	General.....	TS - 8 - 26
	T8.8.2	Diesel engine generator set.....	TS - 8 - 27
	T8.8.3	D.C. power panel.....	TS - 8 - 29
	T8.8.4	Automatic starting panel.....	TS - 8 - 31
T8.9		Grounding System.....	TS - 8 - 31
	T8.9.1	General.....	TS - 8 - 31
	T8.9.2	Grounding materials.....	TS - 8 - 31
T8.10		Dam Leakage Water Drainage System.....	TS - 8 - 32
	T8.10.1	Pumping equipment.....	TS - 8 - 32
	T8.10.2	Paint schedule.....	TS - 8 - 35
T8.11		Measurement and Payment.....	TS - 8 - 35
CHAPTER T9		MISCELLANEOUS METALWORKS.....	TS - 9 - 1

T9.1	General.....	TS - 9 - 1
T9.2	Materials.....	TS - 9 - 2
T9.3	Workmanship.....	TS - 9 - 2
	T9.3.1 General.....	TS - 9 - 2
	T9.3.2 Welding.....	TS - 9 - 3
	T9.3.3 Riveting.....	TS - 9 - 4
	T9.3.4 Unfinished bolt connection.....	TS - 9 - 4
	T9.3.5 High tensile bolt connection.....	TS - 9 - 4
	T9.3.6 Protection of machines surfaces.....	TS - 9 - 5
	T9.3.7 Zinc coatings.....	TS - 9 - 5
	T9.3.8 Shop assembly.....	TS - 9 - 5
	T9.3.9 Field assembly and erection.....	TS - 9 - 6
	T9.3.10 Painting and cleaning.....	TS - 9 - 7
T9.4	Embedded Metalwork.....	TS - 9 - 7
T9.5	Non-embedded Metalwork.....	TS - 9 - 8
T9.6	Measurement and Payment.....	TS - 9 - 8
	T9.6.1 Structural steelwork.....	TS - 9 - 8
	T9.6.2 Embedded metalwork or non-embedded metalwork.....	TS - 9 - 8
	T9.6.3 Guardrail of fence.....	TS - 9 - 9
	T9.6.4 Steel pipe.....	TS - 9 - 9
	T9.6.5 Hook.....	TS - 9 - 9
	T9.6.6 Cast iron valve.....	TS - 9 - 10
	T9.6.7 Painting for structural steelwork.....	TS - 9 - 10
	T9.6.8 V-notched narrow weir.....	TS - 9 - 10
CHAPTER T10	MEASURING APPARATUS.....	TS - 10 - 1
	T10.1 Scope.....	TS - 10 - 1
	T10.1.1 General.....	TS - 10 - 1
	T10.1.2 Installation of apparatus.....	TS - 10 - 2
	T10.2 Pore Pressure Meter.....	TS - 10 - 3
	T10.2.1 General.....	TS - 10 - 3
	T10.2.2 Requirement.....	TS - 10 - 3
	T10.2.3 Installation.....	TS - 10 - 5
	T10.3 Earth Pressure Meter.....	TS - 10 - 6
	T10.3.1 General.....	TS - 10 - 6
	T10.3.2 Requirement.....	TS - 10 - 6
	T10.3.3 Installation.....	TS - 10 - 6

T10.4	Multi-layer Settlement Meter	TS - 10 - 7
T10.4.1	General	TS - 10 - 7
T10.4.2	Requirement.....	TS - 10 - 7
T10.4.3	Installation	TS - 10 - 8
T10.5	Surface Displacement Survey Points and Reference Points for Sediment Monitoring	TS - 10 - 8
T10.5.1	Material.....	TS - 10 - 8
T10.5.2	Installation	TS - 10 - 9
T10.6	Leakage Measuring Facilities.....	TS - 10 - 10
T10.6.1	General.....	TS - 10 - 10
T10.6.2	Material.....	TS - 10 - 10
T10.7	Water Level Detector and Indicator	TS - 10 - 11
T10.8	Measurement and Payment.....	TS - 10 - 11
T10.8.1	Measuring apparatus	TS - 10 - 11
T10.8.2	Surface displacement survey points and reference points for sediment monitoring.....	TS - 10 - 13
T10.8.3	Leakage measuring facility.....	TS - 10 - 13
T10.8.4	Water level detector and indicator	TS - 10 - 13
T10.8.5	Relay terminal box, converter and cable	TS - 10 - 13
T10.9	Recording and Data Processing System.....	TS - 10 - 14
T10.9.1	General	TS - 10 - 14
T10.9.2	Requirement.....	TS - 10 - 14
T10.9.3	Measurement and payment.....	TS - 10 - 15
CHAPTER T11	SPILLWAY STEEL BRIDGE	TS - 11 - 1
T11.1	Scope of Works.....	TS - 11 - 1
T11.2	Applicable Standard.....	TS - 11 - 1
T11.3	Materials.....	TS - 11 - 1
T11.3.1	General.....	TS - 11 - 1
T11.3.2	Steel for general use.....	TS - 11 - 2
T11.3.3	Bolt and nut.....	TS - 11 - 2
T11.3.4	Stud	TS - 11 - 2
T11.3.5	Welding roxls.....	TS - 11 - 2
T11.3.6	Storing of material	TS - 11 - 2
T11.4	Fabrication	TS - 11 - 2
T11.5	Welding	TS - 11 - 4
T11.6	Shop Assembling.....	TS - 11 - 4

