Ministério de Minas e Energia
Brasília-DF - Brazil

Rio Madeira Project

Costs Review and Economic Analysis

Final Report

COLENCO
Colenco Power Engineering Ltd

March 2007

Table of Contents

1 Conclusions and Recommendations

1.1 General

In general, the basic data and the investigations carried out by Furnas – Odebrecht are deemed adequate for supporting a design level even more advanced than the feasibility stage. The proposed design is supported by comprehensive field investigations and desk studies and analyses.

Technical risks which could affect the feasibility of the project are deemed relatively limited, given the characteristics of the site, the predictability of the hydrological behaviour of the river and the good knowledge of the geological – geotechnical conditions achieved. As in any hydroelectric project, there are of course risks of quantity overruns or minor geological unforeseen: it is deemed however that such "normal" risks have already been taken into account at cost estimate level by establishing suitable technical contingencies.

1.2 Main Technical Issues

The main technical open points identified are the following:

- Unprecedented characteristics of the generating units: bulb units of the size proposed are probably at the limit of the present state of the art and their design will require very careful studies. In particular, the very large head variations expected may require adopting a different design for some of the units, to cover as best as possible the full range of operating conditions expected.
- The large amounts of sediments and debris dragged by the river will require in depth studies and possibly layout modifications to minimise their impact on the operation of the plant.
- The characteristics of the long transmission system associated to the Santo Antonio and to the planned upstream Jirau plants must be studied in depth, to assure the stability of the operation and to establish which protection equipment if any shall be foreseen at the plants.

In order to control and possibly eliminate these risks it is necessary to carry out further analyses and design studies, before proceeding to the construction stage.

1.3 Implementation Cost Estimates

1.3.1 Furnas / Odebrecht Solution

The cost estimates carried out by Colenco for the Furnas / Odebrecht Solution are summarised as follows:

Table 1.1 - Furnas / Odebrecht Solution – Cost Estimate

	Colenco Estimate			Original Est.
	Local Portion (Million Reais)	Foreign P. (Million USD)	Total (M.USD Eq.)	Total (M. USD Eq.)
Civil Works				
Itemised Quantities	4'597.6	176.9	2'366.2	
Technical Contingencies	367.8	14.2	189.3	
Civil Works, Total	4'965.4	191.0	2'555.5	2'792.4

	Colenco Estimate			Original Est.
	Local Portion (Million Reais)	Foreign P. (Million USD)	Total (M.USD Eq.)	Total (M. USD Eq.)
Hydromechanical Equipment				
Components Identified	599.2		285.3	
Technical Contingencies	30.0		14.3	
Hydromechanical Equipment, Total	629.2		299.6	294.2
Electromechanical Equipment				
Components Identified	1'838.5	300.3	1'175.8	
Technical Contingencies	91.9	15.0	58.8	
Electromechanical Equipment, Total	1'930.4	315.3	1'234.5	1'327.9
Total Construction Cost	**7'524.9**	**506.3**	**4'089.6**	**4'414.5**
Other Costs at EPC Contractor Level				
EPC Contractor Engineering Costs	163.2	4.1	81.8	
Risks of non recoverable liquidated damages	404.6	26.9	219.5	
Estimated EPC Price, Excl. Price Escalation	**8'092.7**	**537.3**	**4'391.0**	
Additional Costs at Developer Level				
Social and Environmental Costs	310.3	0	147.8	240.5
Developer's Engineering Costs	118.1	14.3	70.5	
Developer legal and administration costs	175.2	4.4	87.8	
Contingencies at Developer level	434.8	27.8	234. 9	
Total Project Implementation Cost, Excl. Price Escalation	**9'131.2**	**583.7**	**4'931.9**	5'468.1
Price Escalation Impact	1'433.2	71.1	753.6	
Total Cost Including Price Escalation	**10'564.3**	**654.8**	**5'685.5**	

1.3.2 Alternative Layouts

Different layouts have been proposed, one in the Chapter 3 of the present report (Alternative 1), another in the report of the sedimentation expert Mr. Sultan Alam (Alternative 2. The cost estimates for these two alternatives are given in the following Tables 1.2 and 1.3.

Table 1.2 - Cost Estimate – Alternative 1

	Colenco Estimate		
	Local Portion (Million Reais)	Foreign P. (Million USD)	Total (M.USD Eq.)
Civil Works			
Itemised Quantities	3'736.1	111.0	1'890.0
Technical Contingencies	364.3	10.8	184.3
Civil Works, Total	4'100.4	121.8	2'074.4
Hydromechanical Equipment			
Components Identified	599.2		285.3
Technical Contingencies	30.0		14.3
Hydromechanical Equipment, Total	629.2		299.6
Electromechanical Equipment			
Components Identified	1'838.5	300.3	1'175.8
Technical Contingencies	91.9	15.0	58.8
Electromechanical Equipment, Total	1'930.4	315.3	1'234.5
Total Construction Cost	**6'660.0**	**437.1**	**3'608.5**
Other Costs at EPC Contractor Level			
EPC Contractor Engineering Costs	144.0	3.6	72.2
Risks of non recoverable liquidated damages	358.1	23.2	193.7
Est. EPC Price, Excl. Price Escalation	**7'162.0**	**463.9**	**3'874.4**
Additional Costs at Developer Level			
Social and Environmental Costs	310.3	0	147.8
Developer's Engineering Costs	109.1	12.6	64.6
Developer legal and administration	154.6	3.9	77.5

	Colenco Estimate		
	Local Portion (Million Reais)	Foreign P. (Million USD)	Total (M.USD Eq.)
costs			
Contingencies at Developer level	386.8	24.0	208.2
Total Project Implementation Cost, Excl. Price Escalation	**8'122.9**	**504.4**	**4'372.4**
Price Escalation Impact	1'306.6	64.3	686.5
Total Cost Including Price Escalation	**9'429.5**	**568.7**	**5'058.9**

Table 1.3 - Cost Estimate – Alternative 2

	Colenco Estimate		
	Local Portion (Million Reais)	Foreign P. (Million USD)	Total (M.USD Eq.)
Civil Works			
Itemised Quantities	3'473.9	101.1	1'755.3
Technical Contingencies	364.8	10.6	184.3
Civil Works, Total	3'838.6	111.7	1'939.6
Hydromechanical Equipment			
Components Identified	584.5		278.4
Technical Contingencies	29.2		13.9
Hydromechanical Equipment, Total	613.8		292.3
Electromechanical Equipment			
Components Identified	1'838.5	300.3	1'175.8
Technical Contingencies	91.9	15.0	58.8
Electromechanical Equipment, Total	1'930.4	315.3	1'234.5
Total Construction Cost	**6'382.8**	**427.0**	**3'466.4**
Other Costs at EPC Contractor Level			
EPC Contractor Engineering Costs	138.3	3.5	69.3
Risks of non recoverable liquidated damages	343.2	22.7	186.1
Est. EPC Price, Excl. Price Escalation	**6'864.3**	**453.1**	**3'721.8**
Additional Costs at Developer Level			
Social and Environmental Costs	310.3	0	147.8
Developer's Engineering Costs	106.5	12.1	62.8
Developer legal and administration costs	148.5	3.7	74.4
Contingencies at Developer level	371.5	23.4	200.3
Total Project Implementation Cost, Excl. Price Escalation	**7'801.1**	**492.4**	**4'207.2**
Price Escalation Impact	1'267.3	62.9	666.4
Total Cost Including Price Escalation	**9'068.4**	**555.3**	**4'873.5**

1.4 Operation and Maintenance Costs

The operation and maintenance costs for the complete plant (44 units in operation) at end 2006 unit price level are estimated in the order of 81.9 million USD per year. As for the splitting between foreign and local currency, it has been considered that 95% of the O&M costs will be in local currency, with 5% only in foreign currency. O&M costs are deemed the same for all project layouts considered.

1.5 Risks

In addition to the unresolved technical issues mentioned in the Paragraph 1.2 above, other significant technical risks relate to the possibility to meet the short implementation schedule presently foreseen. Two main risks can be identified in this respect:

- The river diversion through the spillway must be carried out in the dry season, toward the end of the overall construction period. Thus, if a delay of even few months only accumulates along the construction, there is a significant risk to lose one full year before the first units can be commissioned.
- It may not be feasible to commission the units at the one month interval presently considered, both because of restriction in the manufacturing capacity of the suppliers and because of limitations in the availability of erection facilities and of qualified personnel.

From environmental point of view, despite the favourable characteristics of the project the risk remains that deficiencies in the communication / information process, or delays in implementing the necessary mitigation measure, will trigger legal actions by the affected population and NGO, which in turn can disrupt the project implementation planning and schedule.

The main financial risks to be considered include:

- The cost estimates developed so far might still prove to be on the low side, or simply a monopoly situation may induce the developer, the EPC Contractor or the equipment manufacturers to unduly increase their prices.
- Although the hydrological behaviour of the Madeira River is quite favourable, with limited fluctuations in the annual runoff, a sequence of dry years at the beginning of the operation could have important consequences on the capacity of the project to repay the loans, unless some kind of minimum payment guarantees are established in the tariffs agreement.
- The financing requirements are huge and will most probably require the intervention of different financing institutions at the internal and international levels. The interest rates considered in the cash flow analysis might result low, especially in case most of the financing comes from commercial banks.
- Should most of the financing came from international banks and be denominated in USD or Euro, in case payments to the developer are mostly made in Reais there will be an important exchange rate risk, which in our opinion should be partially transferred to the Government, by establishing suitable clauses in the tariffs agreement.

1.6 Financial Considerations

A tentative cash flow has been first worked out for the Furnas /Odebrecht Solution, to assess the financial conditions under which the project could be financially feasible. The following hypotheses have been considered:

- Total period of the analysis 50 years.
- Energy production remunerated at 55 USD/MWh, constant along the full period analysed.
- Equities are assumed to cover 30% of the implementation costs, both for the local and for the foreign portions. Equities are the first source of funds used.
- Loans cover the remaining financial requirements. Interest rates assumed are 20% for the local currency, and 12% for the foreign currency loans. Interests due during the disbursement period are added to the loans capital.
- Loans repayment starts when energy sales revenues exceed the implementation costs still being faced. Equities payment (interests and capital)

for the local and foreign currency portions starts only after all corresponding loans have been fully repaid.

With these assumptions, the return on equities for the Furnas / Odebrecht Solution is about 24.7%. The model developed shows that with the costs and financial parameters considered the project will not be able to remunerate the equities at a higher interest rate.

For the two alternatives analysed, the same process was repeated to find the tariffs required to achieve the same return on equities. Results were:

- Alternative 1: Required Tariff 49 $/MWh (89.1% of the Furnas /Odebrecht Solution);
- Alternative 2: Required Tariff 47.5 $/MWh (86.4% of the Furnas /Odebrecht Solution)

Provided the implementation schedule remains essentially the same, it can be concluded that the tariff reductions which can be achieved by an alternative arrangement will essentially match the differences in the implementation costs.

Sensitivity analyses were carried out for the Furnas / Odebrecht Solution to assess the financial feasibility of the project under different worse case scenarios. In all cases, it was assumed that a minimum 24.7% interest on the equities will be required, as obtained in the basic analysis. The analysis determined the tariff needed to achieve this minimum interest. Case analysed and results achieved are as follows:

- 10% increase of the implementation cost: 61 $/MWh (110.9% of the Base Case)
- One year longer construction period: 67 $/MWh (121.8% of the Base Case)
- Two months interval in the commissioning of the units: 62 $/MWh (112.7% of the Base Case)
- Higher interest rates of the financing: rates assumed are 25% on Local Currency and 15% on Foreign Currency. Tariff required 58 $/MWh (105.5% of the Base Case).

This analysis indicates that the most critical issue for the financial feasibility of the project will be actually achieving the intended schedule for the initial commissioning of the first units. This appears more important than some limited increase of the implementation costs, or a slower pace for the installation of the units. A moderate increase of the interest rates of the loans seems to have the least impact on the financial feasibility.

1.7 Recommendations

It is considered that carrying out an auction at the present stage, before further in depth studies of the critical technical aspects identified, carries the risk of failure, as any bidder, other than the Furnas / Odebrecht group, may deem the project not sufficiently studied to take the huge financial commitments required. It is recommended to carry out first all necessary additional studies, to properly advertise the project at international level, and to allow to the bidders ample time to study the project and prepare their proposal.

It shall be taken into account that achieving the financial closure for the project will take time: one year from the first approach of a prospective developer to potential financing institutions is not an unreasonably long estimate.

From this point of view, the target to start actual construction by the middle of 2007 is deemed unrealistic.

2 Introduction

2.1 Authority

The present report is prepared according to the scope of work of Colenco's activities, as foreseen in the contract with the Ministry of Mines and Energy (MME) signed on November 21, 2006, and in the Addendum No.1 to the same contract.

2.2 Purpose and Scope

Taking into account the impact that a project like Rio Madeira may have on the operation of the power system and on the economy of the power sector, the Brazilian Government has the obvious interest to achieve an auction process according to the Brazilian Law as open and transparent as possible, and for this purpose has contracted Colenco, an international consultant not involved in previous stages of the studies and not linked to independent power producers, to carry out an independent review of the costs and key risk factors of the project. The general purpose and the scope of work of Colenco's services are given in the Annex A of Colenco's contract, as amended according the Addendum No.1.

As foreseen in the scope of work of the original Colenco's proposal and confirmed by the MME, the analysis of Colenco has been limited to the structures of the Santo Antonio Plant proper, excluding the navigation facilities, which are assumed to be implemented later, and the long distance transmission lines which shall connect the plant to the national transmission grid.

In addition to developing independent cost estimates for the civil structures and the equipment of the plant according to the layout proposed by Furnas / odebrecht, Colenco analysed the main aspects of the design and of the construction planning, with the principal purpose to identify risk factors and issues which might significantly impact on the costs and overall feasibility of the project, if possible proposing improvements which could enhance the attractiveness of the projects to potential investors and to the Government.

Furthermore, as required in the Addendum No.1 of the Contract, Colenco has developed preliminary cost estimates for two alternative layouts of the project:

- The alternative proposed by Colenco itself in the following Chapter 3, hereinafter identified as Alternative 1;
- The arrangement proposed by the sedimentation expert, Mr. Sultan Alam, hereinafter identified as Alternative 2.

While the technical features of the project have been reviewed in some depth, the associated environmental and social aspects have been appraised only to the extent necessary to assess if there could be critical issues, which may represent a serious risk for the project, potentially jeopardising its feasibility or its implementation schedule. Costs associated with land acquisition, resettlement, environmental and social monitoring and impact mitigation measures have not been assessed in detail.

2.3 Documents Analysed

2.3.1 Studies by Furnas / Odebrecht

Documents made available and reviewed by Colenco included the Final Report of the Feasibility Studies of the Santo Antonio Hydroelectric Plant, Revision 1, dated March 2006. The report (fully in Portuguese) includes two volumes of text and a volume of project drawings. The content of the report covers the following subjects:

- Presentation
- Introduction
- Summary and Conclusions
- Previous Studies
- Preliminary (Pre-Feasibility) Studies
- Surveys Carried Out
  - Cartography
  - Hydrometrics
  - Geology-Geotechnics
  - Environmental Surveys
  - Concrete Technology
- Hydrometeorological and Phisiographical Studies
- Geological and Geotechnical Studies
- Environmental Studies
- Power Market Studies
- Transmission System Associated to the Jirau and Santo Antonio Hydroelectric Plants
- Power Economy Studies
- Layout Alternatives
- Final Studies
  - General Description of the Layout
  - Reservoir
  - Construction Stages and River Diversion
  - Civil Works
  - Electrical Equipment
  - Main Mechanical Equipment
  - Cost Estimate
  - Physical Construction Program
  - Semi-annual Disbursement Schedule
- Technical and Economical evaluation of the project
- Multipurpose Development, Navigation, Regional Development

It is known that there are at least two appendices to the Feasibility Report, which however were not made available to Colenco, with the exception of an addendum to the Appendix B – Geological and Geotechnical Studies.

The documentation available at the MME included also an impressive set of environmental studies and reports, which however were not reviewed in detail by Colenco.

2.3.2 Documents Prepared by the Sedimentation Expert, Mr. Sultan Alam

This documentation was made available to Colenco in January 2007. The documents received include:

- Hydraulic and Sediment Management Studies - Draft Report, dated January 2007, including various appendices related to sediment transport, which were not reviewed in detail by Colenco;
- The document “Rio Madeira Hydro Project - Review of Hydraulic and Sediment Management - Feasibility Reports” prepared my Mr. Sultan Alam for a presentation made in January 2007 to MME officials.

2.4 Development of the Activities

The Project Coordinator and the Cost Specialist travelled to Brazil on November 13, 2006, starting the activities in the MME on the following day.

Mr. Hermod Brekke, consultant of the Ministry and Hydraulic Machinery Specialist, in charge of the review of the proposed design of the turbines, joined the Colenco’s team on November 16, 2006.

A meeting with senior officers of the Ministry and the representative of the World Bank, Mr. Enrique Crousillat, was carried out on November 17, 2006.

The Project Coordinator and the Cost Specialist remained in Brazil until December 1, 2006, reviewing the project features and collecting the basic data required for the unit price analyses of the civil works. Some of these basic data were made available during the stay in Brazil, other were received later on, in December.

Further meetings with senior officers of the Ministry and representatives of the World Bank were carried out in November 30 and December 1, 2006, to present and discuss the initial findings of the mission.

Clarifications were required to Furnas – Odebrecht on different technical aspects of the project in November 2006, the reply being received in January 2007.

The cost estimates of the civil works and of the hydro-mechanical and electromechanical equipment of the plant were developed in the Home Office of Colenco in December 2006 and early January 2007, and the initial draft of the present report was forwarded to MME on January 22, 2007.

Following a request by MME, Colenco submitted in February 2007 a proposal for developing the cost estimates of the Alternatives 1 and 2 mentioned above. Upon receiving the agreement of MME, the additional activities required were carried out in March 2007. The present Final Report is being submitted to MME on March 23, 2007.

Following the submission of the report, the Project Coordinator of Colenco has been invited to participate in a workshop on the Project, to be carried out in April 2007.

2.5 Acknowledgement

The Consultant wishes to thank the personnel of the MME for all courtesies and the precious assistance received during its stay in Brazil, and for the contributions made in the review of the project characteristics and in the collection of the basic data and reference information necessary for the cost estimate and the economic assessment of the project.

3 Technical Review and Comments

3.1 Basic Data and Investigations

In general, the basic data and the investigations carried out by Furnas / Odebrecht are deemed adequate for supporting a design level even more advanced than the feasibility stage. The proposed design is supported by comprehensive field investigations and desk studies and analyses. Few remarks on specific issued are given here below.

3.1.1 Cartography

The Feasibility Report of Furnas / Odebrecht indicates that maps at 1:10'000 scale were prepared during an early stage of the studies. These maps, attached to the Appendix A of the Feasibility Report, have not been made available to Colenco: the sheets F-1 to F-4 would have been especially useful to better study the logistics and organisation of the construction. It is recommended that such maps be made available to the companies / groups interested in the planned auction, to give them the possibility to seriously study the design and construction of the project.

3.1.2 Hydrology

There are no special comments about hydrology and meteorology, except for the following aspects (none of them directly related to hydrology):

- It is advisable to obtain as soon as possible data on river water temperature, to allow a reliable estimate of the concrete cooling requirements.[1]
- It will be necessary to carry out mineralogical analyses of the suspended sediments, as a necessary input data for the design of the turbines.[2]

3.1.3 Geology and Geotechnics

No special remarks shall be made about geology and geotechnics: the investigations carried out are comprehensive; for the next design stage, the Feasibility Report of Furnas / Odebrecht indicates the need for few additional investigations, deemed necessary to fully define the design of some minor structure. Given the characteristics of the rock (rather homogeneous granite) the foundation conditions are deemed generally good: the geological risk to be faced is limited.

3.1.4 Construction Materials

The main natural construction materials required are rockfill, transitions / filters and impervious material for the cofferdams and embankment dams, and concrete aggregates. Rockfill and transitions, as well as the coarse aggregates for concrete, will come from required excavations (with proper processing). Sand shall preferentially come from natural river deposits, because sand manufacturing from granite will be quite expensive.

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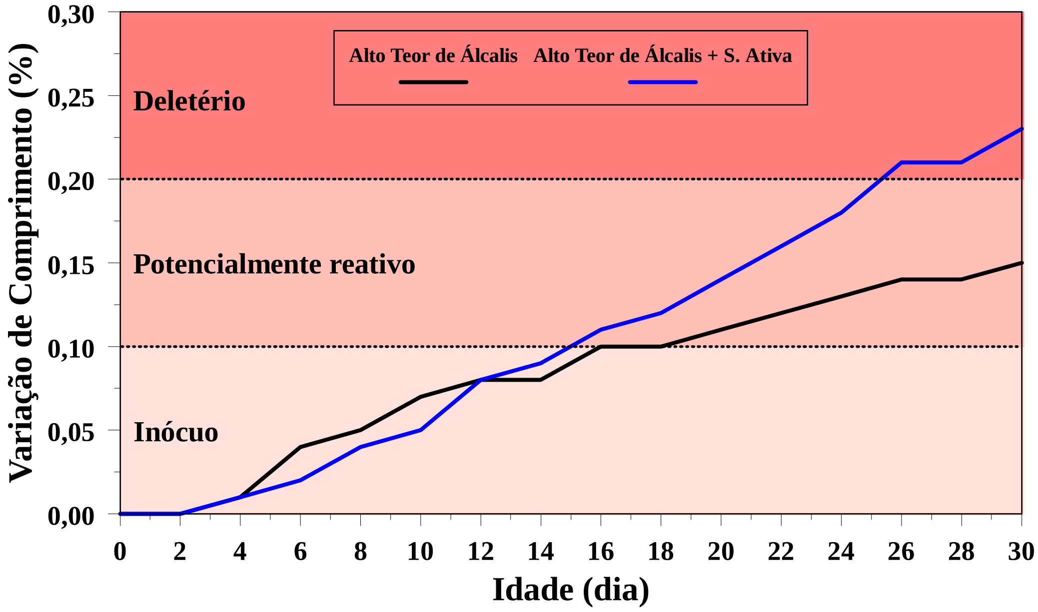
1 Information was received from Furnas / Odebrecht in January 2007 that the water temperature, as measured during sediment sampling, was between 26 and 30°C.

2 Information about sediment granulometric characteristics, concentrations and expected behaviour after construction of the plant are included in the report of Mr. Sultan Alam.

The tests carried out have indicated that according to ASTM C-1260/94 the aggregates manufactured from the granite of the site are on the borderline of potentially deleterious expansion due to the alkali aggregate reaction, being further tests advisable to check their acceptability (see the Figure 3.1, taken from Chapter 6 of the Feasibility Report of Furnas / Odebrecht).

Figura 3.1 - Potential Reativity of Aggregates



The tests carried out on concrete mixes have indicated somewhat high ratios cement quantities / concrete strength (see the Figures 3.2 and 3.3, also taken from Chapter 6 of the Feasibility Report).

Figure 3.2 – Cement Quantity versus Fck (28 days)
Blended Sand (Natural & Artificial) – Adding 8% of Active Silica

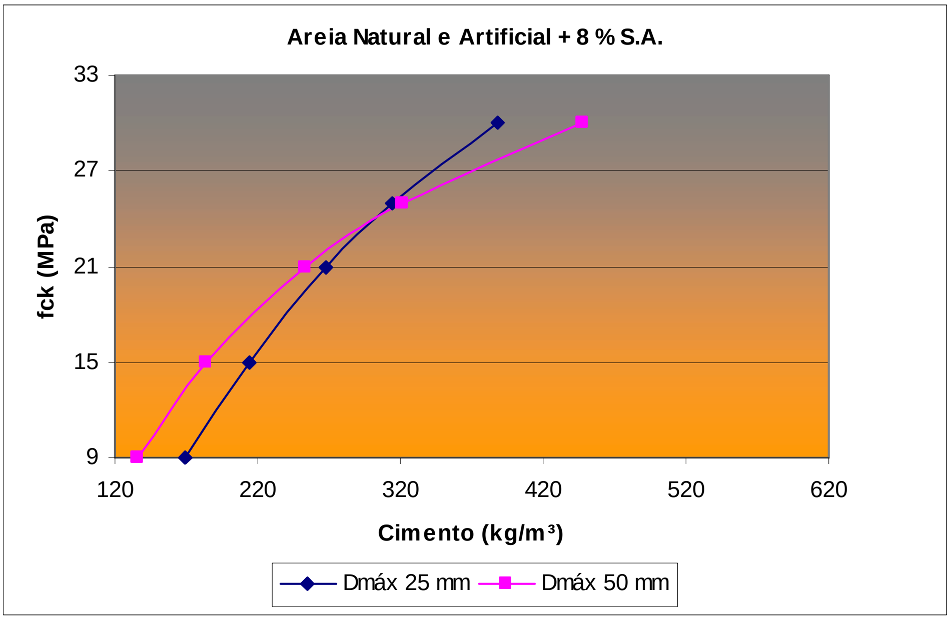
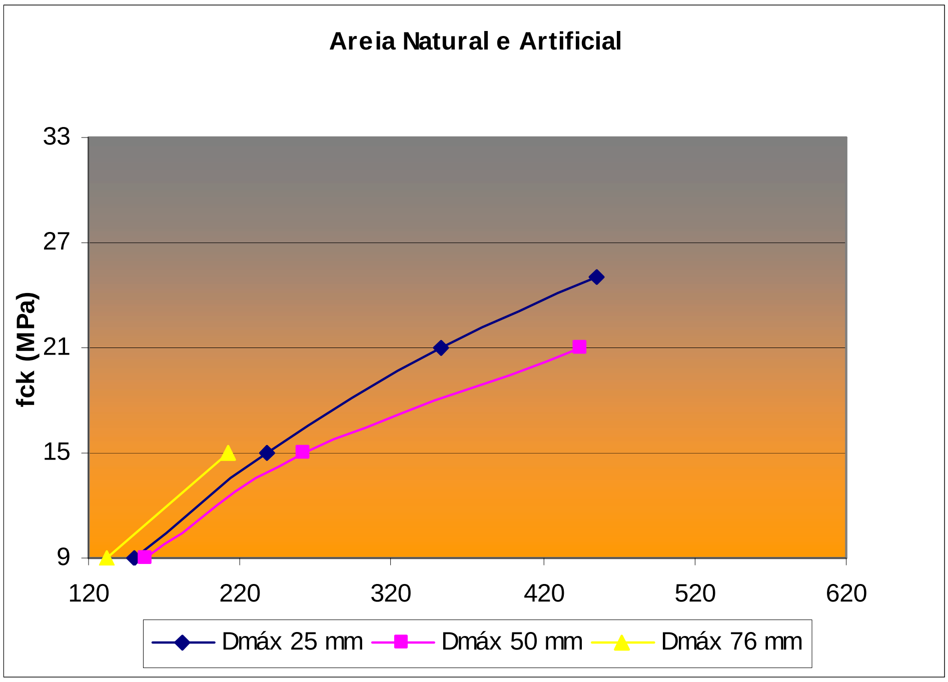


Figure 3.3 – Cement Quantity versus Fck (28 days)
Blended Sand (Natural & Artificial) – Without Active Silica



The effect of adding the active silica is significant.

3.2 General Arrangement and Civil Works

The general arrangement of the project is shown in the Figure 3.4, taken from one of the drawings attached to the Feasibility Report.

In general, the arrangement proposed by Furnas / Odebrecht concentrates all concrete structures on the abutments, with the idea to carry out most civil construction works under the protection of relatively low embankment cofferdams, without affecting the natural river flow. Only toward the end of the initial construction period the river is diverted through the spillway structure, in order to allow the construction of the main embankment dam. An important positive aspect of the proposed layout is the possibility to start the power generation as soon as the cofferdams across the river are completed, without waiting for the construction of the main embankment dam, and of installing the units in a continuous sequence, at intervals basically dictated by the production capacity of the manufacturers and the facilities foreseen for the erection work. On the other hand, locating the entire powerhouse on the left bank of the river implies very large common and rock excavations.

Figure 3.4 – General Arrangement Proposed in the Feasibility Study

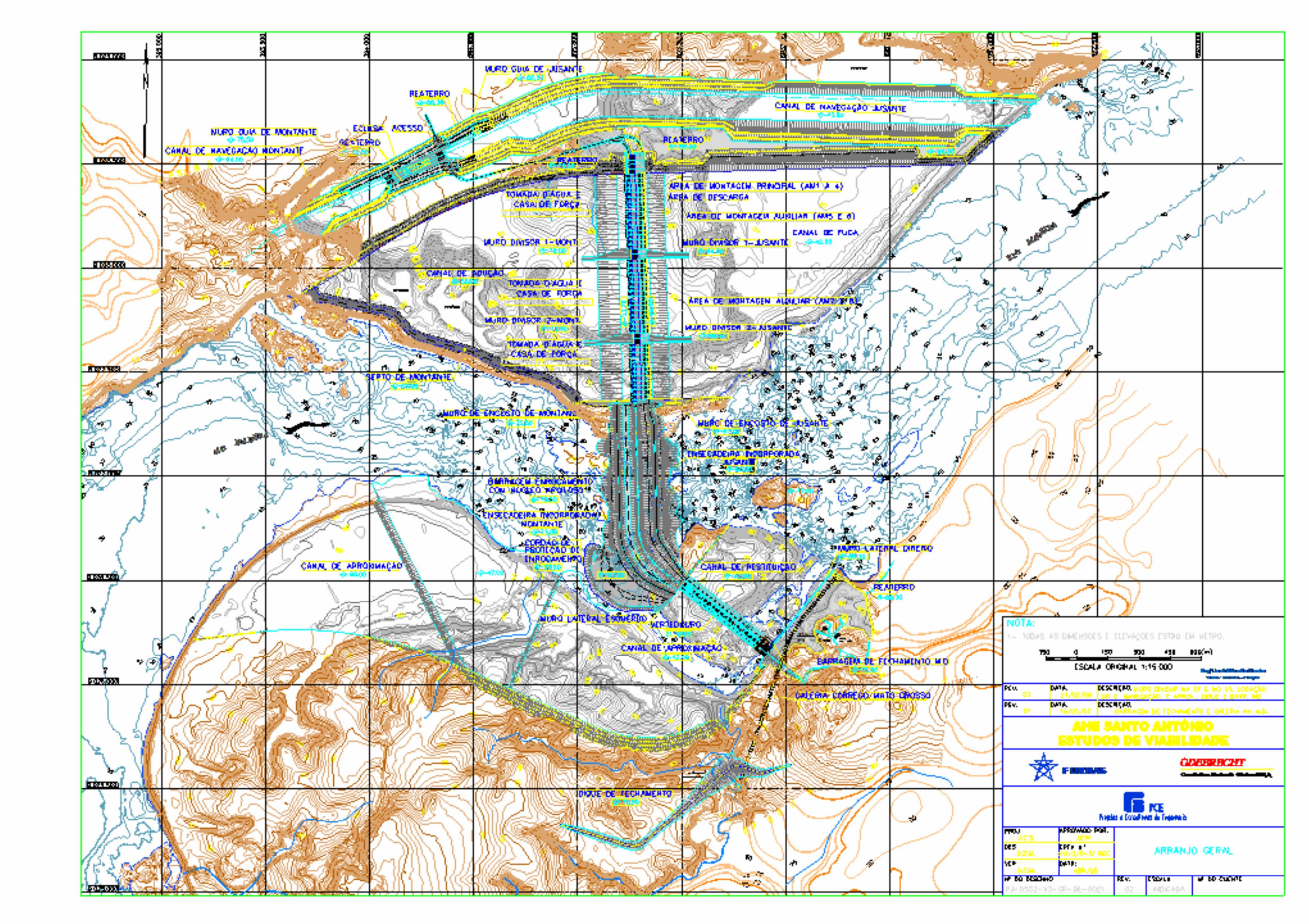
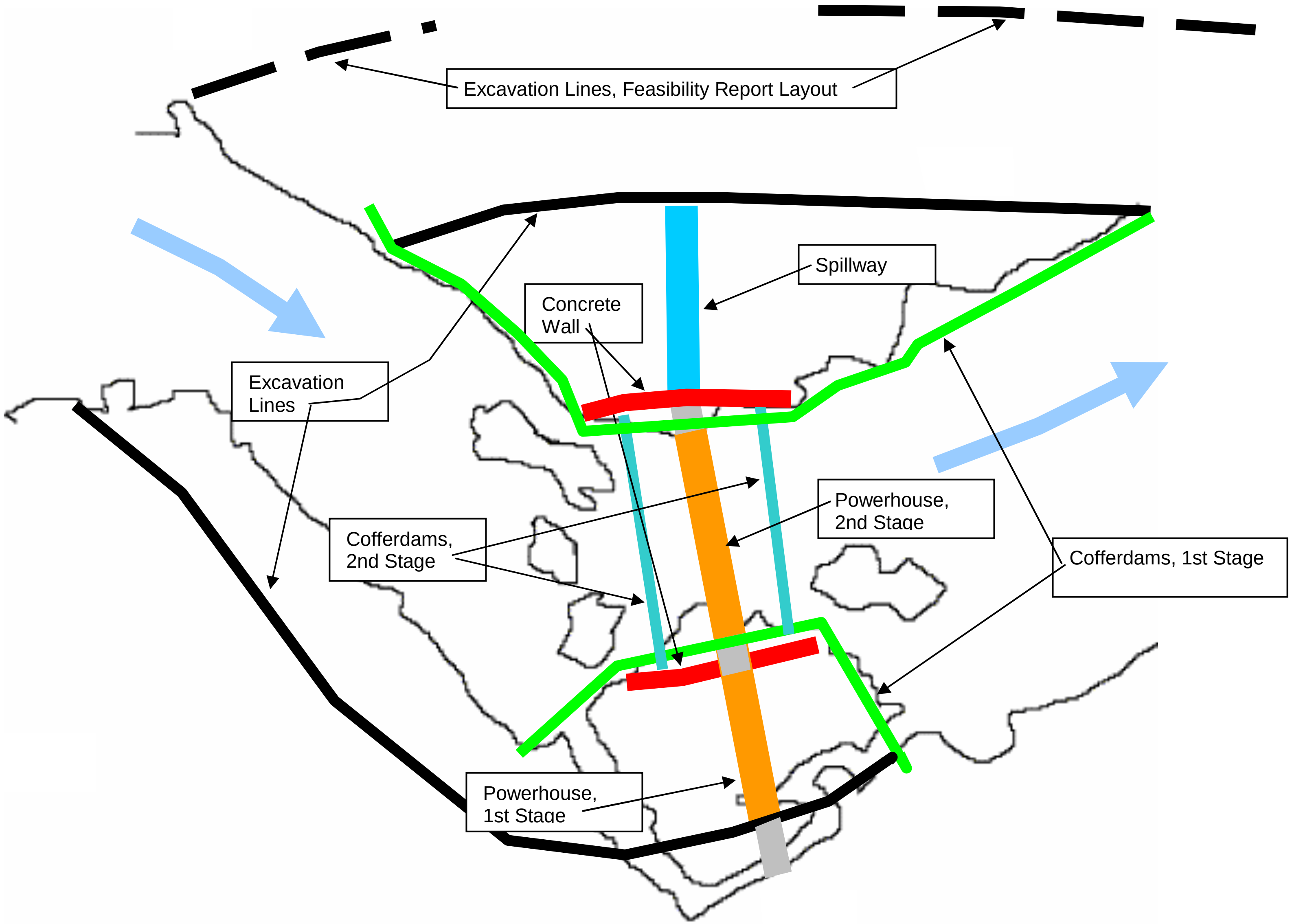


Figure 3.5 – Possible Alternative Arrangement



An alternative option could have been to locate the intake – powerhouse complex in the river bed and across the right side island, and the spillway on the opposite bank, as sketched in the Figure 3.5 (Alternative 1). This option would significantly reduce the space required on the left bank, with a consequent important reduction of the required excavations. Other advantages refer to an easier access for transporting the equipment to the powerhouse in the erection stage, and a more economic routing of the transmission lines to the future Porto Velho substations, avoiding the river crossing. We understand that a somewhat similar arrangement was considered in an early stage of the studies, and later discarded in favour of the proposed solution, although the rationale behind this decision is not clear to us, as the alternative arrangement studies illustrated in the Feasibility Report were limited to few conceptually similar alternatives.

A possible draw back of this alternative scheme could be a longer schedule for the commissioning of the units. The planning indicated in the Feasibility Study is to commission one unit per month in a continuous sequence, and this could not be achieved with the scheme of Figure 3.5:

- The portion of the powerhouse on the right bank island could be some 500 m long, housing 18 units and a first erection area.
- The structure in the river bed to accommodate the remaining 26 units (some 730-750 m long, including the other erection areas), shall be built in one go after the river is diverted, and shall be essentially complete before the cofferdams across the river can be demolished
- Because the construction of this structure is likely to require more than the 18 months assumed between the commissioning of the first and last units of the first stage powerhouse, a time gap of various months (perhaps 6-9 months) is likely to occur between the commissioning of the 18th and the 19th unit.

It shall be commented however that this disadvantage will exist only if the pace of units commissioning (one unit per month) can be kept: doubts about the possibility of achieving this ambitious goal are expressed in the following Paragraph 3.6.

Taking into account the considerations above, in order to develop a fair auction process and try to achieve the minimum possible energy price, we recommend:

- To establish in the documents of the auction and in the bid evaluation criteria reference time schedule requirements to be met: dates foreseen by the MME for the progressive commissioning of portions in the order of 10% of the total capacity of the plant.
- If deemed advisable, to include delay penalties and early commissioning bonus clauses.
- To leave maximum freedom to the bidders to propose technical solutions different from the one shown in the feasibility drawings.

3.3 Arrangement and Civil Design of Individual Structures

Following the comment above to the general arrangement of the project, the paragraphs below outline some comments to the arrangement and to the civil design of individual project structures proposed by Furnas / Odebrecht.

Taking into account the level of the design presently available, no comments to detailed features are presented, on the understanding that minor adjustments will come out automatically from the development of the construction design. Only those aspects are pointed out, which in our opinion have a potentially important impact on costs, time schedule and risks.

3.3.1 Auxiliary Cofferdams No. 1 to 7

These are the cofferdams protecting the work areas in the abutments during the first stage of the work, while the river keeps flowing in its natural bed.

In general, the return periods of the floods considered for the design of these cofferdams are somewhat on the high side (Table 14.3 of the Feasibility Report). On the other hand, the water level differences at the site between say the 50 and the 1000 years floods are no more than two meters. Therefore, considering the importance of the works and the limited additional costs involved, the conservative approach taken in the Feasibility Report is endorsed.

From geotechnical point of view, these cofferdams are all conceived with the same concept, which is a soil embankment few meters high, protected by transition and rip-rap layers on the water side. The geotechnical design of the embankments themselves is fully acceptable and does not deserve comments. It is noted that the cofferdam No. 6, protecting the tailrace channel excavations, is founded on soil and requires the construction of a plastic diaphragm to control seepage and piping: this might become a critical issue, especially for the most downstream area, where the cofferdam is founded on the soft material indicated as “pantano”, which might not be stable under strong hydraulic gradients.

At the end of the first stage of the work only a partial demolition of the auxiliary cofferdam No. 7, protecting the excavations of the headrace channel, is foreseen, lowering the crest of the embankment by 5 m.

This partial demolition is acceptable, in term of velocity over the crest of the remaining portion of the cofferdam during the operation of the powerhouse (maximum in the order of 2.5 m/s); instead, the idea to leave part of the dike to protect the headrace channel from siltation is deemed theoretical, as most probably in few years time the soil embankment will not exist anymore.

3.3.2 Auxiliary Cofferdams No. 8 to 11

These are the cofferdams required to complete the construction of the powerhouse (units 17 to 44), allowing at the same time the operation of the units 1 to 16. No special comments about these structures.

3.3.3 Spillway and Appurtenant Structures

While we have checked that the proposed design of the spillway is sufficient to discharge the 10’000 years flood (taking also into account the discharge reduction due to the high tailwater level), and thus we basically endorse the number and size of the gates, we have the following comments:

- In the next design stage a hydraulic model will be necessary.
- The Introduction of the Feasibility Report – Revision I, dated March 2006, indicates that the revision included “*the introduction of two transversal walls in*

the spillway, to make possible future maintenance works and the extension of the downstream concrete slab if necessary". Such walls are not shown in the drawings made available to Colenco, and are not included in the bill of quantities. We consider that such walls will be highly recommendable, precisely for the reasons stated in the sentence above. We note also that nothing is presently foreseen to protect the toe of the downstream cofferdam in the river bed against erosion, in case strong return currents develop. Although it is an issue to be studied in the hydraulic model, we believe that the risk of erosions is higher at the downstream side than at the upstream one, where extensive erosion protections have been foreseen.

- It seems to us that the rockfill protection for the portion in common material of the bottom of the approach channel is not necessary, as erosion by high velocity flow should have no consequences. Also, we recommend hydraulic model tests to determine the impact on the spillway behaviour of the platform to the left of the approach channel at elevation 57.60, built with common material dumped in water and protected with transition and rockfill.
- The transversal section of the spillway shows that the trunnion beams of the radial gates are lower than the maximum exceptional tailwater level, and not much higher that tailwater levels that will normally occur during the life of the plant in the flood seasons. It also shows that the elevation of the anchor point of the cylinders (elevation 67.6) is not sufficient to safely keep the lower lip of a fully open gate above the running water surface. Both these things are not acceptable and shall be corrected in the next design stage[3]. The rearrangement of the gate design might require moving upstream the slots of the maintenance stoplogs (a temporary upstream slot is already foreseen in ten bays) and consequently the upstream bridge also; however, the adjustments needed will not imply any significant increase of the cost of the gates or of the civil works,

3.3.4 Main Cofferdams and Embankment Dam Across the River

The typical sections shown in the drawing PJ-0532-V3-BA-DE-0002 shows the following weak points:

- While the distance is sufficient toward the abutments, at the centre of the river bed, where the rock is deeper, the centre lines of the two cofferdams are too close to the centre line of the embankment dam: the consequence is that the toes of the cofferdams, dumped under water, will easily cover the foundation of the core of the dam. It is recommended to adopt a curved plan alignment of the two cofferdams, to increase the distance in the centre of the river.
  From hydraulic point of view, increasing the distance between the two closure dikes is beneficial in the critical river diversion stage, as it facilitate splitting in two the total differential head to be faced. During construction of the embankment dam, this would also facilitate the installation of the pumps needed to keep in dry the area.
- We cannot understand the purpose of the platform at elevation 57.60 to the left of the spillway approach channel, built with common material dumped in water and protected with transition and rockfill. If the purpose is to assure that the impervious material dumped in water to seal the upstream cofferdam will not be

[3] The partial clarification provided by Furnas / Odebrecht, that with gate fully of partially open the flow will be supercritical, with water level lower than the trunnion beam, is deemed not sufficient to change our opinion: there will certainly be a partial opening degree for which the hydraulic jump will develop immediately downstream of the gate or will submerge the high velocity flow passing under the gate.

washed away by the spillway flow, it is recommended to minimise the extent of the platform, bringing the rockfill containment dike closer to the cofferdam: this platform will be expensive and difficult to built, as all material shall be dumped from barges, working against the strong current of the river flow diverted through the spillway.

3.3.5 Intake-Powerhouse Complex

There are no special comments about the civil structure proper of the intake – powerhouse complex. We have some concerns about the arrangement and specific characteristics of the equipment, discussed in the next paragraphs, and in general we are not fully confident that the space foreseen in the downstream galleries of the powerhouse will be sufficient to locate all equipment required, as items like main and auxiliary control rooms, ventilation and air conditioning equipment and ducts, switchgears for the auxiliary electrical systems, etc. are not shown in the drawings; a layout we developed for another project with bulb units of comparable characteristics included four galleries, instead than the three foreseen here. Components such as administration building and warehouse are not indicated in the drawings, although they will be necessary and presumably large.

As a general remark concerning the overall safety of the plant, it is noted that apparently nothing is foreseen to prevent the flooding of the entire powerhouse in case of failure of major components (or of human errors such as leaving open a man-hole to access the draft tubes). In order to control / minimise this risk, it is recommended to investigate two options, possibly in combination:

- It would be safer (and not necessarily more expensive), to foresee upstream emergency gates and maintenance stoplogs, and a downstream maintenance stoplog, as it is done in most layouts with bulb or Kaplan units, instead than the downstream emergency gate presently proposed. In case of an accidental flooding of the powerhouse initiated from the hydraulic passages of a unit, this would limit the flooding elevation to the tailwater level.
- A possibility to further minimise this risk could be to build upstream – downstream walls separating the powerhouse in three or four sections, watertight up to a certain elevation, for example the tailwater level of the 10 or 20 years flood. This concept would require some adjustment on the elevation of the cranes, and a different concept for the equipment erection methods.

Given the total size of the plant, the very large number of equipment and components working under pressure, and the potentially disastrous consequences, we believe that the risk of accidental flooding shall be seriously assessed and suitable minimisation measures implemented.

Another general remark refers to the length of the draft tube: the Feasibility Report does not indicate if details of the unit size were investigated with manufacturers, but to a first look the length of the draft tube seems on the low side.

Further comments about the general arrangement of the intake – powerhouse complex refer to the planning of the equipment erection and are discussed further in this chapter of the report.

3.3.6 Navigation Canal

It is understood that the canal will be built later. The general arrangement of the structures makes easy this postponement, without requiring preparatory works. In the future, to avoid interferences with the operation of the plant during the construction of the canal, it might be advisable to move somewhat to the left the downstream part of the canal, particularly near the exit to the river.

3.4 Hydromechanical and Electromechanical Equipment

3.4.1 Hydromechanical Equipment

Comments related to the hydro-mechanical equipment (gates, stoplogs etc.) are limited to the following points:

- The design of the radial gates of the spillway shall be modified, as commented in the Paragraph 3.3.3 above.
- The opportunity to shift the location of the emergency draft tube gates is commented in the Paragraph 3.3.5 above. The proposed design of these gates, with cylinders and cylinders' pistons permanently under water and the pipes connecting to the hydraulic units presumably inside the pistons, is not very reliable. A conventional solution with cylinders above water would be preferable.

3.4.2 Electromechanical Equipment - General

The general arrangement of the equipment is described in the Section 14 of the Feasibility Report, and illustrated to some extent in the drawings.

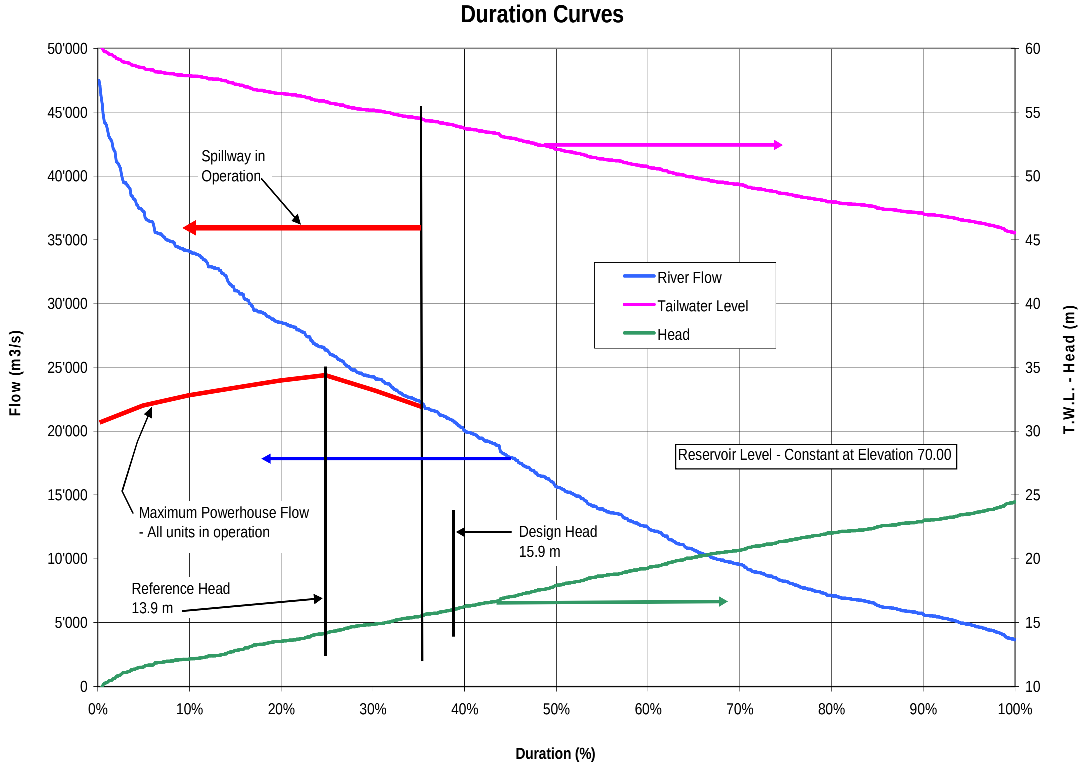
From that description, it seems that the overall layout of the equipment was studied according to a sequence of installation of the units and of civil construction of the powerhouse different than it is now proposed: it is foreseen to have one transformer every four units and one data acquisition and control unit every eight machines, the double bus bars of the 500 kV GIS switchyard are split in two, with one serving the units No.1 to 20, and the second the units No. 21 to 44. However, the powerhouse is now split in three portions, housing the units No. 1 to 16, 17 to 32 and 33 to 44 respectively; and the sequence of commissioning indicated in the Table 14.1 of the Feasibility Report is based on the commissioning of three units at a time. While there are no objections to the overall concept to arrange the equipment by groups of four units, the splitting of the switchyard bus bars shall be re-arranged to match the civil construction stages; a further splitting of the bus bars by groups of eight machines might become advisable to facilitate the erection and commissioning.

As already mentioned, the description of the auxiliary equipment and their arrangement and location inside the powerhouse building are not fully detailed. In the next design stage, powerhouse equipment arrangement shall be completely defined as soon as possible, primarily to confirm that the available space is sufficient or to introduce the adjustments to the powerhouse layout that may become necessary.

3.4.3 Bulb Units

The main issue in relation to the bulb unit is the head range that these machines will be able to cover with acceptable efficiency and performance. The Figure 3.6 shows the ranges of river flow, tailwater levels and gross head to be expected, according to the hydrological data provided in the Feasibility Report. The head ranges from about 24.7 to 9.7 m, without considering the lower heads occurring in extreme flood conditions.