	T11.6.1	General.....	TS - 11 - 4
	T11.6.2	Accuracy of shop assembling.....	TS - 11 - 4
T11.7		Painting.....	TS - 11 - 4
	T11.7.1	Condition for painting.....	TS - 11 - 4
	T11.7.2	Rust removing and cleaning.....	TS - 11 - 4
	T11.7.3	Painting	TS - 11 - 5
	T11.7.4	Memorial record for painting	TS - 11 - 5
T11.8		Packing and Transportation.....	TS - 11 - 5
T11.9		Erection of Steel Structure	TS - 11 - 5
	T11.9.1	General.....	TS - 11 - 5
	T11.9.2	Erection	TS - 11 - 6
	T11.9.3	Field welding.....	TS - 11 - 9
	T11.9.4	Setting of bearings.....	TS - 11 - 9
	T11.9.5	Field painting	TS - 11 - 9
	T11.9.6	Removal of falsework or staging.....	TS - 11 - 10
T11.10		Incidental Facilities.....	TS - 11 - 10
	T11.10.1	Bearing shoe	TS - 11 - 10
	T11.10.2	Expansion joint.....	TS - 11 - 10
	T11.10.3	Drainage facilities.....	TS - 11 - 10
T11.11		Construction.....	TS - 11 - 10
	T11.11.1	Bearing shoes	TS - 11 - 10
	T11.11.2	Expansion joint.....	TS - 11 - 11
	T11.11.3	Drainage facilities.....	TS - 11 - 11
	T11.11.4	Measurement and payment.....	TS - 11 - 11
T11.12		Concrete Work for Slab.....	TS - 11 - 12
	T11.12.1	General	TS - 11 - 12
	T11.12.2	Classification of concrete and concrete mix proportion	TS - 11 - 12
	T11.12.3	Measurement and payment.....	TS - 11 - 12

TECHNICAL SPECIFICATIONS

CHAPTER T1 DEWATERING, CONSTRUCTION OF COFFERDAMS AND RIVER DIVERSION

T1.1 General

The work specified in this CHAPTER consists of:

- Dewatering during construction
- Construction of cofferdams
- River diversion
- Removal of cofferings and facilities for care of water

The work shall include the design and construction of these mentioned above including furnishing, operation, maintenance and relocation required for the performance of the Works.

The work not covered in this CHAPTER shall be performed in accordance with the various provisions of the Specifications.

The Contractor shall be responsible for maintenance of these facilities until completion of the respective Works or section of the Works and subsequent removal.

The scheme of diversion and care of water during construction including dewatering is shown on the Drawings for reference. Before starting the construction work in a river channel, the streamflow shall be diverted. The Contractor shall perform all of the operation works for diversion and care of water as herein specified and as required in the Drawings.

Prior to beginning any work under these Specifications on the diversion of the Terre Rouge river and care of water, the Contractor shall submit to the PMO/Engineer for approval of a water control plan showing his proposed method for the diversion and care of water during construction.