Figure 3.6



The problems to be faced to cover the full range of heads above and the possible technical solutions are illustrated in the report of the Hydraulic Machinery Consultant, Mr. Brekke. In our opinion, priority shall be given to achieve the maximum efficiency when the river flow is minimum and the head is maximum, if necessary designing part of the unit for a higher design head than proposed in the Feasibility Report: this recommendation is based on the following concept:

- When low flow prevails in the Madeira River, presumably the power available in the whole Brazilian system, largely based on hydro plants, will be minimum, and thus it will be important to make the best use of the available flow to maximise the output of the plant.
- Under minimum flow conditions only a limited number of units can be kept in operation (say 8 to 10 machines).
- Should it be necessary to stop these units when the head is too low, the impact on the global power availability of the Brazilian system should not be too critical, because presumably there will be excess capacity available from other hydroelectric plants.

It is recognised that in order to have a private developer following the above approach it will be necessary to take into account in the tariffs and other conditions of the energy sale agreement the different value for the system of the energy provided in dry and flood seasons.

3.5 Transmission System

It is understood that the long distance transmission is not included in the project itself, being foreseen only the 5 km long 500 kV connection to a future Porto Velho substation, which shall finally connect also the lines coming from the Jirau plant.

Only preliminary analyses of the long distance transmission have been made for the feasibility studies of the plant, under assumptions about the general characteristics of the lines (500 kV AC) still to be confirmed. It will be necessary to define as soon as possible the characteristics of the long distance transmission and the stability conditions of the grid, and to establish if any equipment (shunt reactors, etc.) will be needed to protect the Santo Antonio units against problems in the long distance transmission system. The responsibilities for the required studies shall be defined as soon as possible, together with the financial responsibilities for the procurement of the additional equipment possibly required, presently not foreseen.

Concerning the line from the plant to the future Porto Velho substation, it is noted that with the present layout the starting of the lines will be on the left bank of the river, while the Porto Velho substation will be presumably located on the right side. The crossing of the river with one single span will require very high and expensive towers. It will be worth studying the possibility to cross the river at the dam site, making use of the dividing walls of the intake-powerhouse complex and the spillway structure to locate the line towers.

3.6 Construction Planning and Scheduling

The construction planning foreseen is described in general terms in the Section 14 of the Feasibility Report, and the construction program is attached to the same section.

In the construction program, some minor inconsistencies between the sequence of civil construction and equipment erection in the powerhouse, and the stage of construction implied by the location of the intermediate walls have been found, as well as some likely drafting mistakes. A revised construction program has been prepared correcting these inconsistencies, adding activities related to the installation of camp and construction facilities, grouping together some activities and detailing some other, to help identifying critical aspects and work peaks; this revised program is shown in the Figure 3.7 (3 sheets).

Figure 3.7 – Santo Antonio Plant – Simplified Construction Program – Sheet 1/3

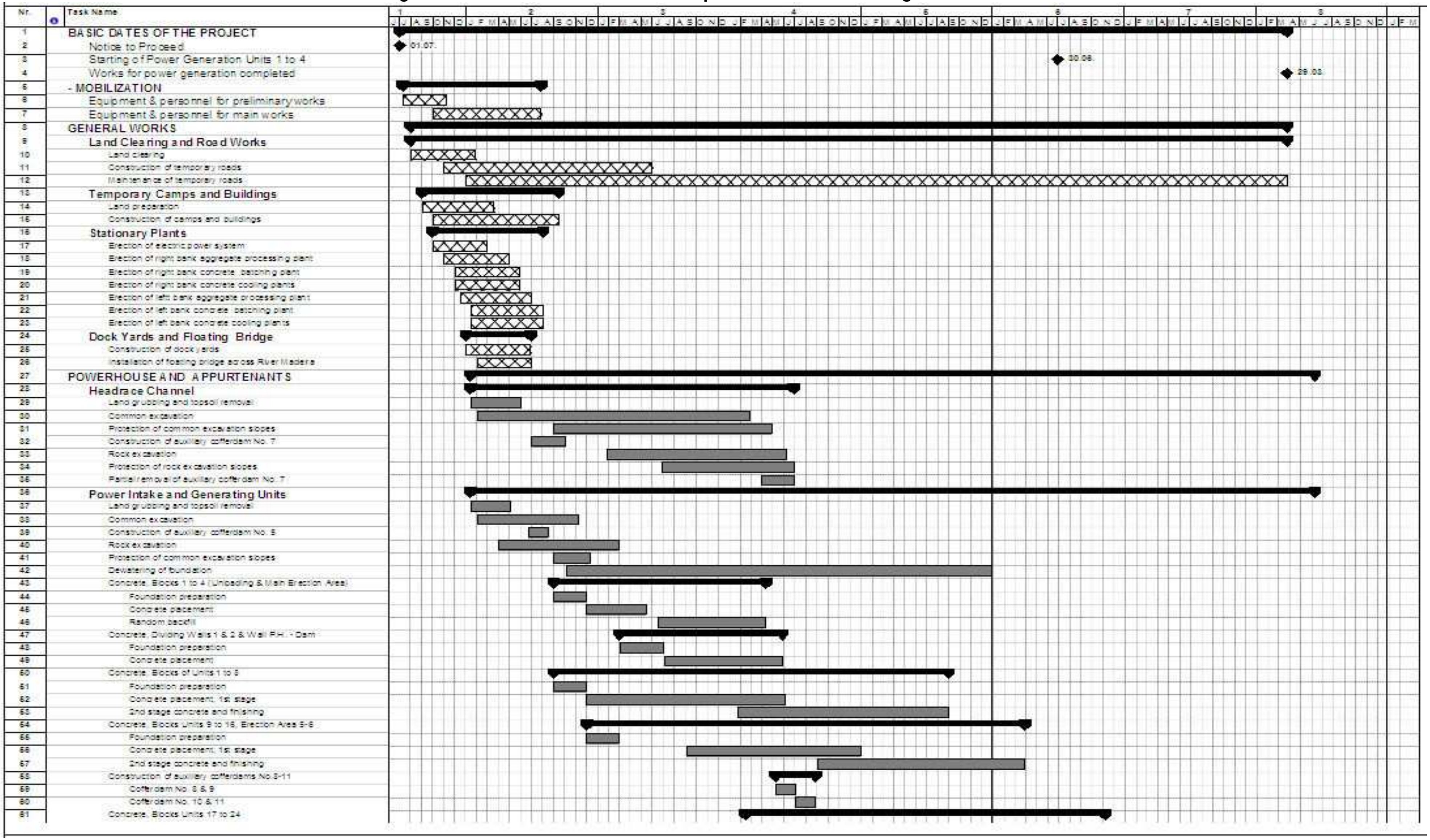


Figure 3.7 – Santo Antonio Plant – Simplified Construction Program – Sheet 2/3

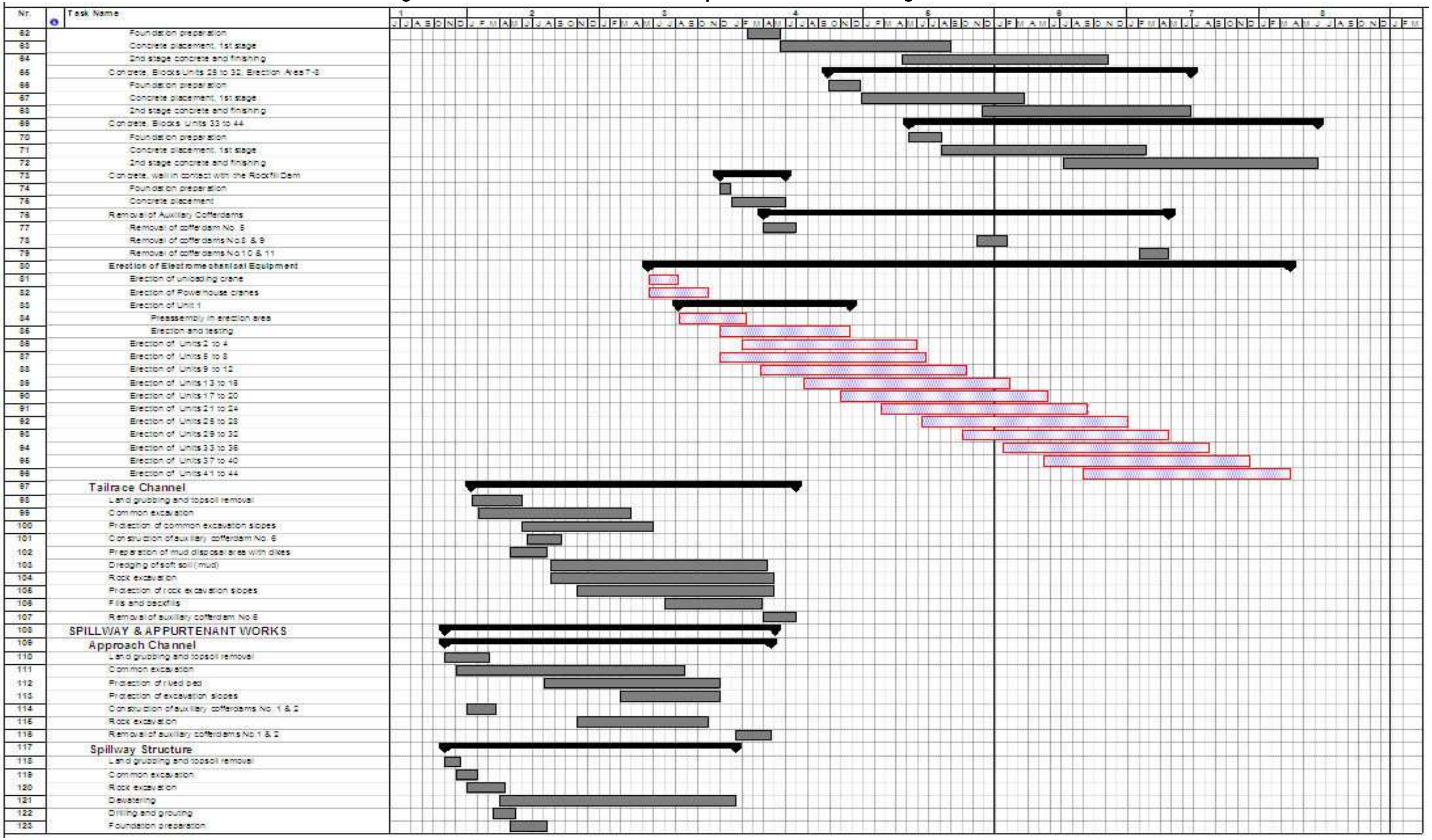
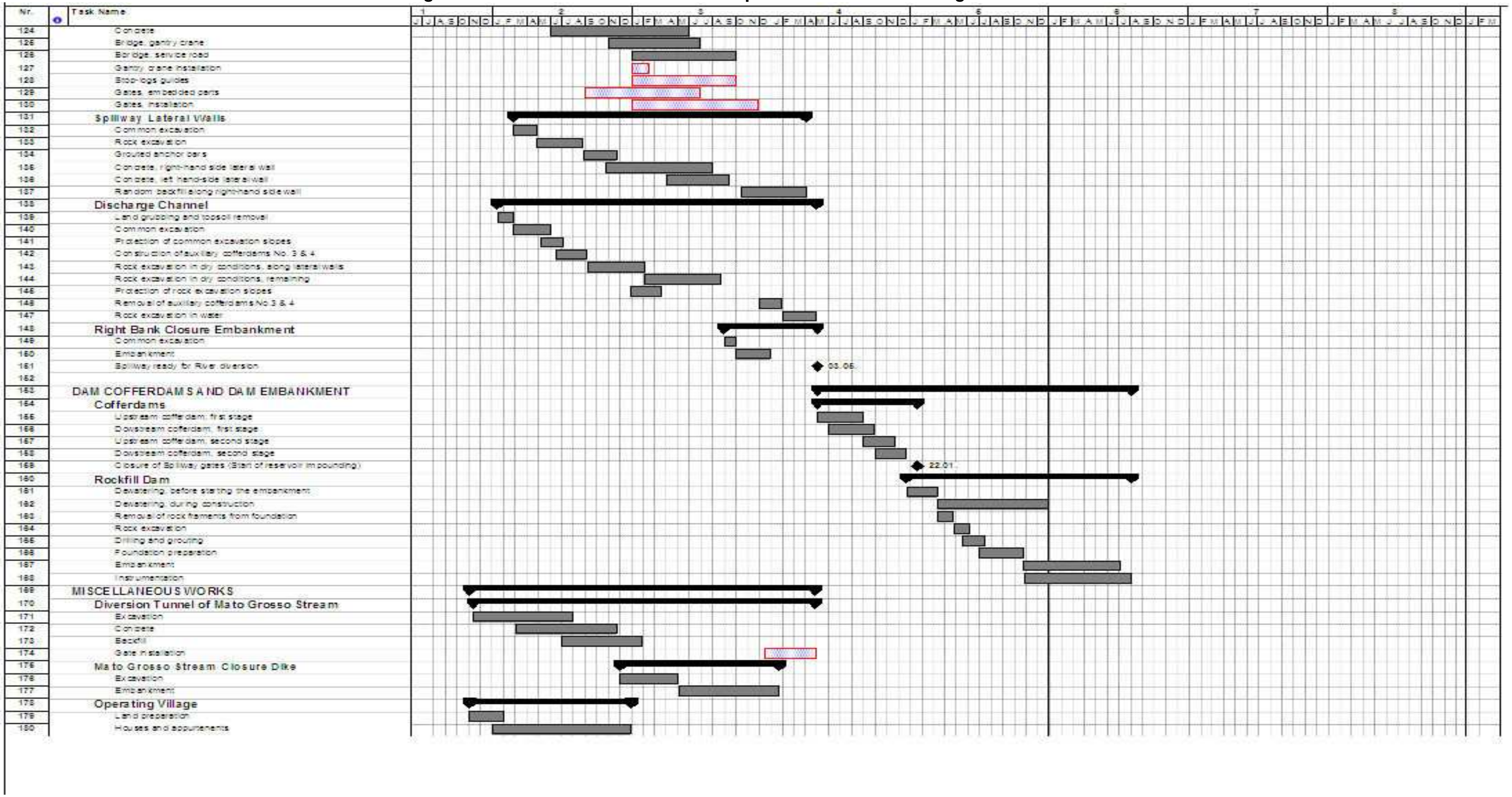


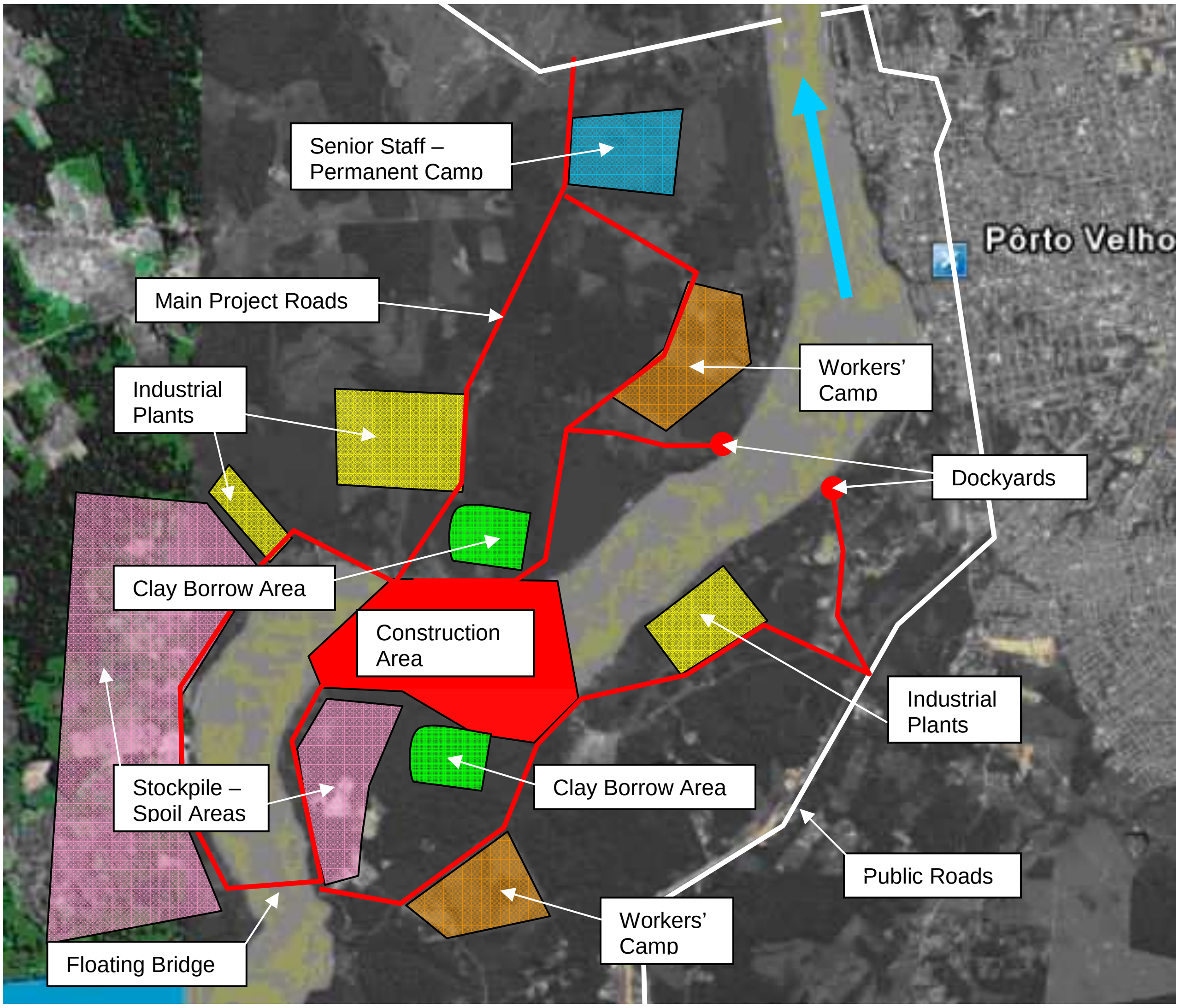
Figure 3.7 – Santo Antonio Plant – Simplified Construction Program – Sheet 3/3



Considering the presence of Odebrecht in the group which developed the feasibility studies, we have been somewhat surprised not to find in the report an in depth analysis of the problems associated with the planning of the construction. For the civil construction aspects, we have identified the following critical issues:

- Despite the statement to the contrary of Furnas / Odebrecht, in our opinion a first critical aspect is the availability of stockpile / spoil areas of sufficient capacity, and generally of sufficient space for the temporary camps and construction facilities, taking into account the immediate vicinity to the Porto Velho town and the presence on the right bank of a cemetery very near the project structures.
- The Porto Velho town is fully developed on the right side, and there is no bridge across the river. On the other hand, in our opinion a project of this magnitude cannot be conceived without a permanent reliable river crossing, sized for heavy and continuous traffic. [4]

Figure 3.8 – Tentative Arrangement of the main Construction Facilities



4 It is recognised that a floating bridge will face problems due to the large amount of floating material carried by the river; the spacing of the floating elements and the height over the water of the bridge structures between them shall be enough to allow the safe passage of floating materials.

The Figure 3.8 above outlines a possible general arrangement of the areas required near the project site for camps, industrial plants and storage – spoil of excavation materials. The location of a proposed pontoon bridge across the river and the alignment of the main temporary roads are also indicated.[5]

The transport distances corresponding to the arrangement described above have been taken into account in the unit price analyses for the cost estimate of the civil works, as described in the Annex 1.

The main civil construction quantities are:

- Common and rock excavations: total around 78 million m^3, 23.5 in the right bank, about 54.5 in the left, to be essentially completed in 2.5 years
- Concrete: some 3.2 million m^3, 650'000 m^3 on the right side, 2.55 millions on the left.
- Embankment: total about 15.2 million m^3, of which 2.1 on the left bank (cofferdams), 4.6 on the right and about 8.5 for the cofferdams across the river and the main embankment dam.

The critical path for the implementation of the project, up to the commissioning of the first group of units (No.1 to 4) is dictated by the following sequence of partially overlapping activities:

- Contractor's mobilisation, initial camps an priority construction infrastructure;
- Excavations for the intake-powerhouse complex, including the separating walls.
- First stage concrete of the unloading and erection area, and then of the first stage of the powerhouse (units No. 1 to 16).
- Erection of the unloading crane and of the powerhouse cranes
- Pre-assembly of the unit components in the erection area.
- Erection and final commissioning.

The construction of the spillway, the erection of the corresponding gates and the river diversion should not be in the critical path, unless problems are experienced in the manufacturing and then in the erection of the large number of huge radial gates foreseen.

One aspect to be mentioned is the difficulty of accessing the river bed for the construction of the main cofferdams: on the right side, the only way will be through the bridge on the downstream side of the spillway, because water will start flowing trough the spillway as soon as the right bank auxiliary cofferdams are removed. On the left side, the concrete walls containing the embankment dam greatly restrict the possibilities of access. Once the main cofferdams are complete and the spillway is closed to raise the reservoir and start energy production, the only way to access the central part of the river bed, for the construction of the dam, will be through the spillway bridge.

[5] It has been commented that it might be preferable to locate the camps on the right bank of the river, taking into account the present poor accessibility of the left bank. In this respect, it shall be noted however that with the layout proposed in the Feasibility Report most civil construction and equipment erection activities will take place on the left bank, and locating the camps on the right side will worsen all transportation problems, making the availability of a reliable bridge crossing even more necessary.

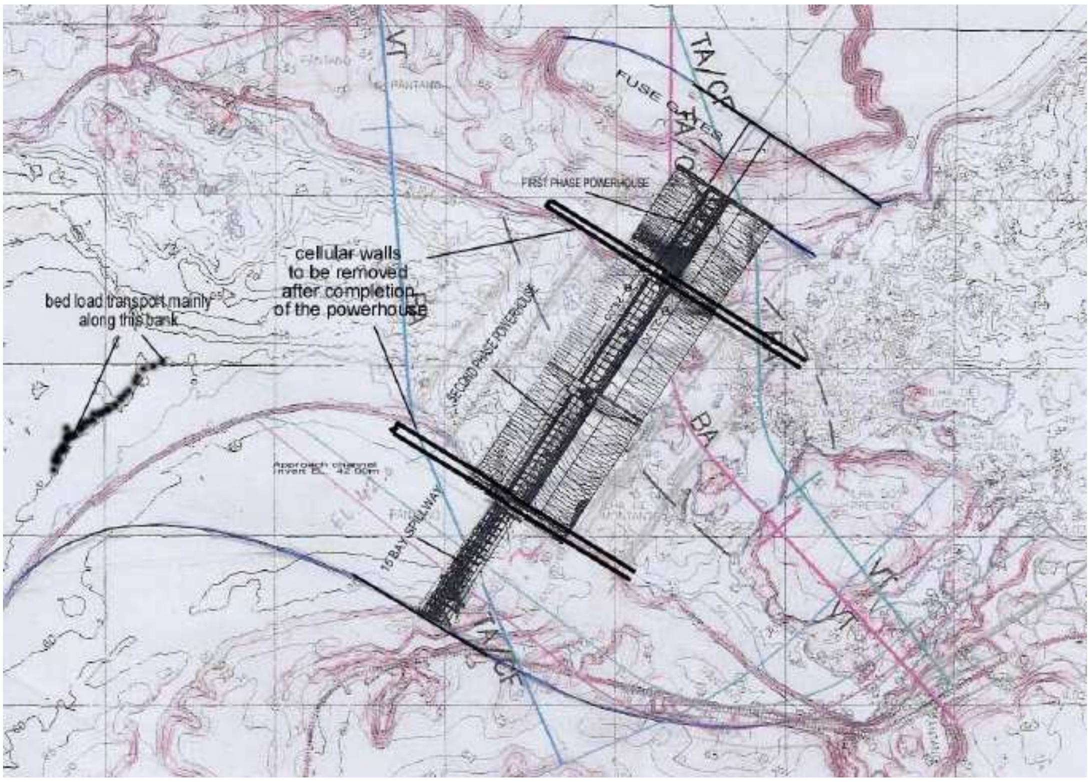
With the closure of the spillway and the filling of the reservoir, all excavations and about half of the concrete will have been completed. From that moment, the critical issue will be the time interval at which the powerhouse units can be put progressively in operation. In our opinion, two aspects shall be considered:

- The turbine manufacturing industry may not have sufficient free capacity to meet the ambitious target of manufacturing and commissioning one unit per month.
- According to the powerhouse arrangement shown in the drawings we understand that all equipment components will be initially unloaded in the main erection area to the right of the Unit No.1, and then part of them transferred to the auxiliary erection areas using the main and auxiliary powerhouse cranes. Given the travel speed of such cranes (normally about 0.5-0.6 m/s when empty, down to few cm/s when fully loaded), this may be a significant bottleneck in the erection programs. It would be advisable to foresee transverse cranes also in the auxiliary erection areas, with the equipment components coming there via the road on the downstream side of the powerhouse.
  Furnas / Odebrecht have clarified that this concept has already been taken into account in their planning; however only one transverse crane has been included in the cost estimate developed by Furnas – Odebrecht made available to Colenco.

3.7 Alternative Arrangement proposed by Mr. Sultan Alam

The alternative layout proposed by Mr. Sultan Alam (Alternative 2) is shown in the Figure 3.9, taken from his report.

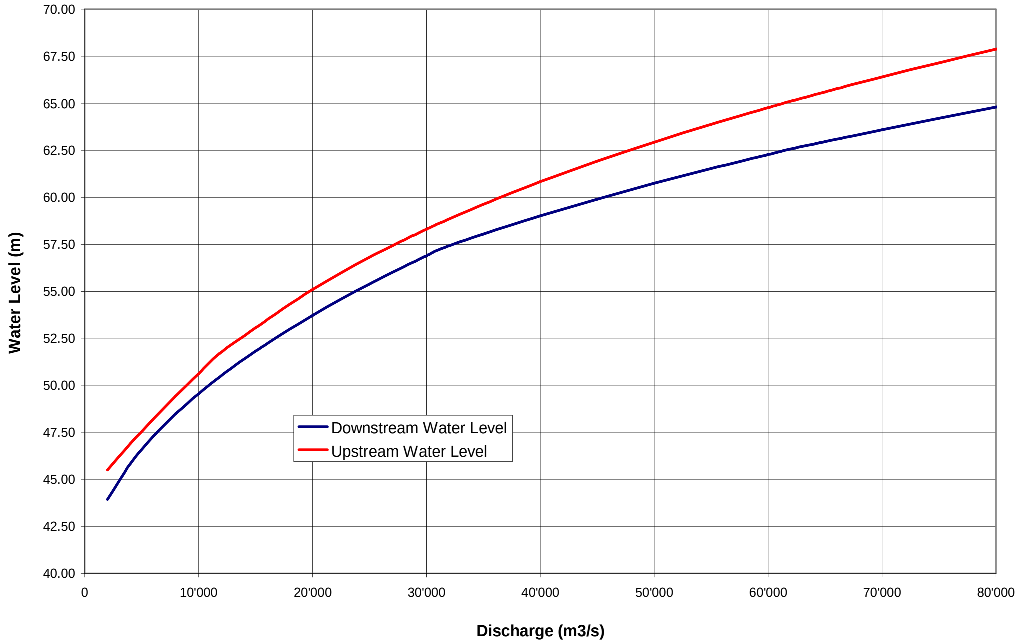
Figure 3.9 – Santo Antonio Plant – Alternative 2



We understand that the proposal of Mr. Alam is mainly aimed to achieve a better control of the sediments carried by the river, and as a second priority to minimise costs. In our opinion, assuming that the required hydraulic model tests will confirm a sediment transit pattern through the spillway better than in the other alternatives, this layout will need further studies and optimisations, mainly in relation to the following aspects:

- According to the data provided in the Furnas / Odebrecht Feasibility Report, there is a considerable difference in the river water level upstream and downstream of the “Cachoeira de Santo Antonio” – see Figure 3.10. It will be necessary to see to what extent the Alternative 2 can recover some head by excavating the powerhouse tailrace.

Figure 3.10 – Rating Curves of the River Across the “Cachoeira de Santo Antonio”



- It is necessary to verify if the idea to leave unexcavated the “Ilha do Presidio” will not significantly worsen the hydraulic conditions of the spillway discharge and its impact on the tailwater level and the conditions of operation of the powerhouse;
- The downstream part of the left cellular wall ends just to the left of the “Ilha Solitaria” reducing to about half the width of the river in its narrowest section: it will be necessary to verify the consequences of this narrowing on the behaviour of the river in the flood seasons along the construction period;
- The smaller spillway proposed in the Alternative 2 has a design capacity of about 61,800 m^3/s with all gates open, approximately corresponding to a flood of 100 years return period, versus 10,000 years in the Furnas / Odebrecht design and in the Alternative 1. Further consideration shall be given to the opportunity to sacrifice safety in exchange for the relatively small cost saving achieved by replacing 6 radial gates with a fuse gates structure.

4 Cost Estimates for the Furnas / Odebrecht Layout

4.1 Purpose and Scope

The purpose of the present section is to summarise the cost estimate of the Santo Antonio plant developed by Colenco for the layout proposed by Furnas / Odebrecht, including:

- Civil works
- Hydro-mechanical equipment
- Electromechanical equipment.
- Other costs attributable to the project.

The detailed cost estimates of the first three items above are given in separate annexes:

- Annex 1 for the civil works,
- Annex 2 for the hydro-mechanical equipment,
- Annex 3 for the electromechanical equipment.

The estimates are generally based on prices prevailing at the end of 2006.

4.2 Civil Works

The summary of the cost estimate for the civil works is given in the following Table 4.1. The exchange rate considered for the calculation of the equivalent USD is

2.10 Reais = 1 USD.

Table 4.1 - Civil Works – Cost Estimate Summary - by Structure

Structure	Construction Costs		
	Local Curr. (Reais)	Foreign Curr. (USD)	Total (USD Equiv.)
General Construction Costs	839'867'566		399'936'936
Powerhouse Headrace Channel	217'923'170	31'399'300	135'172'238
Power Intakes / Powerhouse Complex	1'913'123'106	36'415'750	947'426'753
Powerhouse Tailrace Channel	365'578'651	35'505'362	209'590'434
Right Bank Cofferdams	40'009'956	5'105'696	24'158'056
Left Bank Cofferdams No. 5, 6 & 7	46'038'951	2'800'526	24'723'836
Dam Cofferdams	88'329'891	10'871'941	52'933'794
Cofferdams No. 8, 9, 10 & 11	32'644'668	4'313'602	19'858'682
Rockfill Dam	39'165'372	3'725'764	22'375'941
Concrete Walls	274'213'848	1'872'403	132'450'426
Spillway Approach Channel	204'179'283	28'930'256	126'158'486
Spillway Structure	357'403'345	5'245'630	175'437'699
Spillway Discharge Channel	90'169'981	8'655'971	51'594'057
Right Bank Closure Embankment	2'031'133	251'216	1'218'422
Mato Grosso Stream Closure Dike	10'785'035	1'357'711	6'493'442
Mato Grosso Diversion Conduit	47'576'504	425'076	23'080'554
Dewatering and Care of Water	8'228'552		3'918'358
Operator's Village	20'291'418		9'662'580
Total	**4'597'560'429**	**176'876'204**	**2'366'190'694**

It shall be commented that the unit prices applied are estimated on the basis of "normal" unit prices type of contracts, with at least a partial price escalation allowed, and thus will not cover the additional risks to be faced by an EPC Contractor because of the fix lump sum price.

It shall also be noted that the table above does not include technical contingencies. The corresponding allocation is included in the total construction cost estimate given in the following Paragraph 4.5.

4.3 Hydromechanical Equipment

The cost estimate of the hydro-mechanical equipment of the project (gates, stoplogs trash racks and cranes, excluding the powerhouse cranes), is summarised in the following Table 4.2. The detailed cost estimate can be found in the Annex 2.

Although the detailed cost estimate has been developed in USD, on the basis of international unit prices values deemed applicable to each type of equipment, for the purpose of cost splitting between local and foreign currency it has been considered that the Brazilian industry will have the capacity to manufacture all items required, and thus the entire cost has been considered local. The exchange rates applied for the conversion is

2.10 Reais = 1 USD.

Table 4.2 – Hydro-mechanical Equipment – Cost Estimate Summary

Item	Cost Estimate	
	In USD	In Reais
Surface Spillway	**64'493'000**	**135'435'000**
Radial Gates	44'400'000	93'240'000
Upstream Stoplogs	10'502'000	22'054'000
Downstream Stoplogs	2'165'000	4'547'000
Gantry Crane	413'000	867'000
Miscellanea	692'000	1'453'000
Power Intakes	**96'674'000**	**203'015'000**
Stoplogs	32'900'000	69'090'000
Gantry Crane & Rack Cleaning Machine	885'000	1'859'000
Trash Racks	32'535'000	68'324'000
Miscellanea	1'400'000	2'940'000
Draft Tubes	**123'655'000**	**259'676'000**
Stoplogs	10'348'000	21'731'000
Emergency Gates	98'207'000	206'235'000
Downstream Gantry Crane	1'062'000	2'230'000
Miscellanea	1'400'000	2'940'000
Mato Grosso Stream Diversion	**507'000**	**1'065'000**
Stoplogs	483'000	1'014'000
Miscellanea	24'000	50'000
Total, Hydromechanical Equipment	**285'329'000**	**599'191'000**

In this case also, the table above does not include technical contingencies. The corresponding allocation is included in the total construction cost estimate given in the following Paragraph 4.5.

4.4 Electromechanical Equipment

The summary of the cost estimate for the electromechanical equipment is given in the following Table 4.3. The detailed cost estimate can be found in the Annex 3.

The detailed cost estimate has been developed in USD, on the basis of international prices for comparable types of equipment offered in recent bids or awarded in on-going or recently completed contracts, complemented by the Colenco's internal data base. For the purpose of cost splitting between local and foreign currency, it has been considered that:

- All minor and auxiliary mechanical and electrical equipment (pumps, motors, cranes, MV and LV electrical equipment etc.) will be manufactured in Brazil;
- The bulb units (turbines and generators) could also be mostly manufactured in Brazil, except for some specific items, such as the unit shafts. The critical aspect in this regards is related to the capacity of the Brazilian industry to manufacture all units foreseen at the one month per unit sequence planned in the project implementation schedule. Pending an investigation of this issue, it has been assumed that the units will be manufactured by a consortium of manufacturers, with one unit alternatively coming from Brazil and from abroad. For the units nominally manufactured in Brazil, the foreign currency component on the FOB cost was assumed as 20% of the total, while for the machines nominally manufactured abroad it was assumed that the foreign currency component will increase to 50%.
- The main transformers are assumed to be fully manufactured in Brazil, while the GIS switchyard is assumed to have an 80% foreign currency component.
- Control, metering and protection equipment is assumed to have 50% foreign currency component.
- Equipment transportation cost have been computed according to estimated % of the FOB prices for the international transportation when relevant (in foreign currency) and for the local transportation (always in Reais). Erection costs have been considered local in any case.
- The exchange rates applied for the conversion is

2.10 Reais = 1 USD.

Table 4.3 – Electromechanical Equipment – Cost Estimate Summary

Item	Construction Costs		
	Local Curr. (Reais)	Foreign Curr. (USD)	Total (USD Equiv.)
Turbine, Governors & Ancillaries	898'868'309	165'175'472	593'208'000
Generators & Excitation	522'520'123	96'017'894	344'837'000
Generator Connections, Switchgear & Associated Eq.	24'448'200		11'642'000
Power Transformers and Auxiliaries	45'595'200		21'712'000
Gas Insulated Switchgear	18'446'182	19'671'104	28'455'000
Connection to Porto Velho Substation	17'850'000		8'500'000
Power Cables and Accessories	22'247'400		10'594'000
Auxiliary Electrical Plant	42'535'500		20'255'000
Control, Metering and Protection	40'575'108	10'655'520	29'977'000
Communications and Data Transmission	2'173'500		1'035'000
Cabling	14'483'700		6'897'000
Earthing and Lightning Protection	4'890'900		2'329'000
Lighting and Small Power	19'229'700		9'157'000
Ventilation and Air Conditioning System	26'386'500		12'565'000
Elevators	5'065'200		2'412'000
Fire Detection	11'180'400		5'324'000
Auxiliary Mechanical Plant	10'012'800		4'768'000
Cranes and Lifting Equipment	12'654'600		6'026'000
Maintenance Tools and Equipment	1'439'399	71'572	757'000

Item	Construction Costs		
	Local Curr. (Reais)	**Foreign Curr. (USD)**	**Total (USD Equiv.)**
Spare Parts	84'623'809	6'660'948	46'958'000
Tests on Plant	13'250'160	2'034'400	8'344'000
Total	**1'838'476'689**	**300'286'910**	**1'175'752'000**

4.5 Construction Cost

The Colenco's estimate of the total construction cost is computed adding to the itemised quantities of the civil works and to the identified equipment components suitable technical contingencies, to cover uncertainties in the quantities of the civil works and in the scope of the equipment supply.

The following Table 4.4 gives the detail of the % contingencies added to the cost estimate of the civil works for each structure.

Table 4.4 – Technical Contingencies on Civil Works

Item	Item. Cost ($)	Cont. (%)	Total Cost ($)
General Construction Costs	399'936'936	10%	439'930'630
Powerhouse Headrace Channel	135'172'238	2%	137'875'683
Powerhouse, Power Intakes and Generating Units	947'426'753	10%	1'042'169'428
Powerhouse Tailrace Channel	209'590'434	5%	220'069'956
Right Bank Cofferdams	24'158'056	5%	25'365'959
Left Bank Cofferdams	24'723'836	5%	25'960'028
Main Cofferdams Across the River	52'933'794	15%	60'873'863
Powerhouse Cofferdams	19'858'682	2%	20'255'856
Rockfill Dam	22'375'941	10%	24'613'535
Concrete Walls	132'450'426	5%	139'072'947
Spillway Approach Channel	126'158'486	5%	132'466'410
Spillway Structure	175'437'699	5%	184'209'584
Spillway Discharge Channel	51'594'057	2%	52'625'938
Closure Embankment on the Right Bank	1'218'422	10%	1'340'264
Mato Grosso Stream Closure Dike	6'493'442	10%	7'142'786
Mato Grosso Diversion Tunnel	23'080'554	15%	26'542'637
Dewatering and Care of Water	3'918'358	15%	4'506'112
Operator's Village	9'662'580	10%	10'628'838
Average Contingencies % Rounded to		8.01% 8.00%	
Total Cost	**2'366'190'694**	**8.00%**	**2'555'485'950**

Taking into account the characteristics of the projects, were geological conditions are well known and the design is fairly well developed, and having included in the cost estimates allowances to cover minor civil work items not yet detailed, an 8% for the average technical contingencies on the civil works is deemed adequate. In the specific project conditions, we consider that the most likely possibility of significant quantity increases refers to the concrete of the powerhouse, in case the space foreseen according to the presently proposed layout proves not sufficient. For the hydromechanical and electromechanical equipment a 5% contingency has been applied.

The resulting estimate of the total project construction cost is given in the following Table 4.5. The cost estimate developed by PCE/Furnas/Odebrecht is also shown for reference.

Table 4.5 – Summary of Construction Cost Estimate

	Colenco Estimate			Original Est. Total (USD Eq.) **
	Local Portion (Reais)	Foreign P. (USD)	Total (USD Eq.) *	
Civil Works				
Itemised Quantities	4'597'560'429	176'876'204	2'366'190'694	
Techn. Contingencies (8%)	367'804'834	14'150'096	189'295'256	
Civil Works, Total	4'965'365'263	191'026'300	2'555'485'950	2'792'404'202
Hydromechanical Equipment				
Components Identified	599'191'000		285'329'000	
Techn. Contingencies (5%)	29'959'550		14'266'450	
Hydromech. Eq., Total	629'150'550		299'595'450	294'246'316
Electromechanical Equipment				
Components Identified	1'838'476'689	300'286'910	1'175'752'000	
Techn. Contingencies (5%)	91'923'834	15'014'346	58'787'600	
Electromech. Eq., Total	1'930'400'523	315'301'256	1'234'539'600	1'327'879'100
Total Construction Cost	**7'524'916'337**	**506'327'556**	**4'089'621'000**	**4'414'529'618**

* at the present exchange rate of 2.10 Reais/$

** at the exchange rate of 2.326 Reais/$, according to the original PCE/Furnas/Odebrecht estimate.

4.6 Land Acquisition, Relocations, Social and Environmental Costs

The budget foreseen by PCE/Furnas/Odebrecht has been reviewed, taking into account the description of the different social – environmental actions described in the Chapter 9 of the Feasibility Report, and some general reference cost data from other international projects.

A summary of Colenco's estimate of these costs in equivalent USD (all these costs shall be in Reais) is as follows:

- Land Acquisition 19'796'000
- Relocations 30'360'000
- Other Social-Environmental Actions 90'585'000

Total 147'778'000

Details of Colenco's estimate of the social – environmental costs, compared with the budget provided by PCE/Furnas/Odebrecht, can be found in the Annex 4.

4.7 Other Implementation Costs

4.7.1 Project Implementation Structure

The cost estimates provided in the paragraphs above for the civil works and for the equipment are all based on "standard" contract conditions, which is a contract like the FIDIC "red book" for the civil works, based on unit prices; and one or more electromechanical supply contracts based on the FIDIC "yellow book".

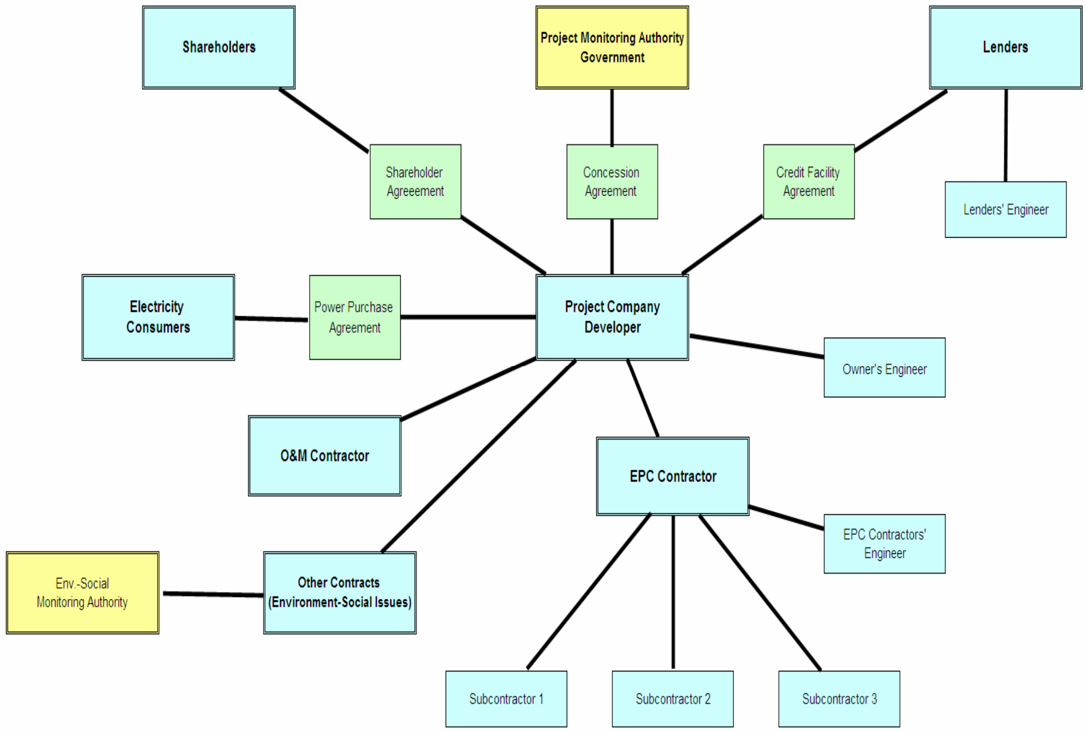
Assuming a project financing by a mix of commercial banks; export credits; loans by international financing institutions like IBRD; and equities of the developer, an important requirement to achieve the financial closing is to have a fix budget, which shall take into account all risks to be faced and all other factors affecting the cost.

To estimate a monetary value of such risks, it is assumed here that the construction will be carried out through one single EPC contract, covering all civil construction and equipment supply work at the project site, plus a number of other contracts, covering mainly works and services related to social and environmental issues.

The structure for the development of the project is thus assumed as shown in the Figure 4.1 here below, based on the typical set up of a project developed by Independent Power Producers (IPP) under one single main EPC contract.

It is pointed out that the structure shown in the figure does not prevent a shareholder of the project company to act as one of the contractors of the same project company, provided its prices are in line with market conditions.

Figure 4.1 – Typical Project Implementations Structure



4.7.2 Additional Costs and Risk Factors at EPC Contractor Level

In addition to the costs summarised in the Paragraph 4.5 above, which already include the physical contingencies, the total EPC Contract price shall include allocations to cover:

- Engineering costs to be faced by the EPC Contractor, which is normally responsible for the detailed engineering of the project.
- Price escalation on labour, construction materials and construction equipment (the estimate provided is based on price information of end 2006).
- Price risk on the equipment sub-contracts, (bids might be more expensive than the cost estimate provided, and for such long supply program manufacturers may require price adjustment mechanisms in their subcontracts).

- Risks of liquidated damages for delays or under-performance of the equipment, which could not be recovered from sub-contractors (especially liquidated damages for delays).

The engineering costs to be faced by the EPC Contractor are estimated at 2% of the construction cost, to be mostly incurred in local currency: it is assumed that the detailed construction engineering will be entirely carried out by a Brazilian engineering company, with minimum input from international specialists. In detail, we estimate these engineering costs as follows:

- Local Currency (Reais) 163'175'878 (95%)
- Foreign Currency (USD) 4'089'621 (5%)

Total (USD Equivalent) 81'792'420

The extra that an EPC Contractor will likely include in its price to cover the risk of liquidated damages for delays and under performance of the equipment is estimated at 5% of the EPC Price, or about 220 million USD, on the assumption that the EPC Contract Conditions will limit to a maximum of 10% the total liability of the contractor for liquidated damages.

It is noted in this respect that according to the energy production estimate given in the Feasibility Report (incremental firm energy = 2’067 Average MW) and assuming an energy tariff of 50 $/MWh, one month delay in the commissioning would mean a loss of revenues in the order of 75 million $. An amount in the same order of magnitude will represent the present value, at 12% discount rate, of the loss of revenues corresponding to a unit efficiency or maximum output 1% lower than foreseen.

Taking into account the exceptional technical characteristics of the units, the generally tight construction program, and in particular the minimum interval between the commissioning of each unit, the price increase indicated above for the liquidated damages risk can be considered low, likely to become higher if a higher total liability for liquidated damages is established in the EPC Contract Conditions.

Concerning the distribution of the above price increase between local and foreign currencies, for the time being it can be assumed proportional to the overall distribution of the EPC price, although the currency(ies) in which the developer will be paid, and the financing conditions, could have an impact.

The Table 4.6 below summarises our assessment of the above factors, except for the price escalation, which is estimated in the following Paragraph 4.8. The estimate takes as a starting point the basic cost estimates developed by Colenco and summarised in the Paragraphs 4.5 above. According to our estimate, a fair EPC price should be in the order of **4'390 million USD**, excluding the price escalation.

Table 4.6 – Estimate of EPC Price (Excluding Price Escalation)

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	Civil Works (incl. Technical Contingencies)	4'965.4	191.0	2'555.5
2	Hydromechanical Equipment (incl. Technical Contingencies)	629.2	0	299.6
3	Electromechanical Equipment (incl. Technical Contingencies)	1'930.4	315.3	1'234.5
4	EPC Contractor Engineering Costs	163.2	4.1	81.8

5	Risks of non recoverable liquidated damages (5.00% of total EPC Price)	404.6	26.9	219.5
Estimated Acceptable EPC Price, Excluding Price Escalation		**8'092.7**	**537.3**	**4'391.0**

4.7.3 Additional Costs and Risk Factors at Developer Level

In addition to the EPC price estimated above and to the social and environmental costs estimated in the previous Paragraph 4.6, the other costs to be considered at Developer level are listed in the following Table 4.7.

Table 4.7 – Project Cost at Developer Level (Excluding Price Escalation)

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	EPC Price	8'092.7	537.3	4'391.0
2	Social and Environmental Costs	310.3	0	147.8
3	Developer's Engineering Costs			
3.1	Pre-investment: investigations & feasibility studies	42.0	0	20.0
3.2	Owner's Engineer costs (1% of total EPC Price)	69.2 (75%)	11.0 (25%)	43.9 (100%)
3.3	Lenders' Engineer costs (0.15% of total EPC Price)	6.9 (50%)	3.3 (50%)	6.6 (100%)
4	Developer legal and administration costs (2% of total EPC Price)	175.2 (95%)	4.4 (5%)	87.8 (100%)
5	Contingencies at Developer level, to cover possible claims by the EPC Contractor, extra environmental & social costs, loss of revenues because of delays or equipment underperformance not chargeable to the EPC Contractor, etc. (5% of 1+2+3+4)	434.8	27.8	234. 9
Est. Total Project Implementation Cost, Excl. Price Escalation		**9'131.2**	**583.7**	**4'931.9**

The following clarifications are put forward:

- Item 3.1: amount based on information provided by the MME; we understand this is the amount that would have to be paid back to PCE/Furnas/Odebrecht, in case another group win the auction process.
- Item 3.2: the Owner's Engineering costs are estimated at 1% of the EPC price, with a higher % in foreign currency than the engineering costs of the EPC Contractor. It is assumed that the Owner's Engineering can be carried out by a Brazilian engineering company, with strong support from an international consultant.
- Item 3.3: the Lenders' Engineering costs are estimated at 0.15% of the EPC price, with a 50% in foreign currency and a 50% in local currency. It is assumed that the Lenders' Engineering will be entrusted to an international engineering company with support from a Brazilian consultant.
- Item 4 does not include financial costs; it is assumed that in any case most legal & administration costs will be faced in Reais.
- Item 5 does not include price escalation contingencies.

In conclusion, according to our estimate the total project development cost, still excluding the price escalation, should be in the order of **4'930 million USD**.

4.8 Operation & Maintenance Cost

At a European and North American price level, the annual costs of the operation and maintenance of hydropower plants, often with various plants operated from a remote central control, are in the order of 20 to 25 $/kW/year, depending on various parameters, such as size of the plants, age, maintenance policies of the owners, etc. For hydropower plants, O&M costs are only marginally depending on energy production.

In the specific case of the Santo Antonio plant, considering on one side the large total installed capacity, the brand new status of the plant and the moderate to low cost of the personnel, and on the other the remote location and the specific characteristics of the units, the annual O&M budget is estimated as follows, at today price level:

▪ Operation Costs - Personnel	5.00 $/kW	15'750'000 $/year
▪ Operation Costs - Consumables	1.00 $/kW	3'150'000 $/year
▪ Average Maintenance	9.00 $/kW	28'350'000 $/year
▪ Spares	1.00 $/kW	3'150'000 $/year
▪ Other Fixed Costs	10.00 $/kW	31'500'000 $/year
Total O&M Cost	**26.00 $/kW**	**81'900'000 $/year**

As for the splitting between foreign and local currency, it has been considered that 95% of the O&M costs will be in local currency, with 5% only in foreign currency.