The Contractor's plan for the works shall include, but shall not be limited to, the following:

- 1) Description of method including layout of the dewatering system for cofferdam, excavation areas, and other parts of the work.
- 2) Details including capacity of the dewatering equipment

- 3) Description including supporting data of any proposed modifications to the diversion scheme shown on the Drawings. The Contractor shall be required to design the proposed modification if it is accepted by the PMO/Engineer.
- 4) Description of method of flood protection
- 5) Scheduled dates of all significant steps in the Contractor's operations that are not shown on the approved construction schedule

The plan may be placed in operation upon approval, but nothing in this Clause shall relieve the Contractor from full responsibility for the adequacy of the diversion and protective works. The hydrographs of the Terre Rouge river and calculated discharge curves for the diversion tunnel shown on the Drawings are solely for an information of the Contractor in timing his construction operations to prepare for such flood storage and/or to bypass such flows as may be necessary. The PMO/Engineer will not be responsible for any deductions, conclusions on interpretation which may be made by the Contractor from these data.

T1.2 Dewatering during Construction

T1.2.1 General

The Contractor shall design the complete dewatering system in open-air and underground construction sites required for all construction sites in such a way that water coming from any source can be drained.

Dewatering system in open-air construction sites will consist of construction of dikes, ditches, channels, trenches, sump pits and/or pump stations, installation of water pump, drainage pipe lines and electric-power supply line and/or providing protective measures against erosion due to seepage water and precipitation.

Dewatering system in underground construction sites will consist of dikes, ditches and sump pits, installing water pump, pipe lines and power supply lines and providing protective measures against erosion caused by seepage water.

The Contractor shall submit his plan of the dewatering systems for each construction site to the PMO/Engineer for approval, at least thirty (30) days prior to commencement of the work in respective site. The plan shall be operated under full responsibility of the Contractor after the approval of the PMO/Engineer.

General design drawings and working procedures with explanatory reports shall be submitted to the PMO/Engineer for his approval prior to commencement of any work under this CHAPTER. These shall show quantity, type, capacity, arrangement, location, etc. of the required system and shall be subject to the approval of the PMO/Engineer.

The Contractor shall supply all the labour, materials, equipment and installations for the dewatering system required for the performance of the Works.

The Contractor shall maintain ready-for-service and cleaning of all the dewatering systems during construction period of the pertinent structures. After the dewatering systems have served their purpose, they shall be removed upon the approval of the PMO/Engineer in such a manner that will have a slight appearance and will not interfere with the operation or usefulness of the Works. If any damage to the Works arises from improper removal of the dewatering system, removal or disposal of the structures including incidental repairs and adjustments shall be made by the Contractor at his own expense.

In order to be able to continue water drainage in the event of power failure, diesel driven emergency units shall be made available.

The Contractor shall be responsible for and shall repair at his own expense any damage to the Works caused by water, flood or failure of the dewatering.

T1.2.2 Measurement and payment

No separate payment will be made for the work under this CHAPTER. The cost of the dewatering system shall be included in the unit prices stated in the Bill of Quantities to which the work is incidental.

T1.3 Construction of Cofferdams

T1.3.1 Cofferdam constituting main dam

The Contractor shall construct the upstream main cofferdam which shall constitute the main dam. The cofferdam shall be constructed to the lines, grades and dimensions as shown on the Drawings, provided that the division lines between the various zones shall be subject to variation at any time prior to or during construction and the Contractor shall be entitled to no additional payment to the

unit prices tendered therefore in the Bill of Quantities by reason of such variation. Construction works for the cofferdam shall be executed in accordance with the provisions of the Technical Specifications.

T1.3.2 Cofferdam as temporary facilities

The Contractor shall construct and maintain the primary upstream cofferdam as shown on the Drawings and/or other cofferdams, if necessary, for diverting streamflow in the Terre Rouge river or other works as approved by the PMO/Engineer. These cofferdams will be constructed with dumped random materials without regular compaction as specified in the Technical Specifications.

The shape and dimensions of these cofferdams as shown on the Drawings give solely a suggested scheme. The Contractor shall be responsible for the adequacy of arrangements for construction and maintenance of the cofferdams during the construction of the Works. For the purpose of coffering, the Contractor shall be required to propose his scheme of cofferdams with his construction program to be submitted.

T1.3.3 Measurement and payment

(1) Main cofferdam

Measurement and payment for main cofferdam shall be made at the respective Contract unit prices stated in the Bill of Quantities in accordance with the requirement prescribed in the appropriate provisions of the Technical Specifications.

(2) Primary upstream cofferdam

Measurement and payment for primary upstream cofferdam shall be made at the Contract lump sum stated in the Bill of Quantities in accordance with the requirement prescribed in the appropriate provisions of the Technical specifications.