4.9 Disbursement Schedule and Price Escalation Impact

The disbursement schedule has been worked out separately for the local and foreign currency costs spreading the estimated total implementation cost along the construction period according to the construction program given in the previous Chapter 3.

The following advance payments and retention moneys have been assumed:

- Advance payment for the civil works: 10%
- Retention money on the civil works 10%, repaid as follows:
  - 5% at reservoir filling
  - 2.5% at the substantial completion of the civil works (removal of cofferdams No. 10 and 11)
  - 2.5% at the expiry of the warranty period (one year after commissioning of the last unit)
- Advance payment for the hydromechanical and electromechanical equipment: 5%
- Retention money on the hydromechanical and electromechanical equipment: 5%, repaid as follows:
  - 2.5% at reservoir filling and commissioning of the first unit
  - 2.5% at the expiry of the warranty period (one year after commissioning of the last unit)

The price escalation impact has been evaluated considering the following price escalation factors:

- 4% per year on local currency components
- 2% per year on foreign currency components

The total implementation cost, including price escalation, results as follows:

	Cost		
	Local (M. Reais)	**Foreign (M. USD)**	**Total (M. USD Eq.)**
Implementation Cost at End 2006 Price Level	9'131.2	583.7	4'931.9
Price Escalation Impact	1'433.2	71.1	753.6
Total Cost Including Price Escalation	**10'564.3**	**654.8**	**5'685.5**

Details of the disbursement schedule can be found in the Annex 5.

4.10 Financial Considerations

Following the preparation of the disbursement schedule for the implementation of the plant, a tentative cash flow has been worked out, to assess the financial conditions under which the project could be financially feasible. The following hypotheses have been considered:

- Total period of the analysis 50 years.
- Operation and maintenance costs have been added (including the relevant price escalations). O&M costs start being incurred from the year 5, when the first units start operation, reaching the full value indicated in the previous Paragraph 4.8 in the year 8, when all units are expected to be in operation.
- The energy production has been assumed as indicated in the feasibility report; in this case also, energy production starts at year 5, with full production reached in the year 8.
- It is assumed that the energy production will be remunerated with the following tariffs:
  - 45'000 USD equivalent /GWh in local currency, plus
  - 10'000 UDS/GWh in foreign currency

  These tariffs are kept constant along the full period analysed.
- Equities are assumed to cover 30% of the implementation costs, both for the local and for the foreign portions. Equities are the first source of funds used.
- Loans cover the remaining financial requirements. Interest rates assumed are 20% for the local currency loans, and 12% for the foreign currency loans. Interests due on the loans during the disbursement period are added to the loans capital.
- Loans repayment starts in the second half of year 5, when energy sales revenues exceed the implementation costs still being faced. For the local currency loans, revenues available until the beginning of year 7 are only sufficient to pay part of the interest due, the remaining interest portion is still added to the loans capital
- Equities payment (interests and capital) for the local and foreign currency portions starts only after all corresponding loans have been fully repaid.

With these assumptions, the return on equities is about 24.7%. The model developed shows that the project will not be able to remunerate the equities at a higher interest rate: the interests will consume most available revenues, making impossible to return the equity capital.

Details of the cash flow developed can be found in the Annex 6.

4.11 Comparison with Other Projects

Around the world there are very few if any projects comparable to the Santo Antonio Plant in terms of combination of installed capacity, type of units, location and other general characteristics.

In general terms, to the knowledge of Colenco other projects developed by private developers have been cheaper, in terms of $/kW of installed capacity. Project presently under construction in South East Asia, with installed capacities in the order of 500 to 1’000 MW, are generally near 1’000 $/kW at developer budget level (excluding interests during construction). The much smaller 82 MW Taquesi Project in Bolivia, for which Colenco was a partner in the EPC Contractor Joint Venture, had an EPC price of about 750 $/kW.

On the other hand, there have been and there are much more expensive projects also implemented by private developers: the 150 MW Casecnan Project in the Philippines had an EPC price near 1’500 $/kW, and the 250 MW Bujagali Project in Uganda is being awarded to an EPC Bidder at a price near 2’000 $/kW. All these prices are net of financial charges.

From another point of view, the cash flow analysis discussed in the previous paragraph has shown that the project is financially feasible with constant tariffs in the order of 55 $/MWh, practically the same established in the Power Purchase Agreements of various projects being built in Laos by private developers for energy export to Thailand.

In conclusion, it can be stated that the large energy production makes the Santo Antonio Project financially viable, despite the relatively high implementation cost. It would seem recommendable, in order to lower the financial costs, to adopt a variable tariffs approach, as it was done in other cases, increasing the tariffs in the initial period of operation and lowering them in later years, in order to achieve an earlier repayment of the loans.

5 Cost Estimates for the Alternative Layouts

5.1 Purpose and Scope

The purpose of the present chapter is to summarise the cost estimate of the Santo Antonio Plant according to the two alternative layouts outlined in the previous Chapter 3.

Cost differences are essentially related to the civil works, plus a small difference in the cost of the hydromechanical equipment of the Alternative 2, because of the replacement of part of the spillway radial gates with fuse type gates, and because of the elimination of the Mato Grosso diversion equipment. The cost of the electromechanical equipment is assumed identical for the three arrangements considered, although the Alternative 1 should allow some saving in the transmission line to the Porto Velho substation, which does not need to cross the river.

It shall be clearly pointed out that the estimate of the cost of the civil works for the two alternative layouts carries a high degree of uncertainty, both because no drawings are available to precisely estimate the quantities of the works; and because no specific unit price analyses have been carried out: the costs have been estimated by applying the same unit prices developed for the cost estimate of the Furnas / Odebrecht Solution.

5.2 Civil Works

The summary of the cost estimate for the civil works of the Alternative 1 is given in the following Table 5.1. The exchange rate considered for the calculation of the equivalent USD is the same used for the cost estimate of the Furnas / Odebrecht solution:

2.10 Reais = 1 USD.

Table 5.1 - Civil Works of Alternative 1 – Cost Estimate by Structure

Structure	Construction Costs		
	Local Curr. (Reais)	**Foreign Curr. (USD)**	**Total (USD Equiv.)**
General Construction Costs	769'270'396		366'319'236
Powerhouse Headrace Channel	132'548'617	19'955'908	83'074'297
Power Intakes / Powerhouse Complex	1'877'090'673	30'738'214	924'590'915
Powerhouse Tailrace Channel	84'772'883	7'983'958	48'351'997
Right Bank Cofferdams	35'518'044	4'517'640	21'430'994
Left Bank Cofferdams	35'356'794	2'335'385	19'171'954
Main Cofferdams across the River	161'162'799	23'091'175	99'835'365
Concrete Walls	199'351'333	1'590'627	96'519'834
Spillway Approach Channel	39'189'588	5'866'864	24'528'572
Spillway Structure	364'059'964	6'304'951	179'666'838
Spillway Discharge Channel	47'305'166	6'537'654	29'063'924
Right Bank Closure Embankment	2'031'132	251'216	1'218'422
Mato Grosso Stream Closure Dike	10'785'035	1'357'711	6'493'442
Mato Grosso Diversion Conduit	47'576'504	425'076	23'080'554
Dewatering and Care of Water	8'228'552		3'918'358
Operator's Village	20'291'418		9'662'580
Total	**3'834'538'899**	**110'956'380**	**1'936'927'284**

The summary of the cost estimate for the civil works of the Alternative 2 is given in the following Table 5.2.

Table 5.2 - Civil Works of Alternative 2 – Cost Estimate by Structure

Structure	Construction Costs		
	Local Curr. (Reais)	Foreign Curr. (USD)	Total (USD Equiv.)
General Construction Costs	839'867'566		399'936'936
Powerhouse Headrace Channel	5'261'548	768'660	3'274'159
Power Intakes / Powerhouse Complex 1)	1'850'766'776	27'963'445	909'280'957
Powerhouse Tailrace Channel	30'480'369	4'278'820	18'793'281
Right Bank Cofferdams 2)	73'320'246	8'795'752	43'710'155
Left Bank Cofferdams 2)	114'842'720	13'917'875	68'604'885
Main Cofferdams across the River	161'162'799	23'091'175	99'835'365
Concrete Walls	153'854'775	920'188	74'184'366
Spillway Approach Channel	40'419'272	6'024'962	25'272'234
Spillway Structure	294'770'288	4'685'129	145'051'933
Spillway Discharge Channel	66'772'468	10'216'885	42'013'298
Fuse Gates Structure	30'660'000	400'000	15'000'000
Dewatering and Care of Water	8'228'552		3'918'358
Operator's Village	20'291'418		9'662'580
Total	**3'690'698'798**	**101'062'891**	**1'858'538'508**

1) The powerhouse is assumed built with conventional technology; the application of the prefabricated float-in type construction technique was not considered.
2) Includes the construction and removal of the cellular cofferdams

It shall be noted that the tables above do not include technical contingencies. The corresponding allocation is included in the total construction cost estimate given in the following Paragraph 5.5.

5.3 Hydromechanical Equipment

As mentioned, the cost estimate of the hydro-mechanical equipment of the project for the Alternative 1 is identical to the corresponding estimate for the Furnas / Odebrecht Solution, which is 599'191'000 Reais, or 285'329'000 USD equivalent.

For the Alternative 2, the cost estimate of the hydromechanical equipment is reduced to 584'550'000 Reais, or 278'357'000 USD equivalent, because of the replacement of six spillway radial gates by fuse gates and because the upstream arrangement of the project structure makes unnecessary the diversion of the Mato Grosso Stream.

In this case also, the figures above do not include technical contingencies.

5.4 Electromechanical Equipment

The cost of the electromechanical equipment is deemed identical for all arrangements analysed, which is, excluding technical contingencies:

- Local Currency 1'838'476'689 Reais
- Foreign Currency 300'286'910 USD
- Total 1'175'752'000 USD Equivalent

5.5 Construction Cost

The estimate of the total construction cost of the alternatives is computed adding to the itemised quantities of the civil works and to the identified equipment components suitable technical contingencies, to cover uncertainties in the quantities of the civil works and in the scope of the equipment supply.

The Table 5.3 summarises the contingencies added in the two alternatives on the itemised costs of the civil works, structure by structure, and allows a comparison with the corresponding figures for the solution proposed by Furnas / Odebrecht.

The average technical contingencies applied for the civil works of the alternatives are higher than considered for the Furnas / Odebrecht Solution, on account of the higher uncertainty in the quantity estimates, and of the need to further study specific technical issues, like those pointed out for the Alternative 2 in the previous Chapter 3. For the hydromechanical and electromechanical equipment the same 5% contingency adopted for the Furnas / Odebrecht Solution has been applied.

The resulting estimate of the total project construction cost is given in the following Tables 5.4 and 5.5 for the Alternative 1 and the Alternative 2 respectively.

Table 5.4 –Summary of Construction Cost Estimate - Alternative 1

	Local Portion (Reais)	Foreign P. (USD)	Total (USD Eq.)
Civil Works			
Itemised Quantities	3'736'139'570	110'956'380	1'890'070'461
Techn. Contingencies (8%)	364'273'608	10'818'247	184'281'870
Civil Works, Total	4'100'413'178	121'774'627	2'074'352'331
Hydromechanical Equipment			
Components Identified	599'191'000		285'329'000
Techn. Contingencies (5%)	29'959'550		14'266'450
Hydromech. Eq., Total	629'150'550		299'595'450
Electromechanical Equipment			
Components Identified	1'838'476'689	300'286'910	1'175'752'000
Techn. Contingencies (5%)	91'923'834	15'014'346	58'787'600
Electromech. Eq., Total	1'930'400'523	315'301'256	1'234'539'600
Total Construction Cost	**6'659'964'252**	**437'075'882**	**3'608'487'381**

Table 5.5 –Summary of Construction Cost Estimate - Alternative 2

	Local Portion (Reais)	Foreign P. (USD)	Total (USD Eq.)
Civil Works			
Itemised Quantities	3'473'859'743	101'062'891	1'755'281'816
Techn. Contingencies (8%)	364'755'273	10'611'604	184'304'591
Civil Works, Total	3'838'615'016	111'674'494	1'939'586'406
Hydromechanical Equipment			
Components Identified	584'549'700		278'357'000
Techn. Contingencies (5%)	29'227'485		13'917'850
Hydromech. Eq., Total	613'777'185		292'274'850
Electromechanical Equipment			
Components Identified	1'838'476'689	300'286'910	1'175'752'000
Techn. Contingencies (5%)	91'923'834	15'014'346	58'787'600
Electromech. Eq., Total	1'930'400'523	315'301'256	1'234'539'600
Total Construction Cost	**6'382'792'724**	**426'975'750**	**3'466'400'856**

Table 5.3 - Technical Contingencies on Civil Works

No.	Description	Total Construction Costs (US $)								
		Furnas/Odebr. Layout			Alternative 1			Alternative 2		
		Item. Costs	Cont. (%)	Total	Item. Costs	Cont. (%)	Total	Item. Costs	Cont. (%)	Total
1	General Construction Costs 1)	399'936'936	10%	439'930'630	319'462'413	10%	351'408'654	296'680'243	10%	326'348'268
2	Powerhouse Headrace Channel	135'172'238	2%	137'875'683	83'074'297	2%	84'735'783	3'274'159	2%	3'339'642
3	Powerhouse, Power Intakes and Generating Units	947'426'753	10%	1'042'169'428	924'590'915	12%	1'035'541'825	909'280'957	12%	1'018'394'672
4	Powerhouse Tailrace Channel	209'590'434	5%	220'069'956	48'351'997	3%	49'802'557	18'793'281	5%	19'732'945
5	Right Bank Cofferdams	24'158'056	5%	25'365'959	21'430'994	5%	22'502'544	43'710'155	10%	48'081'171
6	Left Bank Cofferdams	24'723'836	5%	25'960'028	19'171'954	5%	20'130'551	68'604'885	10%	75'465'373
7	Main Cofferdams Across the River 2)	52'933'794	15%	60'873'863	99'835'365	15%	114'810'670	99'835'365	15%	114'810'670
8	Powerhouse Cofferdams 3)	19'858'682	2%	20'255'856						
9	Rockfill Dam	22'375'941	10%	24'613'535						
10	Concrete Walls	132'450'426	5%	139'072'947	96'519'834	5%	101'345'825	74'184'366	5%	77'893'585
11	Spillway Approach Channel	126'158'486	5%	132'466'410	24'528'572	2%	25'019'144	25'272'234	5%	26'535'846
12	Spillway Structure 4)	175'437'699	5%	184'209'584	179'666'838	5%	188'650'180	145'051'933	5%	152'304'530
13	Spillway Discharge Channel 5)	51'594'057	2%	52'625'938	29'063'924	2%	29'645'202	42'013'298	10%	46'214'628
14	Fuse Gates Structure							15'000'000	5%	15'750'000
15	Closure Embankment on the Right Bank	1'218'422	10%	1'340'264	1'218'422	10%	1'340'264			
16	Mato Grosso Stream Closure Dike	6'493'442	10%	7'142'786	6'493'442	10%	7'142'786			
17	Mato Grosso Diversion Tunnel	23'080'554	15%	26'542'637	23'080'554	15%	26'542'637			
18	Dewatering and Care of Water	3'918'358	15%	4'506'112	3'918'358	15%	4'506'112	3'918'358	15%	4'506'112
19	Operator's Village	9'662'580	10%	10'628'838	9'662'580	10%	10'628'838	9'662'580	10%	10'628'838
Average Contingencies %			8.01%			9.72%			10.52%	
Rounded to			8.00%			9.75%			10.50%	
Total Cost		**2'366'190'694**	**8.00%**	**2'555'485'950**	**1'890'070'461**	**9.75%**	**2'074'352'331**	**1'755'281'816**	**10.50%**	**1'939'586'406**

1) General Construction Costs of Alternatives: same % of the total cost estimated for the Furnas / Odebrecht Layout.
2) Main Cofferdams across the River: for the alternatives, the cost includes the cofferdams removal, not foreseen in the Furnas / Odebrecht Layout.
3) These are the cofferdams foreseen in the Furnas / Odebrecht Layout to allow the construction of the 2nd & 3rd stage of the powerhouse. Not required in the alternatives.
4) The spillway structure of the Alternative 2 is still relatively expensive because the foundation rock is deeper than at the other locations.
5) The high contingency assumed for the Alternative 2 takes into account the possible need to excavate the “Ilha do Presidio”, not considered in the quantity estimates.

5.6 Land Acquisition, Relocations, Social and Environmental Costs

For these costs, the same amount estimated by Colenco for the Furnas/Odebrecht solution, of 147'778'000 equivalent USD, has been kept for the two alternatives considered.

It is noted that the Alternative 2 should allow some reduction of this budget, because the upstream alignment of the project structures reduces somewhat the flooded area and possibly the population resettlement and infrastructures relocation needs: however, the data available to Colenco do not allow an estimate of such reduction, which in any case is deemed not significant at total implementation cost level.

5.7 Other Implementation Costs

5.7.1 Additional Costs and Risk Factors at EPC Contractor Level

By applying the same criteria considered for the Furnas / Odebrecht Solution in the previous Chapter 4, the additional costs and risk factors to be added to arrive at the expected EPC prices for the two alternatives are estimated as follows:

Table 5.6 – Estimate of EPC Price (Excluding Price Escalation) – Alternative 1

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	Civil Works (incl. Technical Contingencies)	4'100.4	121.8	2'074.4
2	Hydromechanical Equipment (incl. Technical Contingencies)	629.2		299.6
3	Electromechanical Equipment (incl. Technical Contingencies)	1930.4	315.3	1'234.5
4	EPC Contractor Engineering Costs (2% of the construction cost)	144.0	3.6	72.2
5	Risks of non recoverable liquidated damages (5.00% of total EPC Price)	358.1	23.2	193.7
Estimated Acceptable EPC Price, Excluding Price Escalation		**7'162.0**	**463.9**	**3'874.4**

Table 5.7 – Estimate of EPC Price (Excluding Price Escalation) – Alternative 2

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	Civil Works (incl. Technical Contingencies)	3'838.6	111.7	1'939.6
2	Hydromechanical Equipment (incl. Technical Contingencies)	613.8		292.3
3	Electromechanical Equipment (incl. Technical Contingencies)	1930.4	315.3	1'234.5
4	EPC Contractor Engineering Costs (2% of the construction cost)	138.3	3.5	69.3
5	Risks of non recoverable liquidated damages (5.00% of total EPC Price)	343.2	22.7	186.1
Estimated Acceptable EPC Price, Excluding Price Escalation		**6'864.3**	**453.1**	**3'721.8**

5.7.2 Additional Costs and Risk Factors at Developer Level

The other costs to be considered at Developer level, in addition to the EPC price estimated above and to the social and environmental costs are listed in the following Tables 5.8 and 5.9.

Table 5.8 – Project Cost at Developer Level (Excluding Price Escalation) – Alternative 1

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	EPC Price	7'162.0	463.9	3'874.4
2	Social and Environmental Costs	310.3	0	147.8
3	Developer's Engineering Costs			
3.1	Pre-investment: investigations & feasibility studies	42.0	0	20.0
3.2	Owner's Engineer costs (1% of total EPC Price)	61.0	9.7	38.7
3.3	Lenders' Engineer costs (0.15% of total EPC Price)	6.1	2.9	5.8
4	Developer legal and administration costs (2% of total EPC Price)	154.6	3.9	77.5
5	Contingencies at Developer level, to cover possible claims by the EPC Contractor, extra environmental & social costs, loss of revenues because of delays or equipment underperformance not chargeable to the EPC Contractor, etc. (5% of 1+2+3+4)	386.8	24.0	208.2
Est. Total Project Implementation Cost, Excl. Price Escalation		**8'122.9**	**504.4**	**4'372.4**

Table 5.9 – Project Cost at Developer Level (Excluding Price Escalation) – Alternative 2

No.	Item	Cost		
		Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
1	EPC Price	6'864.3	453.1	3'721.8
2	Social and Environmental Costs	310.3	0	147.8
3	Developer's Engineering Costs			
3.1	Pre-investment: investigations & feasibility studies	42.0	0	20.0
3.2	Owner's Engineer costs (1% of total EPC Price)	58.6	9.3	37.2
3.3	Lenders' Engineer costs (0.15% of total EPC Price)	5.9	2.8	5.6
4	Developer legal and administration costs (2% of total EPC Price)	148.5	3.7	74.4
5	Contingencies at Developer level, to cover possible claims by the EPC Contractor, extra environmental & social costs, loss of revenues because of delays or equipment underperformance not chargeable to the EPC Contractor, etc. (5% of 1+2+3+4)	371.5	23.4	200.3
Est. Total Project Implementation Cost, Excl. Price Escalation		**7'801.1**	**492.4**	**4'207.2**

In conclusion, according to our estimate the total project development cost, still excluding the price escalation, should be in the order of:

- 4'370 million USD for the Alternative 1 (about 89% of the corresponding cost of the Furnas /Odebrecht solution)
- 4'210 million USD for the Alternative 2 (about 85% of the corresponding cost of the Furnas /Odebrecht solution)

5.8 Operation & Maintenance Cost

The O&M costs for the two alternatives considered are deemed identical to the corresponding costs of the Furnas / Odebrecht solution: 81'900'000 $/year, with 95% of the O&M costs in local currency and 5% in foreign currency.

5.9 Disbursement Schedule and Price Escalation Impact

The disbursement schedule of the two alternatives has been worked out with the same assumptions applied in the previous Chapter 4 for the Furnas / Odebrecht solution, and assuming for both alternatives the same construction program given in the previous Chapter 3. This assumption is debatable: once the alternatives are studied at a sufficient level, for a better evaluation of the price escalation impact and of the financing requirement it would be necessary to develop the corresponding specific construction programs.

According to the assumptions above, the total implementation costs, including price escalation, results as follows:

Table 5.10 – Price Escalation Impact – Alternative 1

	Cost		
	Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
Implementation Cost at End 2006 Price Level	8'122.9	504.4	4'372.4
Price Escalation Impact	1'306.6	64.3	686.5
Total Cost Including Price Escalation	**9'429.5**	**568.7**	**5'058.9**

Table 5.11 – Price Escalation Impact – Alternative 2

	Cost		
	Local (M. Reais)	Foreign (M. USD)	Total (M. USD Eq.)
Implementation Cost at End 2006 Price Level	7'801.1	492.4	4'207.2
Price Escalation Impact	1'267.3	62.9	666.4
Total Cost Including Price Escalation	**9'068.4**	**555.3**	**4'873.5**

5.10 Required Tariffs

Following the preparation of the disbursement schedule for the two alternatives, tentative cash flows have been worked out, to assess the impact of the cost reductions allowed by the two alternatives on the financial feasibility of the project. The analyses were aimed to determine the tariffs needed to achieve the same return on equities obtained for the Furnas / Odebrecht Solution. The same hypotheses considered in the previous Chapter 4 have been applied:

- Total period of the analysis 50 years.
- Operation and maintenance costs have been added (including the relevant price escalations). O&M costs start being incurred from the year 5, when the first units start operation, reaching the full value indicated in the previous Paragraph 4.8 in the year 8, when all units are expected to be in operation.
- The energy production has been assumed as indicated in the feasibility report[1]; in this case also, energy production starts at year 5, with full production reached in the year 8.
- Equities are assumed to cover 30% of the implementation costs, both for the local and for the foreign portions. Equities are the first source of funds used.
- Loans cover the remaining financial requirements. Interest rates assumed are 20% for the local currency loans, and 12% for the foreign currency loans. Interests due on the loans during the disbursement period are added to the loans capital.
- Loans repayment starts when energy sales revenues exceed the implementation costs still being faced. When revenues are only sufficient to pay part of the interest due, the remaining interest portion is still added to the loans capital
- Equities payment (interests and capital) for the local and foreign currency portions starts only after all corresponding loans have been fully repaid.
- Required return on equities shall be 24.7%, as obtained in the previous Chapter 4 for the Furnas / Odebrecht solution.

[1] It shall be pointed out however that the energy production of the Alternative 2 might be lower, because of the upstream emplacement of the powerhouse – see in this respect the comment in the previous Paragraph 3.7.

With these assumptions, the tariffs required result as follows:

- Alternative 1
  - 41 $/MWh in Local Currency
  - 8 $/MWh in Foreign Currency
- Alternative 2:
  - 40.5 $/MWh in Local Currency
  - 7 $/MWh in Foreign Currency

6 Risk Factors

6.1 General

Risks discussed in the present chapter, which could jeopardise the feasibility of the project, follows into the following main categories:

- Technical Risks
- Environmental Risks
- Financial Risks

6.2 Technical Risks

Technical risks which could affect the feasibility of the project are deemed relatively limited, given the characteristics of the site, the predictability of the hydrological behaviour of the river and the good knowledge of the geological – geotechnical conditions achieved. As in any hydroelectric project, there are of course risks of quantity overruns or minor geological unforeseen: it is deemed however that such “normal” risks have already been taken into account at cost estimate level by establishing suitable technical contingencies.