(3) Other temporary cofferdams

No separate payment shall be made for the work of other temporary cofferdams. The rest of other temporary cofferdams shall be included in the Contract lump sums or Contract unit prices stated in the Bill of Quantities to which the work is incidental.

T1.4 River Diversion

T1.4.1 Diversion scheme

The Contractor shall execute river diversion together with construction of cofferdams at upstream of the main dam and execute the closure of the diversion tunnel.

The diversion scheme shown on the Drawings and descriptions in this Specifications give only tentative one.

The Contractor shall prepare construction program of coffering including design of cofferdams, construction method and time schedule thereof and shall submit them to the PMO/Engineer for his approval.

The Contractor shall prepare the design drawings and programme under the following conditions, but not limited to.

(1) Design of cofferdams

- Design flood runoff : 520 m³/s (20 years)
- Diversion tunnel : 6.8 m in diameter as shown on the Drawings
- Upstream main cofferdam crest elevation : EL. 155.5 m
- Length of tunnel : 499 m
- Inlet invert level : EL. 129.00 m
- Outlet invert level : EL. 125.00 m
- Slope of tunnel : 1/123

(2) Maintenance and closing operation of diversion tunnel gate

In order to close the diversion tunnel, one set of steel diversion tunnel gate, guide frames and hoist tower as shown on the Drawings has been manufactured, supplied and installed by the contractor for the Contract of Lot-I. The Contractor shall maintain these facilities at the Site until the closure of diversion tunnel and shall close such gate in accordance with the work manual prepared by the Contractor.

The work manual prepared by other contractor will be handed over to the Contractor by the PMO/Engineer after completion of diversion tunnel gate installation. The work manual will consist of inspection records with respect to the installed guide frame, gate leaf and hoist

tower, and details of proposed method of closure operation and maintenance of the gate. The Contractor shall prepare their independent gate closure manual and maintenance manual on the basis of such work manual and submit to the PMO/Engineer for his approval.

The diversion gate has been designed under the condition of the reservoir water level at EL. 162.999m on month after closing gate estimated in the conditions of 0.7 m³/sec inflow into the reservoir in October.

A steel structure will have been provided on the concrete slab of the diversion tunnel inlet for assembling the gate leaf and for closing operation of the diversion gate.

The allowable stresses for the diversion gate are applied 1.5 times the allowable stresses for the intake gate which are permanent facilities since the diversion gate is temporary gate of one time use.

The Contractor shall provide all necessary labour materials, equipment, electricity, fuel water, stores and apparatus as may be reasonably demanded to carry out such work efficiently

The designing, manufacturing, suppling, testing ,finishing, painting, packing for export, insuring, shipping, delivering inland transportation and installation of the gate guide frame and hoist tower will be made by the Contract of Lot-I in accordance with the Specifications given as Appendix to Technical Specifications "DIVERSION GATE AND HOIST TOWER."

(3) Construction programme

- 1) Prior to diverting the stream through the diversion tunnel, the Contractor shall check the diversion tunnel to be provided with required appurtenant structures and facilities for the closing gate at the inlet of the diversion tunnel.
- 2) River diversion shall be accomplished within two (2) months after receipt of the Order to Commence the Works.
- 3) The embankment of main dam shall be commenced from the beginning of the ninth (9th) month since the start of the Works.
- 4) The time of closure of the diversion tunnel shall be completed within the twenty seventh (27th) month since the start of the Works.

T1.4.2 Measurement and payment

Payment for maintenance and closure of the diversion tunnel gate will be made one hundred (100) per cent upon substantial completion of the closure of the diversion tunnel gate at the Contract lump sum price stated in the Bill of Quantities, which unit price shall constitute full compensation for the

rest of all labour, tools, equipment and material including constructing, maintaining and other items necessary to complete the work.

T1.5 Removal of Cofferings and Facilities for Care of Water

The Contractor shall remove all temporary cofferings and facilities for care of water, except otherwise as directed by the PMO/Engineer, after they have served their purpose at the time approved by the PMO/Engineer. Removal shall be made so as not to interfere with the operation or requirement of neighboring permanent structures and not to injure the sightly appearance. If any damage is caused in the surrounding, the Contractor shall repair them at his own cost as approved by the PMO/Engineer.

The waste shall be disposed in the area as approved by the PMO/Engineer.

No separate payment shall be made for the removals. The cost for the removal shall be included in the Contract unit prices stated in the Bill of Quantities to which the work is incidental.