The main remaining technical risks identified are the following:

- Unprecedented characteristics of the generating units: bulb units of the size proposed are probably at the limit of the present state of the art and their design will require very careful studies. In particular, the very large head variations expected may require adopting a different design for some of the units, to cover as best as possible the full range of operating conditions expected.
- The large amounts of sediments and debris dragged by the river will require in depth studies, hydraulic model tests and possibly layout modifications to minimise their impact on the operation of the plant.
- The characteristics of the long transmission system associated to the Santo Antonio and to the planned upstream Jirau plants must be studied in depth, to assure the stability of the operation and to establish which protection equipment if any shall be foreseen at the plants.

It shall be possible to control and possibly eliminate these risks by carrying out further analyses and design studies, before proceeding to the construction stage. The impact on the project cost of the layout modifications possibly required is outlined in the previous Chapter 5, where preliminary cost estimates of the two alternative arrangements presently considered can be found. The impact of layout modifications to the construction schedule cannot be precisely assessed at the present stage; it is noted however that both alternative arrangements outlined so far should allow some reduction of the construction period, mainly because of the lesser excavations of the abutments. On the other hand, it must be stated that carrying out an auction at the present stage, before further in depth studies of these aspects, carries the risk of failure, as any bidder, other than the Furnas / Odebrecht group, may deem the project not sufficiently studied to take the huge financial commitments required.

Other significant technical risks relate to the possibility to meet the short implementation schedule presently foreseen. Two main risks can be identified in this respect, common to all project layouts considered:

- The construction of the main cofferdams required to divert the river through the spillway must be carried out in the dry season, toward the end of the first stage construction period. Thus, if a delay of even few months only accumulates along the construction, there is a significant risk to lose one full year before the first units can be commissioned.
- It may not be feasible to commission the units at the one month interval presently considered, both because of restriction in the manufacturing capacity of the suppliers and because of limitations in the availability of erection facilities and of qualified personnel. This risk is also common to all layouts outlined so far.

6.3 Environmental Risks

Given the characteristics of the project, environmental risks by themselves are deemed limited and controllable at acceptable costs. From this point of view, the estimate of the environmental costs provided in the feasibility study, and even the lower estimate developed by Colenco, are deemed on the high side.

The risk remains however that deficiencies in the communication / information process, or delays in implementing the necessary mitigation measure, will trigger legal actions by the affected population and by NGOs, which in turn can disrupt the project implementation planning and schedule.

6.4 Financial Risks

6.4.1 General

Main risks to be considered under this heading include:

- Although the cost estimates developed so far:
  - Furnas / Odebrecht Solution: 5'468 million $ estimated by Furnas – Odebrecht, presumably at developer's level, 4'932 million $ estimated by Colenco, increasing to 5'685 including the price escalation impact,
  - Alternative 1: 5059 million $, including the price escalation impact (89% of the Furnas / Odebrecht Solution),
  - Alternative 2: 4873 million $, also including price escalation (86% of the Furnas / Odebrecht Solution),

  are deemed conservative, they might still prove to be on the low side, or simply a monopoly situation may induce the developer, the EPC Contractor or the equipment manufacturers to unduly increase their prices. The best way to control this risk is through a proper auction process: it is deemed particularly important to carry out first all necessary additional studies, to properly advertise the project at international level, and to allow to the bidders ample time to study the project and prepare their proposal. From this point of view, the target to start actual construction by the middle of 2007 is deemed unrealistic.
- Although the hydrological behaviour of the Madeira River is quite favourable, with limited fluctuations in the annual runoff, a sequence of dry years at the

beginning of the operation could have important consequences on the capacity of the project to repay the loans, unless some kind of minimum payment guarantees are established in the tariffs agreement.

- The financing requirements are huge and will most probably require the intervention of different financing institutions at the internal and international levels. The interest rates considered in the cash flow analysis illustrated in the previous chapters 4 and 5, which are intended to cover also all accessory financial charges, might result low, especially in case most of the financing comes from commercial banks. In any case, achieving the financial closure for the project will take time: one year from the first approach of a prospective developer to potential financing institutions is not an unreasonably long estimate.
- The cash flow analyses developed assume that the financing and the energy remuneration will match the currencies actually disbursed for the project implementation. Should most of the financing came from international banks and be denominated in USD or Euro, in case payments to the developer are mostly made in Reais there will be an important exchange rate risk. In our opinion, it would be appropriate to transfer part of this risk to the Brazilian Government, by establishing suitable clauses in the tariffs agreement, linking the currencies of payment (or the exchange rates considered, in case all payments are made in Reais) to the conditions of the financing.

6.4.2 Furnas / Odebrecht Solution and Alternatives Considered

The tariffs required to remunerate the equities with a 24.7% return, under the assumptions illustrated in the previous chapters 4 and 5, result as follows:

- Furnas /Odebrecht Solution:
  - 45 $/MWh in Local Currency
  - 10 $/MWh in Foreign Currency
  - Total 55 $/MWh
- Alternative 1:
  - 41 $/MWh in Local Currency
  - 8 $/MWh in Foreign Currency
  - Total 49 $/MWh (89% of the Furnas /Odebrecht Solution)
- Alternative 2:
  - 40.5 $/MWh in Local Currency
  - 7 $/MWh in Foreign Currency
  - Total 47.5 $/MWh (86% of the Furnas /Odebrecht Solution)

Provided the implementation schedule remain the same,, it can be concluded that the tariff reductions which can be achieved by an alternative arrangement will essentially match the differences in the implementation costs.

6.5 Sensitivity Analyses

Sensitivity analyses were carried out for the Furnas / Odebrecht Solution to assess the financial feasibility of the project under different worse case scenarios. The following cases were studied:

- 10% increase of the implementation cost

- One year longer construction period
- Two months interval in the commissioning of the units
- Higher interest rates of the financing.

In all cases, it was assumed that a minimum 24.7% interest on the equities will be required, as obtained in the basic analysis. The analysis determined the tariff needed to achieve this minimum interest. Results are as follows:

- Base Case. Tariff required:
  - 45 $/MWh in Local Currency
  - 10 $/MWh in Foreign Currency
  - Total 55 $/MWh
- 10% increase of the implementation cost. Tariff required:
  - 51 $/MWh in Local Currency
  - 10 $/MWh in Foreign Currency
  - Total 61 $/MWh (111% of the Base Case)
- One year longer construction period. Tariff required:
  - 57 $/MWh in Local Currency
  - 10 $/MWh in Foreign Currency
  - Total 67 $/MWh (122% of the Base Case)
- Two months interval in the commissioning of the units. Tariff required:
  - 53 $/MWh in Local Currency
  - 9 $/MWh in Foreign Currency
  - Total 62 $/MWh (113% of the Base Case)
- Higher interest rates of the financing: rates assumed are 25% on Local Currency and 15% on Foreign Currency. Tariff required:
  - 48 $/MWh in Local Currency
  - 10 $/MWh in Foreign Currency
  - Total 58 $/MWh (106% of the Base Case)

This analysis indicates that the most critical issue for the financial feasibility of the project will be actually achieving the intended schedule for the initial commissioning of the first units. This appears more important than some limited increase of the implementation costs, or a slower pace for the installation of the units. A moderate increase of the interest rates of the loans seems to have the least impact on the financial feasibility.

Annex 1

Detailed Cost Estimate of Civil Works

Contents

FOREWORD

1 General

This report deals with the cost estimate of the civil works for the construction of the Santo Antonio Hydropower Project belonging to the Rio Madeira Hydropower Development.

Santo Antonio Project is located along the Madeira River in the federal State of Rondonia approximately 10 km upstream of Porto Velho town.

2 Construction Type Contract

The civil works cost estimate has been based on FIDIC standard contract for competitive tenders including the following key conditions:

- Advance payment: 10% of the Contract Price;
- Retention money: 10% of the Contract Price up to 50% of payments, 5% on the remaining 50%;
- Release of retention money: against bank guarantee;
- Liquidated damages: max. amount 10% of Contract Price;
- Price escalation: provisions for adjustment covering labour and main materials.

3 Structure of the Cost Estimate

The Civil works cost estimate is composed of seven sections as follows:

Section I	Basic Costs of Labour and Materials
Section II	Construction Equipment Rates
Section III	Construction Time Schedule
Section IV	Construction Methods
Section V	Unit Price Analyses:

- Part 1 – Topsoil Removal and Stockpiling
- Part 2 – Common Excavation and Dredging
- Part 3 – Rock Excavation
- Part 4 – Protection of Excavation Surfaces
- Part 5 – Auxiliary Cofferdam Removal
- Part 6 – Fills and Backfills
- Part 7 – Concrete Aggregates
- Part 8 – Concrete Works

Section VI	Price List
Section VII	Bill of Quantities

4 Rates of Exchange

The Cost Estimate has been worked out during the months of November and December 2006 on the ground of the basic costs related to labour, materials and construction equipment that have been investigated mainly in November 2006.

The detailed price analyses of Section V have been elaborated in United States Dollars considering the rate of exchange prevailing in mid November 2006 that was 1 US$ = 2.10 R$.

5 Rates of Exchange

The construction costs related to the civil works are detailed in the Bill of Quantities of Section VI.

6 Costs not Included in the Estimate

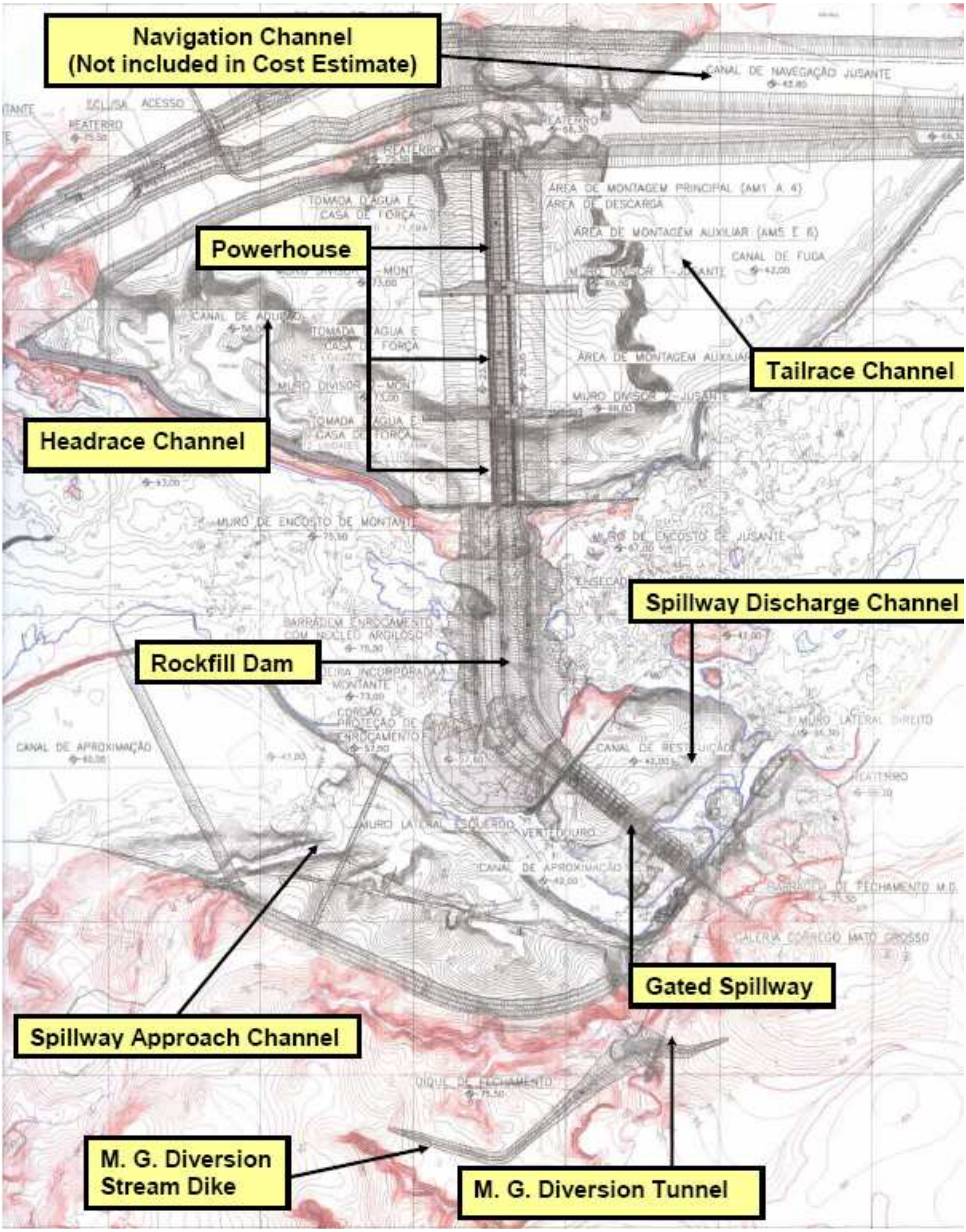
The cost estimate does not include the following costs:

a) All the costs listed in Item 10 of the Original Bill of Quantities included in the feasibility report dated October 2005 (land acquisition, environments, resettlement etc.);
b) Physical contingencies;
c) Contract administration;
d) Interests during construction;
e) Price escalation.

7 Layout of the Project

The general layout of Santo Antonio Project with the indications of the major works to be done is shown on the Figure 1.

Figure 1 – Project Layout



SECTION I

BASIC COSTS OF LABOUR & MATERIALS

1 General

Section I of the cost estimate includes the labour wages, the basic costs of materials both local and imported and the electric power that have been included in the detailed analyses for obtaining the unit prices related to the main items of the civil works that are included in Section V.

2 Labour Wages

The local labour wages have been investigated in Brazil during the months of November 2006 and prevailing for the construction of the main infrastructures in the Country.

The wages are inclusive of the additional burdens such as social lows, overtime, night shift differential, leave, site allowance, bonuses and extra compensations for working outside of the states where the high qualified workers are recruited for the execution of the Works.

The cost estimate has been elaborated assuming that:

a) The semiskilled, the unskilled and part of skilled labour necessary for the construction activities will be mainly local, i.e. recruited from Porto Velho town and from the surrounding villages; and

b) The foremen, the specialists and part of skilled labour are recruited off the Site, i.e. from the developed federal states of the Country and in particular from south-east area of Brazil.

For the personnel recruited outside the work-site area has been considered an extra compensation applied to all the foremen, all the specialists and part of the skilled labour employed at the Site.

The time of the workers considered in the price analyses is in general ten percent additional to the time established for the construction equipment involved for the specific activities in order to take the actual time to be paid by the contractor for the execution of the works into account.

3 Materials

The construction materials to be purchased for the Project have been considered mainly supplied from the local market except for those to be imported from foreign markets being not manufactured in the Country.

The main local materials include Portland cement, fuels, lubricants, reinforcing steel bars, welded wire fabric, anchor bars, rock bolts, steel shapes, lumber, plywood, steel formworks, steel scaffoldings, explosives, and all the materials for the finishing works.

The main materials to be purchased abroad include drilling tools i.e. adaptor shanks, rods, couplings, rock bits, integral drill steels, breaker tools and other similar consumable goods.

Most of the basic costs concerning the materials have been investigated by means of Faxes that have been sent to the main companies or representatives operating in the Country asking quotations normally applied to contractors involved in the construction of large projects.

Where possible the local basic prices obtained with the direct inquiry have been compared with those published by PINI bulletin of Brazil.

The cost of loading, freight, inland transportation to the Site including insurance premium, duties and taxes have been added to the ex-factory costs of each item in order to obtain the on Site cost.

The burden for losses that occurs during transport and handling of some goods has been considered in percentage of the cost and included in the material price list.

4 Electric Power

The rate of electric power is that currently applied by the utility in Porto Velho for industrial use.

5 Annexed Tables

The labour wages are listed in Table BC-1 (1 Sheet) which follows.

The basic costs of local and imported materials are listed in Tables BC-2 (5 Sheets) which follow.

RIO MADEIRA HYDROPOWE D. - SANTO ANTONIO HYDROELECTRIC PROJECT ***TABLE BC-1***
CIVIL WORKS COST ESTIMATE
BASIC COSTS - LABOUR WAGES

Item	Description	Curren.	Cost		Cost per Hour in US$ Equival.
			Per Day (8 hrs)	Per Hour	
1	**LABOUR WAGES**				
1.1	**Average Rates in Force in Brazil**				
1.1.1	Foreman	R$	164.00	20.50	9.76
1.1.2	Operator of heavy equipment	do	113.00	14.13	6.73
1.1.3	Specialist (welder, mechanic, explosive s. etc.)	do	80.00	10.00	4.76
1.1.4	Skilled (carpenter, mason, re-steel w., etc)	do	64.00	8.00	3.81
1.1.5	Driver of cars and light equipment	do	50.00	6.25	2.98
1.1.6	Semiskilled	do	38.00	4.75	2.26
1.1.7	Unskilled	do	30.00	3.75	1.79
1.2	**Extra Over on Average Ratesof Item 1.1 for Working at the Santo Antonio Project**				%
1.2.1	Foreman	R$	49.20	6.15	30%
1.2.2	Operator of heavy equipment	do	33.90	4.24	30%
1.2.3	Specialist (welder, mechanic etc.)	do	24.00	3.00	30%
1.2.4	Skilled (carpenter, mason, re-steel w., etc)	do	16.00	2.00	25%
1.2.5	Driver of cars and light equipment	do	10.00	1.25	20%
1.2.6	Semiskilled	do	----	----	----
1.2.7	Unskilled	do	----	----	----
1.3	**Average Rates for Santo Antonio Project**				
1.3.1	Foreman	R$	198.44	24.81	11.81
1.3.2	Operator of heavy equipment	do	136.73	17.09	8.14
1.3.3	Specialist (welder, mechanic, blaster etc.)	do	96.80	12.10	5.76
1.3.4	Skilled	do	75.20	9.40	4.48
1.3.5	Driver of cars and light equipment	do	57.00	7.13	3.39
1.3.6	Semiskilled	do	38.00	4.75	2.26
1.3.7	Unskilled	do	30.00	3.75	1.79

RIO MADEIRA HYDROPOWER D. - SANTO ANTONIO HYDROELECTRIC PROJECT ***TABLE BC-2***
CIVIL WORKS COST ESTIMATE
BASIC COSTS - MATERIALS AND ELECTRIC POWER

Item	Description	Unit	Source or deliv. place	R$ Ex- w. Cost	R$ Tran- sport	R$ T. & H. Losses	R$ Total Cost	Cost in US$ Equiv.
1	**LOCAL MATERIALS**							
1.1	**Fuels and Lubricants**							
1.1.01	Diesel oil	Lit	Site	----	----	----	2.00	0.95
1.1.02	Gasoline	Lit	do	----	----	----	2.70	1.29
1.1.03	Lubricant for diesel engine	kg	do	----	----	----	5.80	2.76
1.1.04	Lubricant for gasoline engine	kg	do	----	----	----	9.50	4.52
1.1.05	Lubricant for gear & transmissions	kg	do	----	----	----	7.02	3.34
1.1.06	Hydraulic oil	kg	do	----	----	----	5.65	2.69
1.1.07	Break fluid	kg	do	----	----	----	14.30	6.81
1.1.08	Grease, litium base type	kg	do	----	----	----	9.50	4.52
1.2	**Cementitious Materials**							
1.2.01	Portland cement CP II Z 32 type and CP IV 32 RS from Capanamena cement factory:							
	a) Normal bags of 50 kg each	t	Capanamena	172.854	101.97	10.99	285.82	136.10
	b) 1.5 t plastic bags excluding cost of bags	t	do	150.909	86.28	3.56	240.75	114.64
1.2.02	Portland cement CP II Z 32 type from Itaituba cement factory:							
	a) Normal bags of 50 kg each	t	Itaituba	208.263	57.55	10.63	276.45	131.64
	b) 1.5 t plastic bags excluding cost of bags	t	do	169.774	48.70	3.28	221.75	105.59
1.2.03	Portland cement CP II Z 32 type from Manaus cement factory:							
	a) Normal bags of 50 kg each	t	Manaus	205.337	26.60	9.28	241.21	114.86
	b) 1.5 t plastic bags excluding cost of bags	t	do	198.209	22.51	3.31	224.03	106.68
1.2.04	Portland cement CPII E32 type, in 50 kg bags	t	S. Paulo	179.20	820.00	39.97	1'039.17	494.84
1.2.05	High strenght cement (ARI)	t	B. Horizonte	180.80	820.00	40.03	1'040.83	495.63
1.2.06	Natural pozzolan in 1.5 t bag (excl. bag cost)	t	Pessoa	65.00	140.00	4.10	209.10	99.57
1.2.07	Silica activa	t	----	----	----	----	----	—
1.3	**Concrete Admixtures**							-
1.3.01	Water-reducing admixture	kg	S.Paulo	2.42	0.84	0.065	3.32	1.58
								-
1.3.02	Water-reducing retarding admixture	kg	do	2.55	0.84	0.068	3.46	1.65

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT ***TABLE BC-2***
CIVIL WORKS COST ESTIMATE
BASIC COSTS - MATERIALS AND ELECTRIC POWER

Item	Description	Unit	Source or deliv. place	R$ Ex- w. Cost	R$ Tran- sport	R$ T. & H. Losses	R$ Total Cost	Cost in US$ Equiv.
	LOCAL MATERIALS (CONT.D)							
1.3.03	Superplasticizer admixture	kg	S.Paulo	1.85	0.84	0.054	2.74	1.31
1.3.04	Retarding admixture	kg	do	4.28	0.84	0.102	5.22	2.49
1.3.05	Shotcrete quick set admixture	kg	do	1.60	0.84	0.049	2.49	1.19
1.4	**Steel Items**							
1.4.01	Reinforcing steel, 12 mm dia., type CA-25	kg	S. Paolo	2.51	0.84	----	3.35	1.60
1.4.02	Reinforcing steel, 20 mm dia., type CA-50	kg	do	2.69	0.84	----	3.53	1.68
1.4.03	Reinforcing steel, 6 mm dia., type CA-60	kg	do	3.33	0.84	----	4.17	1.99
1.4.04	Reinforcing steel, prestress concrete type	kg	do	5.01	0.84	----	5.85	2.79
1.4.05	Welded wire fabric, 150x150x5 mm mesh	kg	do	4.98	0.84	----	5.82	2.77
1.4.06	Steel plates, from 3 to 10 mm thickness	kg	do	4.86	0.84	----	5.70	2.71
1.4.07	Steel plates, from 10 to 25 mm thickness	kg	do	3.00	0.84	----	3.84	1.83
1.4.08	Steel beams, 150-300 m shape heigth	kg	do	3.27	0.84	----	4.11	1.96
1.4.09	Steel conventional shapes (L, T, Z etc.)	kg	do	5.13	0.84	----	5.97	2.84
1.4.10	Black steel pipes (3/4 -1 1/2" size)	kg	do	5.92	0.84	----	6.76	3.22
1.4.11	Black steel pipes (2"-6" size)	kg	do	5.22	0.84	----	6.06	2.89
1.4.12	Galvanized steel pipes (1"-1 1/2" dia.)	kg	do	7.86	0.84	----	8.70	4.14
1.4.13	Galvanized steel pipes (2"-3" dia.)	kg	do	6.94	0.84	----	7.78	3.70
1.4.14	Black wire (0.8-1.5 mm dia)	kg	do	3.80	0.84	----	4.64	2.21
1.4.15	Nails for wooden forworks	kg	do	4.00	0.84	----	4.84	2.30
1.4.16	Rock bolt, 26.5 mm dia.	m	do	28.10	3.80	----	31.90	15.19
1.4.17	Anchor bars (dowel), 32 mm dia.	m	do	17.04	5.27	----	22.31	10.62
1.4.18	Tendon, capacity 30 t, length 15 m	ea	do	346.50	48.51	----	395.01	188.10
1.4.19	Tendon, capacity 60 t, length 20 m	ea	do	630.00	88.20	----	718.20	342.00

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE BC-2*
CIVIL WORKS COST ESTIMATE
BASIC COSTS - LOCAL MATERIALS

Item	Description	Unit	Source or deliv. place	R$ Ex- w. Cost	Tran- sport	T. & H. Losses	Total Cost	Cost in US$ Equiv.
	LOCAL MATERIALS (CONT.D)							
1.4.20	Steel scaffolding, pipe	m	S. Paulo	10.20	2.55	---	12.75	6.07
1.4.21	Steel scaffolding, joint	ea	do	9.37	2.34	---	11.71	5.58
1.4.22	Steel scaffolding, connection	ea	do	4.14	1.04	---	5.18	2.46
1.4.23	Steel scaffolding, base	ea	do	5.33	1.33	---	6.66	3.17
1.4.24	Steel formworks for mass concrete	kg	do	1'294	134.40	---	1'428.40	680.19
1.4.27	Steel formworks for structural concrete	kg	do	701	76.00	---	777.00	370.00
1.5	**Explosives and Accessories**							
1.5.01	Explosive, emulsion type NPGEL E. 2"x24"	kg	B. Horizonte	3.68	0.50	----	4.18	1.99
1.5.02	Explosive, emulsion type NPGEL E. 1"x24"	kg	do	3.99	0.50	----	4.49	2.14
1.5.03	Explosive, emulsion type NPGEL AL. 2"x24"	kg	do	3.49	0.50	----	3.99	1.90
1.5.04	Explosive, emulsion type NPGEL AL. 1"x24"	kg	do	3.68	0.50	----	4.18	1.99
1.5.05	Explosive, emulsion type NPGEL BR. 2"x24"	kg	do	3.15	0.50	----	3.65	1.74
1.5.06	Explosive, emulsion type NPGEL BR. 1"x24"	kg	do	3.36	0.50	----	3.86	1.84
1.5.07	Explosive, ANFO	kg	do	2.10	0.50	----	2.60	1.24
1.5.08	Detonating fuse NP-10	m	do	0.63	0.01	----	0.64	0.30
1.5.09	Detonating fuse NP-05	m	do	0.58	0.01	----	0.59	0.28
1.5.10	Low burning fuse	m	do	0.70	0.01	----	0.71	0.34
1.5.11	Delays for detonatong fuse	ea	do	8.00	0.02	----	8.02	3.82
1.5.12	Ordinary detonators	ea	do	0.50	0.01	----	0.51	0.24
1.5.13	Detonator with 5 m connector to det. fuse	ea	do	7.00	0.02	----	7.02	3.34
1.6	**Wooden Materials**							
1.6.01	Lumber for formworks, sawn planks	m^3	Site	----	----	----	320.00	152.38
1.6.02	Lumber for formworks, planed planks	m^3	do	----	----	----	385.00	183.33

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT ***TABLE BC-2***
CIVIL WORKS COST ESTIMATE
BASIC COSTS - LOCAL MATERIALS

Item	Description	Unit	Source or deliv. place	R$ Ex- w. Cost	Tran- sport	T. & H. Losses	Total Cost	Cost in US$ Equiv.
	LOCAL MATERIALS (CONT.D)							
1.6.03	Lumber for formworks, sawn squares	m^3	Site	----	----	----	380.00	180.95
1.6.04	Plywood for formworks, 12 mm thick	m^2	do	----	----	----	27.70	13.19
1.6.05	Plywood for formworks, 20 mm thick	m^2	do	----	----	----	36.90	17.57
1.6.06	Resin treated wooden formworks, dimensions 1.10 x 2.20 m, thickness 21 mm	ea	S. Paulo	44.60	13.38	----	57.98	27.61
1.6.07	Wooden formworks (Naval type), dimensions 1.60x2.20 m, thickness 20 mm	ea	do	99.10	29.73	----	128.83	61.35
1.7	**Miscellaneous Materials**							
1.7.01	PVC waterstop, width 220 mm	m	S. Paolo	7.40	0.37	---	7.77	3.70
1.7.02	PVC waterstop, width 250 mm	m	do	8.40	0.42	---	8.82	4.20
1.7.03	PVC waterstop, width 300 mm	m	do	13.10	0.66	---	13.76	6.55
1.7.04	Formwork bond-break emulsion	kg	do	6.55	0.84	---	7.39	3.52
1.7.05	Rubber hoses 3/4" diameter	m	do	6.90	1.04	---	7.94	3.78
1.7.06	Rubber hoses 1" diameter	m	do	8.80	1.32	---	10.12	4.82
1.7.07	Rubber hoses 1-1/2" diameter	m	do	18.70	2.81	---	21.51	10.24
1.7.08	Rubber hoses 2" diameter	m	do	23.80	3.57	---	27.37	13.03
1.7.09	Reinforced concrete pipes, 50 cm dia.	m	Site	---	---	---	38.70	18.43
1.7.10	Reinforced concrete pipes, 80 cm dia.	m	do	---	---	---	81.90	39.00
1.7.11	Reinforced concrete pipes, 100 cm dia.	m	do	---	---	---	112.50	53.57
1.7.12	Non-shink mortar for rock bolt	kg	S. Paulo	2.73	0.84	0.071	3.64	1.73
1.7.13	Plastic bags for cement, 2 t max. capacity	ea	do	472.65	94.50	---	567.15	270.07
1.7.14	Rigid plastic pipes for explosive charging	m	do	12.30	2.80	---	15.10	7.19
2	**ELECTRIC POWER**							
2.1	Electric power at Porto Velho switchyard	Kwh	Porto Velho	---	---	---	0.223	0.106

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT ***TABLE BC-2***
CIVIL WORKS COST ESTIMATE
BASIC COSTS - MATERIALS AND ELECTRIC POWER

Item	Description	Unit	Source	Cost (US$) CIF Cost	Transp. to Site	Duties & Taxes	Total Cost
3	**IMPORTED MATERIALS**						
3.1	**Rock Tools**						
3.1.01	Integral drill steel, 800 mm	ea	Sweden	68.00	3.40	24.28	95.68
3.1.02	Integral drill steel, 1600 mm	ea	do	79.00	3.95	28.20	111.15
3.1.03	Integral drill steel, 2400 mm	ea	do	91.00	4.55	32.49	128.04
3.1.04	Integral drill steel, 3200 mm	ea	do	103.00	5.15	36.77	144.92
3.1.05	Integral drill steel, 4000 mm	ea	do	170.00	8.50	60.69	239.19
3.1.06	Hand held breaker standard moil point	ea	do	22.00	1.10	7.85	30.95
3.1.07	Track drill rod, 3660 x 44 mm	ea	do	374.00	11.22	131	516.19
3.1.08	Shank adapter for ditto	ea	do	340.00	10.20	119	469.27
3.1.09	Coupling for ditto	ea	do	96.00	2.88	34	132.50
3.1.10	Track drill rod, 3660 x 37 mm	ea	do	316.00	9.48	111	436.14
3.1.11	Shank adaptor for ditto	ea	do	287.00	8.61	101	396.12
3.1.12	Coupling for ditto	ea	do	81.00	2.43	28	111.80
3.1.13	Wagon drill rod, 4915 x 37 mm	ea	do	444.00	13.32	155	612.81
3.1.14	Shank adaptor for ditto	ea	do	287.00	8.61	101	396.12
3.1.15	Button type rock bit, 50 mm dia.	ea	do	118.00	3.54	41	162.86
3.1.16	Button type rock bit, 64 mm dia.	ea	do	167.00	5.01	58	230.49
3.1.17	Button type rock bit, 76 mm dia.	ea	do	214.00	6.42	75	295.36
3.1.18	Button type rock bit, 89 mm dia.	ea	do	267.00	8.01	94	368.51
3.1.19	Button type rock bit, 102 mm dia.	ea	do	325.00	9.75	114	448.57

SECTION II

CONSTRUCTION EQUIPMENT RATES

1 Determination of the Rates

The rates of the construction equipment have been established by means of a computerized program which takes the following factors into account: ex-factory cost, freight cost, resale value, estimated hours of life, estimated hours of total use, estimated hours of use on Site, repairs and maintenance, mechanical availability, condition of roads, abrasion degree of the soil and other specific data which can affect the cost of the specific equipment.

Depreciation and interest on investment and insurance have been included in the owning costs. Repairs, fuel, lubricants, electric power, specific wear items and other minor items such as filters, batteries, grease, tires, and tire repair have been included in the operating costs.

Minor costs for installation and dismantling costs have been included in the hourly rates. The major costs for installation and dismantling (aggregate processing plants, batching/mixing plants etc.) have been analyzed separately and included in the fixed costs of the equipment.

The depreciation was calculated according to the straight- line method for the economic life of the different equipment, leaving a residual amount (i.e. resale salvage value) for some units according to the total life established for the depreciation and the hours of work foreseen for the Site.

Interest and insurance, applied against owner's average capital cost, have been calculated with an annual rate equal to 18.5% and 1.5% respectively.

The rates of equipment have been divided into two groups, i.e. rates for mobile units and rates for stationary/dedicated units. The first group includes the units that can be used in all work sections; the second group includes the units that are dedicated to specific work sections for long times (months and/or years).

The hourly owning costs of the mobile units has been tabulated separately from the total hourly costs (i.e. owning plus operating costs) in order to take the cost for the reserve units that have to be kept on Site into account for avoiding delay of the construction activities.

The rates of stationary/dedicated units have been divided into two components, i.e. owning and operating costs with the owning costs calculated per month and the operating ones calculated per hour. The owning rates are inclusive of the cost for the availability on Site of the recommended spare parts that the contractor has to keep in the stores in order to assure a continuous service of the units.

The rate of some earthmoving unit has been calculated both for average and severe working conditions for a better tuning of the costs to the actual work conditions.

2 Annexed Tables

The construction equipment rates are listed in Table ER-1 which follows (6 Sheets).

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***

CIVIL WORKS COST ESTIMATE

CONSTRUCTION EQUIPMENT RATES

Item	Description	O/R (1)	O.C. (A or S) (2)	Hourly Cost L.C.P (US$ equiv.)	F.C.P. (US$)	Aggregate Cost (US$)
1	**MOBILE EQUIPMENT**					
1.1	**Bulldozers**					
1.1.01	Bulldozer, 52 kW nominal power	O	A	44.80		44.80
		R		22.18		22.18
1.1.02	Bulldozer, 86 kW nominal power	O	A	58.33		58.33
		R		26.33		26.33
1.1.03	Bulldozer, 149 kW nominal power	O	A	89.80		89.80
		R		37.34		37.34
1.1.04	Bulldozer, 149 kW nominal power	O	S	107.76		107.76
		R		44.81		44.81
1.1.05	Bulldozer, 231 kW nominal power	O	A	126.61		126.61
		R		49.71		49.71
1.1.06	Bulldozer, 231 kW nominal power	O	S	157.40		157.40
		R		60.10		60.10
1.2	**Wheel Loaders**					
1.2.01	Wheel loader, 67 kW, 1.3 m3 heaped bucket	O	A	42.66	112.58	155.24
		R		22.50	64.82	87.32
1.2.02	Wheel loader, 161 kW, 2.9 m3 heaped bucket	O	A	66.49		66.49
		R		32.52		32.52
1.2.03	Wheel loader, 229 kW, 4.2 m3 heaped bucket	O	A	50.23	43.99	94.22
		R		15.84	25.15	40.99
1.2.04	Wheel loader, 354 kW, 6.60 m3 heaped bucket	O	A	87.17	82.58	169.75
		R		30.38	48.38	78.76
1.2.05	Wheel loader, 468 kW, 8.90 m3 heaped bucket	O	A	116.86	112.58	229.44
		R		40.63	64.82	105.45
1.3	**Hydraulic Backhoes and Front Shovels**					
1.3.01	Hydraulic backhoe, 67 kW, 0.40 m3 heaped bucket	O	A	38.14	112.58	150.72
		R		21.22	64.82	86.04
1.3.02	Hydraulic backhoe, 103 kW, 1.50 m3 heaped bucket	O	A	58.07		58.07
		R		27.63		27.63
1.3.03	Hydraulic backhoe, 200 kW, 2.55 m3 heaped bucket	O	A	91.71		91.71
		R		38.51		38.51
1.3.04	Hydraulic backhoe, 257 kW, 3.2 m3 heaped bucket	O	A	71.29	40.56	111.85
		R		16.70	27.61	44.31
1.3.05	Hydraulic backhoe, 257 kW, 3.2 m3 heaped bucket	O	S	79.40	45.30	124.70
		R		18.90	30.57	49.47
1.3.06	Hydraulic backhoe, 382 kW, 5.8 m3 heaped bucket	O	A	128.92	65.55	194.47
		R		31.06	44.69	75.75
1.3.07	Hydraulic backhoe, 382 kW, 5.8 m3 heaped bucket	O	S	148.48	74.70	223.18
		R		35.10	30.95	66.05
1.3.08	Hydraulic front shovel, 260 kW, 4.3 m3 heaped bucket	O	A	80.84	62.27	143.11
		R		26.06	43.26	69.32
1.3.09	Hydraulic front shovel, 260 kW, 4.3 m3 heaped bucket	O	S	92.97	71.61	164.58
		R		29.96	49.75	79.71
	O = Operating unit					
	R = Reserve unit					
	Operating conditions (O.C.): A=Average, S=Severe					

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***
CIVIL WORKS COST ESTIMATE
CONSTRUCTION EQUIPMENT RATES

Item	Description	O/R (1)	O.C. (A or S) (2)	Hourly Cost L.C.P US$ equiv.)	Hourly Cost F.C.P. (US$)	Aggregate Cost (US$)
	MOBILE EQUIPMENT (CONT.D)					
1.3.10	Hydraulic front shovel, 390 kW, 5.7 m3 heaped bucket	O	A	106.81	80.15	186.96
		R		34.34	56.99	91.33
1.3.11	Hydraulic front shovel, 390 kW, 5.7 m3 heaped bucket	O	S	122.83	92.17	215.00
		R		39.49	65.54	105.03
1.4	**Rear Tipper and Dumpers**					
1.4.01	Rear tipper with rock body, 28.0 t pay load	O	A	62.49		62.487
		R		18.75		18.747
1.4.02	Rear dumper, 37.3 ton pay load	O	A	65.37	53.83	119.2
		R		20.21	32.45	52.66
1.4.03	Rear dumper, 37.3 ton pay load	O	S	71.90	59.21	131.11
		R		22.23	35.69	57.92
1.4.04	Rear dumper, 63.5 ton pay load	O	A	100.64	80.60	181.24
		R		33.71	50.86	84.57
1.4.05	Rear dumper, 63.5 ton pay load	O	S	110.78	88.66	199.44
		R		37.08	55.95	93.03
1.4.06	Rear dumper, 90.9 ton pay load	O	A	119.00	94.66	213.66
		R		40.59	56.50	97.09
1.4.07	Rear dumper, 90.9 ton pay load	O	S	130.90	104.13	235.03
		R		44.65	62.15	106.8
1.5	**Trucks and Trailers**					
1.5.01	Flat bed truck with hydraulic crane, 15 t pay load	O	A	39.20		39.2
		R		14.72		14.72
1.5.02	Flat bed truck, 25 t pay load	O	A	52.85		52.85
		R		19.76		19.76
1.5.03	Truck with bi-train, 330 kW, 57 t pay load	O	A	79.77		79.77
		R		22.38		22.38
1.5.04	Truck mounted water tank, 330 kW, 20 m3 capacity	O	A	58.51		58.51
		R		24.71		24.71
1.5.05	Semi-trailer truck with water s.tank, 560 kW, 45 m3 cap.	O	A	65.58	52.53	118.11
		R		27.92	22.35	50.27
1.5.06	Trailer, 70 t capacity, 330 kW truck	O	A	95.12		95.12
		R		31.16		31.16
1.6	**Motorgraders**					
1.6.01	Motorgrader, 138 kW nominal power	O	A	66.09		66.09
		R		31.88		31.88
1.6.02	Motorgrader, 149 kW nominal power	O	A	74.36		74.36
		R		34.53		34.53
1.7	**Rollers and Compactors**					
1.7.01	Smooth drum vibrating roller, 10 840 kg, 97 kW	O	A	34.70		34.7
		R		15.24		15.24
1.7.02	Smooth drum vibrating roller, 10 840 kg, 97 kW	O	S	38.10		38.1
		R		16.55		16.55

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***
CIVIL WORKS COST ESTIMATE
CONSTRUCTION EQUIPMENT RATES

Item	Description	O/R (1)	O.C. (A or S) (2)	Hourly Cost L.C.P US$ equiv.)	Hourly Cost F.C.P. (US$)	Aggregate Cost (US$)
	MOBILE EQUIPMENT (CONT.D)					-
						-
1.7.03	Smooth drum vibrating roller, 18 600 kg, 142 kW	O	A	56.71		56.71
		R		22.62		22.62
1.7.04	Pad-foot drum vibrating roller, 11 530 kg, 97 kW	O	A	35.99		35.99
		R		16.21		16.21
1.7.05	Tandem smooth vibrating roller, 3.3 t	O	A	19.12		19.12
		R		13.50		13.50
1.7.06	Tandem smooth vibrating roller, 6.2 t	O	A	34.34		34.34
		R		22.77		22.77
1.7.07	Vibrating plate compactor, 450 kg, 7.5 kW	O	A	7.21		7.21
		R		5.63		5.63
1.7.08	Tamper (rammer), 3.0 kW	O	A	2.61		2.61
		R		1.68		1.68
1.8	**Rock Drilling Equipment**					
1.8.01	Hydraulic rubber-tired rock drill, 48 kW, holes 51-64 mm	O	A	23.81	32.02	55.83
		R		13.65	26.67	40.32
1.8.02	Hydraulic crawler rock drill, 131 kW, holes 76-89 mm	O	A	45.99	44.58	90.57
		R		21.04	55.27	76.31
1.8.03	Hydraulic crawler rock drill, 147 kW, holes 89-125 mm	O	A	51.30	51.50	102.80
		R		23.43	41.31	64.74
1.8.04	Hand-held rock drill, light weight type	O	A	0.53	1.03	1.56
		R		0.48	0.93	1.41
1.8.05	Hand-held rock drill, heavy weight type	O	A	1.30	2.54	3.84
		R		1.17	2.29	3.46
1.8.06	Hand-held breaker medium weight type	O	A	0.28	0.54	0.82
		R		0.25	0.49	0.74
1.8.07	Hand-held breaker heavy weight type	O	A	0.62	1.19	1.81
		R		0.55	1.08	1.63
1.9	**Water Pumps**					
1.9.01	Electric powered submesible water pump, 10 kW	O	A	3.72		3.72
		R		1.08		1.08
1.9.02	Electric powered submesible water pump, 20 kW	O	A	7.08		7.08
		R		2.05		2.05
1.9.03	Electric powered submesible water pump, 37 kW	O	A	13.19		13.19
		R		4.15		4.15
1.9.04	Electric powered submesible water pump, 53 kW	O	A	18.34		18.34
		R		5.62		5.62
1.9.05	Electric powered submesible water pump, 94 kW	O	A	31.59		31.59
		R		9.43		9.43
1.10	**Motorcompressors**					
1.10.01	Motorcompressor, 8.4 m3/min	O	A	21.30		21.30
		R		7.58		7.58
1.10.02	Motorcompressor, 17.0 m3/min	O	A	41.24		41.24
		R		13.96		13.96
1.10.03	Motorcompressor, 23.6 m3/min	O	A	50.12		50.12
		R		16.87		16.87

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***
CIVIL WORKS COST ESTIMATE
CONSTRUCTION EQUIPMENT RATES

Item	Description	O/R (1)	O.C. (A or S) (2)	Hourly Cost L.C.P US$ equiv.)	Hourly Cost F.C.P. (US$)	Aggregate Cost (US$)
	MOBILE EQUIPMENT (CONT.D)					
1.10.04	Electric powered air compressor, 32.9 m3/min	O	A	56.00		56.00
		R		12.43		12.43
1.11	**Concrete Equipment**					
1.11.01	Truck-mounted concrete mixer, 10.0 m3 capacity	O	A	71.76		71.76
		R		20.45		20.45
1.11.02	Truck-mounted concrete screw-agitator, 10.6 m3 cap.	O	A	36.20	29.76	65.96
		R		10.88	8.91	19.79
1.11.03	Towed concrete pump, 63 kW nominal power	O	A	35.82		35.82
		R		21.91		21.91
1.11.07	Towed concrete pump, 82 kW nominal power	O	A	28.60	21.79	50.39
		R		15.55	16.58	32.13
1.11.08	Truck mounted concrete pump, 32 m reach	O	A	81.38	103.77	185.15
		R		60.85	60.85	121.70
1.11.09	Shotcrete pump, 37 kW nominal power	O	A	17.88	19.34	37.22
		R		12.38	13.13	25.51
1.11.10	Crane mounted conveyor belt (Rotec Crater Crane model CC-200-24)	O	A	59.31	74.64	133.95
		R		42.73	61.48	104.21
1.11.11	Auger tank feeder for "Rotec Crater Crane"	O	A	7.81	6.48	14.29
		R		6.95	4.53	11.48
1.11.12	RCC hydraulic joint cutter 100 cm wide blade	O	A	14.99	11.39	26.38
		R		13.73	9.68	23.41
1.11.13	Set of four mass concrete type hydraulic vibrators	O	A	19.26	19.31	38.57
		R		13.96	16.41	30.37
1.11.14	Air powered concrete vibrator 87 mm	O	A	0.51	0.77	1.28
		R		0.35	0.69	1.04
1.11.15	Air powered concrete vibrator 107 mm	O	A	0.45	0.87	1.32
		R		0.75	0.98	1.73
1.12	**Cranes**					
1.12.01	Rought terrain crane, 18 t capacity	O	A	73.25		73.25
		R		55.78		55.78
1.12.01	Rought terrain crane, 30 t capacity	O	A	97.97		97.97
		R		64.65		64.65
1.12.01	Crawler crane, 100 t capacity	O	A	193.47		193.47
		R		134.76		134.76
1.12.01	Orage peel bucket for cranes, 2.50 m3 capacity	O	A	9.09		9.09
		R		8.28		8.28
1.12.01	Rock grapple for cranes, 1.70 m opening	O	A	3.32		3.32
		R		2.82		2.82
1.13	**Miscellaneous**					
1.13.01	Crawled rock crushing unit, 320 kW, 120 t/h capacity	O	A	78.48	46.37	124.85
		R		21.91	31.79	53.70
1.13.02	Modular type pontoon, 70 t capacity	O	A	81.96		81.96
		R		60.13		60.13

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***
CIVIL WORKS COST ESTIMATE
CONSTRUCTION EQUIPMENT RATES

Item	Description	O/R (1)	O.C. (A or S) (2)	Hourly Cost L.C.P US$ equiv.)	Hourly Cost F.C.P. (US$)	Aggregate Cost (US$)
	MOBILE EQUIPMENT (CONT.D)					
1.13.03	Self-propelled barge with tilting body, 200 t capacity	O	A	156.13		156.13
		R		84.89		84.89
1.13.04	Conventional barge with 50 kW engine	O	A	32.50		32.50
		R		12.37		12.37
1.13.05	Disel powered mobile winch, 25 t, 100 kW	O	A	417.60		417.60
		R		30.68		30.68
1.13.06	Portable diesel powered floodlight, 10 kW	O	A	9.72		9.72
		R		6.20		6.20
1.13.07	Halogen floodlight, 1000 W	O	A	0.36		0.36
		R		0.12		0.12
1.13.08	Halogen floodlight, 2000 W	O	A	0.41		0.41
		R		0.11		0.11
1.13.09	Steel bar bending and cutting machines (set)	O	A	2.96		2.96
		R		1.82		1.82
1.13.10	Button bit grinder	O	A	2.74	1.37	4.11
		R		0.81	1.28	2.09
1.13.11	Integrall drill steel grinder	O	A	3.03	1.56	4.59
		R		0.92	1.45	2.37
1.13.12	Concrete bucket, 3 m^3 capacity	O	A	2.37		2.37
		R		2.19		2.19
1.13.13	Concrete bucket, 5 m^3 capacity	O	A	3.59		3.59
		R		3.33		3.33
2	**STATIONARY / DEDICATED EQUIPMENT**					
2.01	Aggregate processing plant, 300 t/h capacity	ea.	month	124'127.0		124'127.00
			hr	328.82		328.82
2.02	Aggregate processing plant, 340 t/h capacity	ea.	month	127'448.8		127'448.78
			hr	386.43		386.43
2.03	Concrete batching/mixing plant, 240 m3/hr capacity	ea.	month	53'363.4		53'363.35
			hr	107.92		107.92
2.03	Concrete mixing plant, 370 m3/hr capacity	ea.	month	77'338.8		77'338.81
			hr	154.61		154.61
2.04	Aggregate loading system from stockpiles, 480 t/h	ea.	month	4'532.35		4'532.35
			hr	14.85		14.85
2.05	Aggregate loading system from stockpiles, 740 t/h	ea.	month	6'638.00		6'638.00
			hr	21.75		21.75
2.06	Cement bag emptier, 75 t/h capacity	ea.	month	3'593.75		3'593.75
			hr	4.25		4.25
2.07	Cement bag emptier, 110 t/h capacity	ea.	month	5'007.60		5'007.60
			hr	5.95		5.95
2.08	Ice plant, 180 t/day capacity	ea.	month	118'773.5		118'773.53
			hr	169.09		169.09
2.09	Ice plant, 275 t/day capacity	ea.	month	172'227.6		172'227.62
			hr	245.18		245.18
2.10	Chilled water plant, 6 x 810 000 kcal/h capacity	ea.	month	107'843.3		107'843.31
			hr	297.52		297.52
2.11	Chilled water plant, 9 x 810 000 kcal/h capacity	ea.	month	156'370.0		156'370.00
			hr	340.40		340.40

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT ***TABLE ER-1***
CIVIL WORKS COST ESTIMATE
CONSTRUCTION EQUIPMENT RATES

Item	Description	Unit	Month & Hour	Cost L.C.P US$ equiv.)	Cost F.C.P. (US$)	Aggregate Cost (US$)
	STATIONARY / DEDICATED EQUIPMENT (CONT.D)					
2.12	Aggregate cooling plant, 2330 kW capacity	ea.	month	85'112.2		85'112.21
			hr	199.57		199.57
2.13	Aggregate cooling plant, 3590 kW capacity	ea.	month	127'780.2		127'780.20
			hr	289.95		289.95
2.14	Tower crane, height 66 m, jib 55 m, capacity 14.8 t	ea.	month	33'011.77	51'788.38	84'800.15
			hr	58.84	46.98	105.82
2.15	Tower crane, height 47 m, jib 68 m, capacity 9.4 t	ea.	month	36'853.18	45'852.73	82'705.91
			hr	57.06	42.98	100.04
2.16	Electric powered compressor, 32.9 m3/min	ea.	month	2'289.37		2'289.37
			hr	43.57		43.57
2.17	Dredger, 600 kW installed power, 120 m3/h	ea.	month	91'489.84		91'489.84
			hr	323.38		323.38
2.18	Booster for dredger pipeline, 520 kW installed power	ea.	month	22'872.46		22'872.46
			hr	80.85		80.85
2.19	Compressed air tank, 8 m3	ea.	month	177.95		177.95
2.20	Cement silos, 320 m3, 500 t	ea.	do	2'039.95		2'039.95
2.21	Cement silos, 500 m3, 900 t	ea.	do	4'831.04		4'831.04
2.22	Steel water tank, 100 m3 capacity	ea.	do	255.21		255.21
2.23	Steel water tank, 200 m3 capacity	ea.	do	455.12		455.12
2.24	Wictaulic joint type steel pipe, 125 mm dia	m	do	0.65		0.65
2.25	Wictaulic joint type steel pipe, 200 mm dia	m	do	1.31		1.31
2.26	Wictaulic joint type steel pipe, 250 mm dia	m	do	1.83		1.83
2.27	Transformer cabin, 250 kVA	ea.	do	531.82		531.82
2.28	Transformer cabin, 500 kVA	ea.	do	764.33		764.33
2.29	Transformer cabin, 750 kVA	ea.	do	1'223.56		1'223.56
2.30	Transformer cabin, 1500 kVA	ea.	do	2'535.70		2'535.70

SECTION III

CONSTRUCTION TIME SCHEDULE

1 General

Section III of the cost estimate includes the Construction Time Schedule concerning the main construction activities related to the civil works and the permanent electromechanical equipment of Santo Antonio Project.

2 Basic Dates of the Project

The basic dates considered in the Time Schedule are the following:

a) Notice to Proceed, July 1st 2007;

b) Starting of power generation of Units from No. 1 to No. 4, June 30th 2012;

c) Works of power generation completed, March 29th 2014.

3 Mobilization

The mobilization of construction equipment (installation of motor-generator stations, installation of plants for the preliminary concretes, etc) and personnel for the execution of the preliminary works starts 10 days after the Notice to Proceed.

The mobilization of construction equipment and personnel for the execution of the main works starts in October 2007.

4 Preliminary Works

The preliminary works listed in the schedule shown include:

a) Land clearing;

b) Construction of temporary roads;

c) Construction of temporary camps and buildings;

d) Installation of electric power system;

e) Installation of the main aggregates processing and batching/mixing plants;

f) Installation of a floating bridge across the Madeira River;

g) Construction of the dock yards.

The completion of all the above listed works except for the construction of the temporary roads have been planned by the end of the year 2008.

5 Powerhouse Channels

The works for the construction of the Headrace Channel and Tailrace Channel start in January 2008 and terminate by mid Year 2010.

The construction of the Auxiliary cofferdam 7 designed for the protection of the excavations and appurtenant works of the Headrace Channel has been foreseen during the months of July, August and September 2008.

The construction of the Auxiliary cofferdam 6 designed for the protection of the excavations and appurtenant works of the Tailrace Channel has been foreseen during the months from June to September 2008.

The removal of the above mentioned auxiliary cofferdams has been planned in April, May and June 2010 when the works for the river diversion are in progress and before the time that the areas of the channels can be affected by the rising water of the reservoir.

The dredging of the mud existing in the area of the Tailrace Channel starts in August 2008 when the dikes around the disposal area to be constructed with material from required excavation are completed and end in mid April 2010.

6 Power Intakes and Generating Units

The works the construction of the Power Intakes and Generating Units start in January 2008 and terminate in March 2014, i.e. when all the generating units have been installed.

The excavations start in February 2008 and end in February 2009.

The construction of the Auxiliary cofferdam 5 designed for the protection of the excavation works along the river has been foreseen mainly during the months of July and August 2008.

The construction of the Auxiliary cofferdams 8, 9, 10 and 11 designed for the protection of the Power Intakes and Generating Units from No. 17 to No.44 when the Units from No. 1 to No.16 are in operation has been foreseen during the months from May to August 2010.

The first stage concrete has been scheduled as listed in the following table.

No.	Description	Months of Construction	
		from	to
1	Blocks of Units 1 to 4 for unloading and main erection area	12/2008	5/2009
2	Dividing walls and wall in contact with Dam	07/2009	05/2010
3	Blocks of Units 1 to 8	12/2008	06/2010
4	Blocks of Units 9 to 16 and erection area 5-6	09/2009	01/2011
5	Blocks of Units 17 to 24	05/2010	09/2011
6	Blocks of Units 25 to 32 and erection area 7-8	11/2011	06/2013
7	Blocks of Units 33 to 44	08/2011	02/2013

The backfill in contact with the concrete of the unloading and main erection area has been planned from June 2009 to April 2010.

7 Spillway Approach Channel

The excavations for the construction of the Spillway Approach Channel start in December 2007 and terminate in October 2009.

The construction of the Auxiliary cofferdams 1 and 2 designed for the protection of the works related to the channel have been foreseen during the months of January, February and March 2008.

The removal of the above mentioned auxiliary cofferdams has been foreseen early Year 2010 so that can be terminated before starting the construction of the dam cofferdams.

8 Spillway Structure

The excavations for the construction of the Spillway Structure start in December 2007 and terminate in April 2008.

The concrete works of the start in June after the drilling and grouting works and the foundation preparation and terminate at the end of May 2009. During the same period are carried out the concrete works related to the lateral walls of the Spillway.

The random backfill in contact with the right-hand side wall of the Spillway has been scheduled one month after the termination of the concrete wall.

9 Spillway Discharge Channel

The excavations in dry condition for the construction of the Spillway Discharge Channel start in February 2008 and terminate by August 2009.

The construction of the Auxiliary cofferdams 3 and 4 designed for the protection of the works related to the channel have been foreseen during the months of June, July and August 2008.

The removal of the above mentioned auxiliary cofferdams has been foreseen in the months of December 2009 and January 2010 leaving sufficient time for the execution of the rock excavation in water.

The rock excavation in water in the area where the Auxiliary cofferdams 3 and 4 have been located start in January 2010 and terminate in a three month time before starting the river diversion.

10 River Diversion and Starting of Reservoir Impounding

The river diversion has been planned to start on May 10th 2010.

The construction of the dam cofferdams start in May 2010 and terminate at the end of September 2010 period that allows the performance of the last stretch of the cofferdams (total closure of the river) in the period of low floods.

The termination of the part of the cofferdams above water is foreseen by the end of December 2010.

The closure of the Spillway gated has been planned on January 22nd 2011.

11 Rockfill Dam

The construction of the dam starts in February 2011 immediately after the completion of the cofferdams.

The works on the foundation area such as dewatering, removal of rock fragments, rock excavation, drilling and grouting, and surface preparation are planned to be completed by the end of October 2011.

The embankment works start in October 2011 and are completed in July 2012.

12 Miscellaneous Works

The Mato Grosso diversion tunnel starts in November 2007 and the concrete works terminate in January 2009 so that the waterway can be ready for operation before the commencement of the stream closure dike.

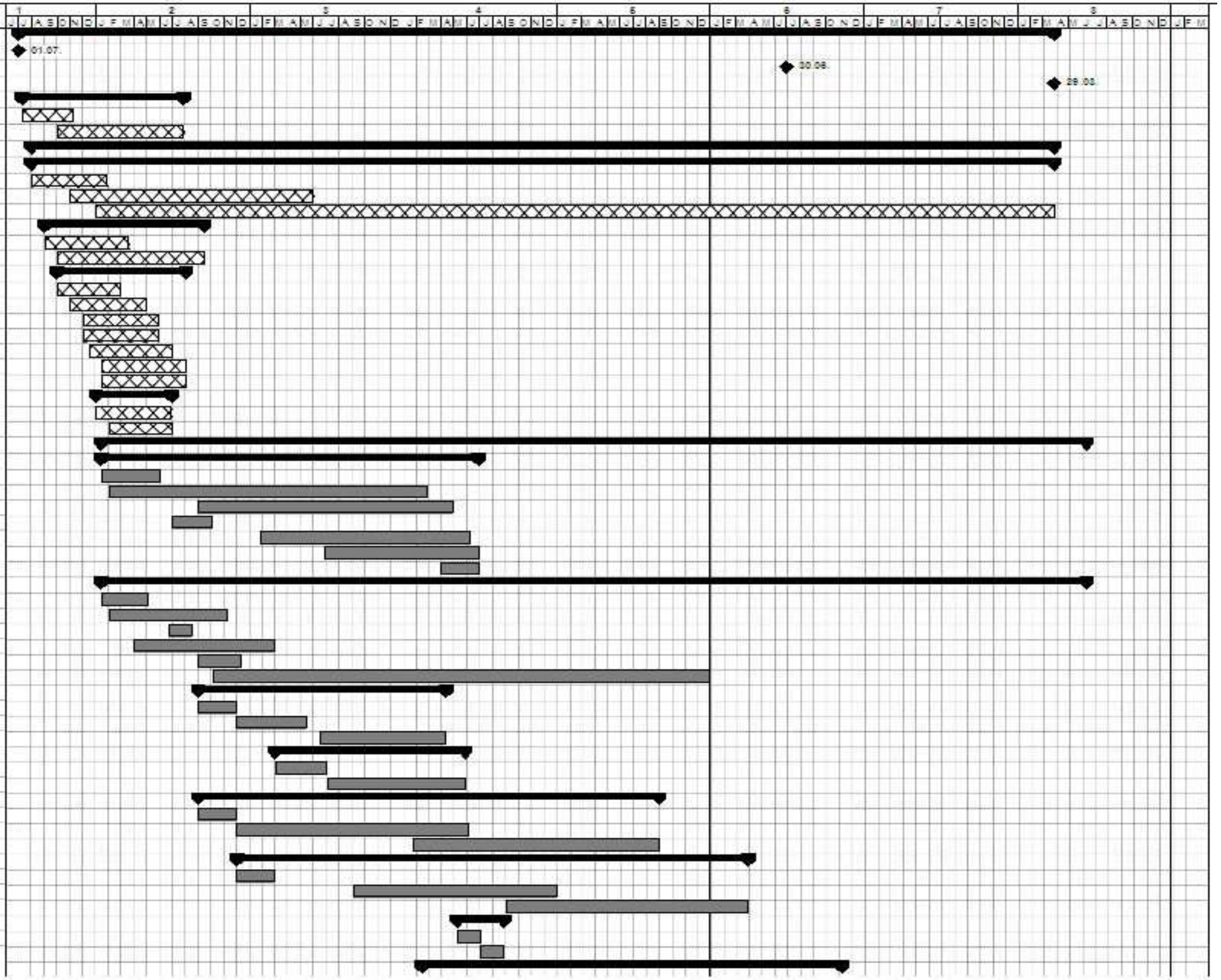
The Mato Grosso stream closure dike starts in December 2008 and ends in January 2010.

The operator's village starts in November 2007 and is completed by the end of the Year 2008 in such a way that it can be used by the Contractor during the execution of the Project works and handed over to the Employer in stages before starting the operation of the Units.

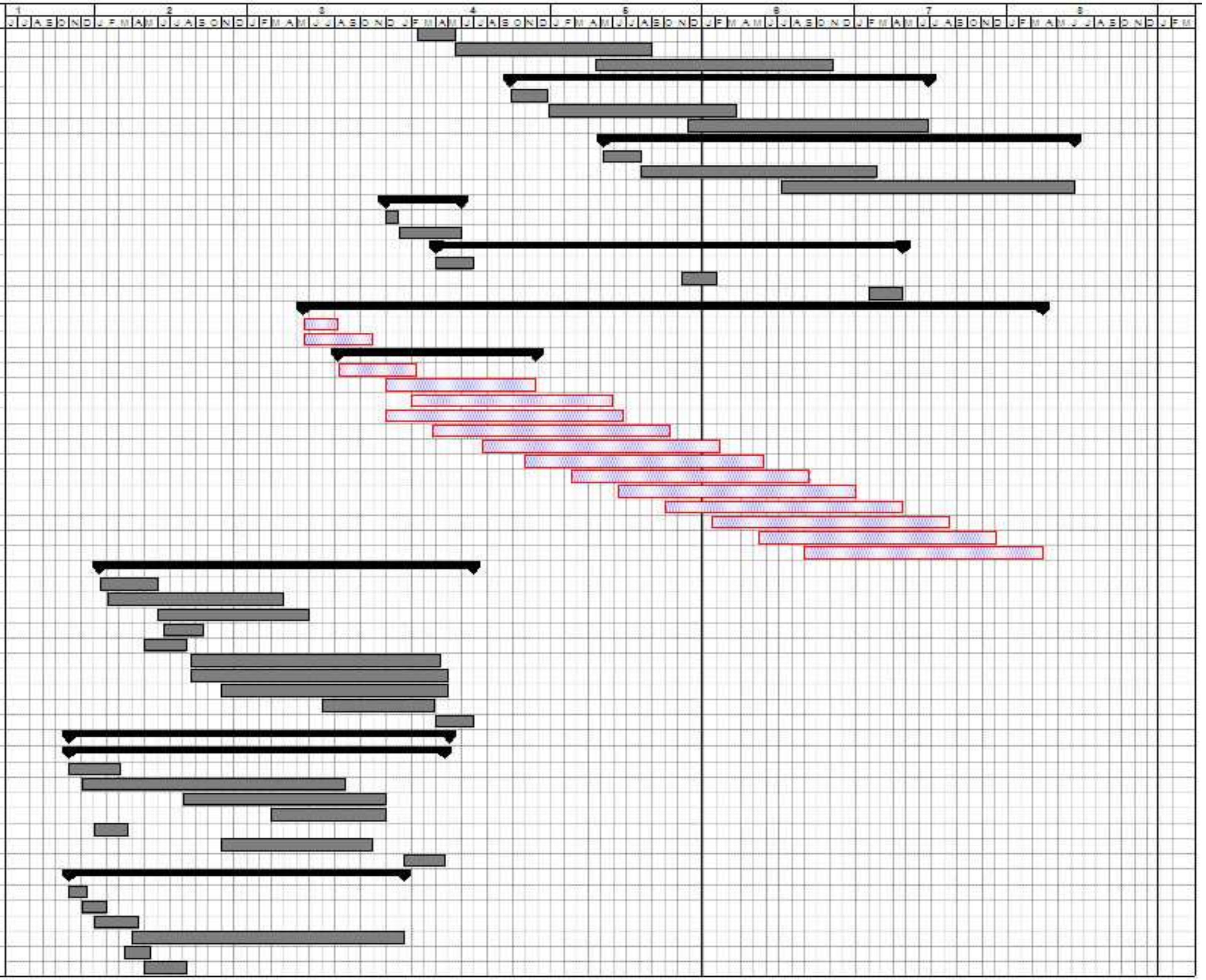
13 GANTT Schedule

The Construction Time Schedule is given in the three sheets which follow.

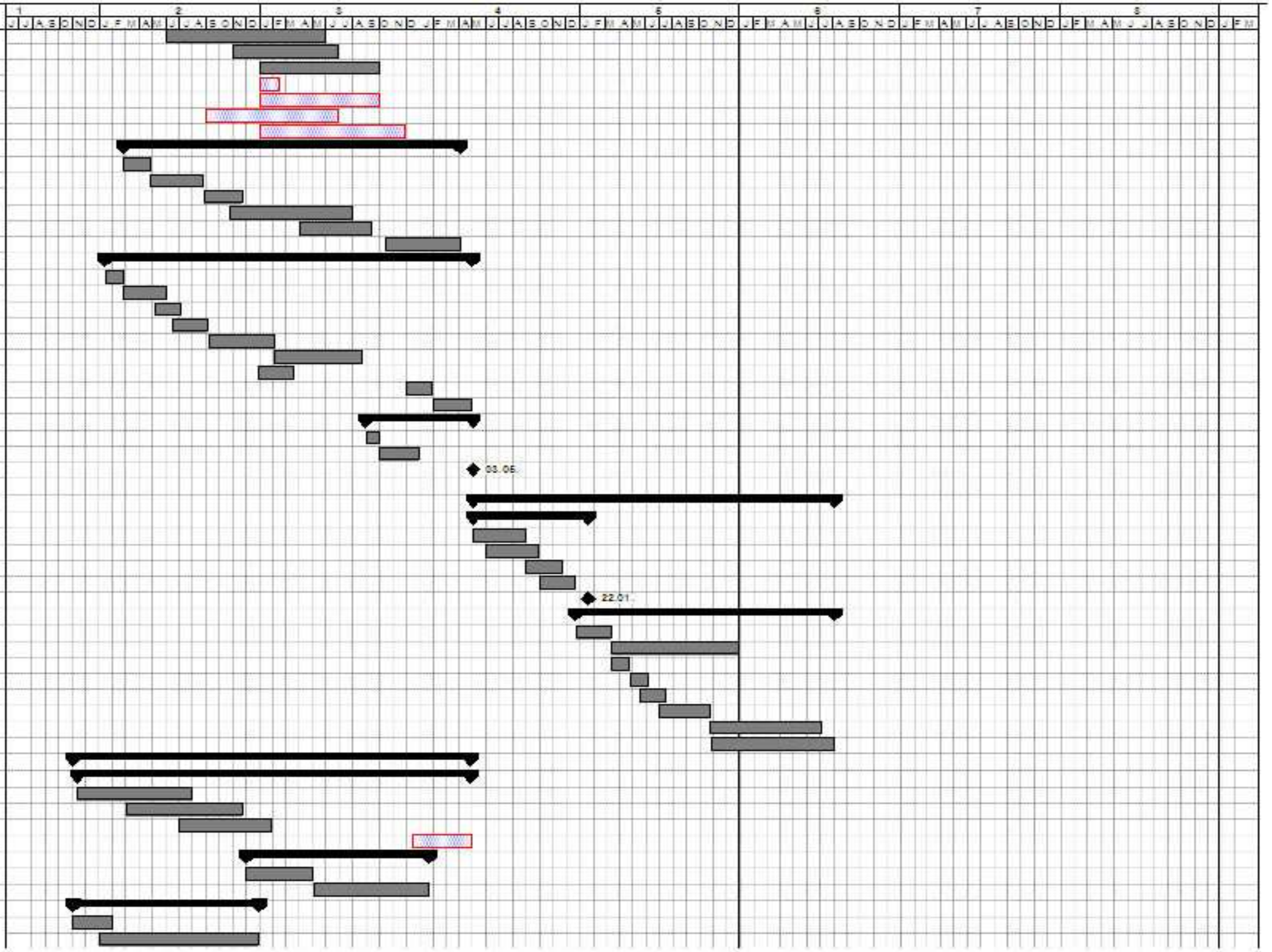
Nr.	Task Name
1	BASIC DATES OF THE PROJECT
2	Notice to Proceed
3	Starting of Power Generation Units 1 to 4
4	Works for power generation completed
5	- MOBILIZATION
6	Equipment & personnel for preliminary works
7	Equipment & personnel for main works
8	GENERAL WORKS
9	Land Clearing and Road Works
10	Land clearing
11	Construction of temporary roads
12	Maintenance of temporary roads
13	Temporary Camps and Buildings
14	Land preparation
15	Construction of camps and buildings
16	Stationary Plants
17	Erection of electric power system
18	Erection of right bank aggregate processing plant
19	Erection of right bank concrete batching plant
20	Erection of right bank concrete cooling plants
21	Erection of left bank aggregate processing plant
22	Erection of left bank concrete batching plant
23	Erection of left bank concrete cooling plants
24	Dock Yards and Floating Bridge
25	Construction of dock yards
26	Installation of floating bridge across River Madeira
27	POWERHOUSE AND APPURTENANTS
28	Headrace Channel
29	Land grubbing and topsoil removal
30	Common excavation
31	Protection of common excavation slopes
32	Construction of auxiliary cofferdam No. 7
33	Rock excavation
34	Protection of rock excavation slopes
35	Partial removal of auxiliary cofferdam No. 7
36	Power Intake and Generating Units
37	Land grubbing and topsoil removal
38	Common excavation
39	Construction of auxiliary cofferdam No. 5
40	Rock excavation
41	Protection of common excavation slopes
42	Dewatering of foundation
43	Concrete, Blocks 1 to 4 (Unloading & Main Erection Area)
44	Foundation preparation
45	Concrete placement
46	Random backfill
47	Concrete, Dividing Walls 1 & 2 & Wall P.H. - Dam
48	Foundation preparation
49	Concrete placement
50	Concrete, Blocks of Units 1 to 8
51	Foundation preparation
52	Concrete placement, 1st stage
53	2nd stage concrete and finishing
54	Concrete, Blocks Units 9 to 16, Erection Area 5-6
55	Foundation preparation
56	Concrete placement, 1st stage
57	2nd stage concrete and finishing
58	Construction of auxiliary cofferdams No.8-11
59	Cofferdam No. 8 & 9
60	Cofferdam No. 10 & 11
61	Concrete, Blocks Units 17 to 24



Nr.	Task Name
62	Foundation preparation
63	Concrete placement, 1st stage
64	2nd stage concrete and finishing
65	Concrete, Blocks Units 29 to 32, Erection Area 7-8
66	Foundation preparation
67	Concrete placement, 1st stage
68	2nd stage concrete and finishing
69	Concrete, Blocks Units 33 to 44
70	Foundation preparation
71	Concrete placement, 1st stage
72	2nd stage concrete and finishing
73	Concrete, wall in contact with the Rockfill Dam
74	Foundation preparation
75	Concrete placement
76	Removal of Auxiliary Cofferdams
77	Removal of cofferdam No. 5
78	Removal of cofferdams No 8 & 9
79	Removal of cofferdams No 10 & 11
80	**Erection of Electromechanical Equipment**
81	Erection of unloading crane
82	Erection of Powerhouse cranes
83	Erection of Unit 1
84	Preassembly in erection area
85	Erection and testing
86	Erection of Units 2 to 4
87	Erection of Units 5 to 8
88	Erection of Units 9 to 12
89	Erection of Units 13 to 16
90	Erection of Units 17 to 20
91	Erection of Units 21 to 24
92	Erection of Units 25 to 28
93	Erection of Units 29 to 32
94	Erection of Units 33 to 36
95	Erection of Units 37 to 40
96	Erection of Units 41 to 44
97	Tailrace Channel
98	Land grubbing and topsoil removal
99	Common excavation
100	Protection of common excavation slopes
101	Construction of auxiliary cofferdam No. 6
102	Preparation of mud disposal area with dikes
103	Dredging of soft soil (mud)
104	Rock excavation
105	Protection of rock excavation slopes
106	Fills and backfills
107	Removal of auxiliary cofferdam No 6
108	SPILLWAY & APPURTENANT WORKS
109	Approach Channel
110	Land grubbing and topsoil removal
111	Common excavation
112	Protection of river bed
113	Protection of excavation slopes
114	Construction of auxiliary cofferdams No. 1 & 2
115	Rock excavation
116	Removal of auxiliary cofferdams No 1 & 2
117	Spillway Structure
118	Land grubbing and topsoil removal
119	Common excavation
120	Rock excavation
121	Dewatering
122	Drilling and grouting
123	Foundation preparation



Nr.	Task Name
124	Concrete
125	Bridge, gantry crane
126	Bridge, service road
127	Gantry crane installation
128	Stop-logs guides
129	Gates, embedded parts
130	Gates, installation
131	**Spillway Lateral Walls**
132	Common excavation
133	Rock excavation
134	Grouted anchor bars
135	Concrete, right-hand side lateral wall
136	Concrete, left hand-side lateral wall
137	Random backfill along right-hand side wall
138	**Discharge Channel**
139	Land grubbing and topsoil removal
140	Common excavation
141	Protection of common excavation slopes
142	Construction of auxiliary cofferdams No. 3 & 4
143	Rock excavation in dry conditions, along lateral walls
144	Rock excavation in dry conditions, remaining
145	Protection of rock excavation slopes
146	Removal of auxiliary cofferdams No 3 & 4
147	Rock excavation in water
148	**Right Bank Closure Embankment**
149	Common excavation
150	Embankment
151	Spillway ready for River diversion
152	
153	**DAM COFFERDAMS AND DAM EMBANKMENT**
154	**Cofferdams**
155	Upstream cofferdam, first stage
156	Dowstream cofferdam, first stage
157	Upstream cofferdam, second stage
158	Dowstream cofferdam, second stage
159	Closure of Spillway gates (Start of reservoir impounding)
160	**Rockfill Dam**
161	Dewatering, before starting the embankment
162	Dewatering, during construction
163	Removal of rock fragments from foundation
164	Rock excavation
165	Drilling and grouting
166	Foundation preparation
167	Embankment
168	Instrumentation
169	**MISCELLANEOUS WORKS**
170	**Diversion Tunnel of Mato Grosso Stream**
171	Excavation
172	Concrete
173	Backfill
174	Gate installation
175	**Mato Grosso Stream Closure Dike**
176	Excavation
177	Embankment
178	**Operating Village**
179	Land preparation
180	Houses and appurtenents



SECTION IV

CONSTRUCTION METHODS

1 Introduction

This Section deals with the worksite organization and construction methods that have been foreseen for the preparation of the civil works cost estimate related to Santo Antonio Hydroelectric Project.

2 Construction Facilities

2.1 Electric Power Supply

2.1.1 General

The electric power for the construction of the Works will be supplied by the utility which operates the existing power station and 69 kV switchyard in the area of Porto Velho.

It has been considered that the Contractor will install at is cost the 69/34 kV transformers with the appurtenant accessories at the utility's switchyard and the transmission line from Porto Velho to the Site.

2.1.2 Transmission Line

The Contractor will construct a 34 kV transmission power line from Porto Velho to the transformer cabins which will be installed at the Site both on the right and left banks of the Rio Madeira.

The transformer cabins will be located where the major power requirements are foreseen, i.e. camps, workshops, aggregate processing plants, batching plants, cooling plants, tower cranes, pumping stations etc..

The power line from Porto Velho to the Site will be located on the right bank.

The electric power necessary for feeding the transformer cabins that will be located on the left bank of the River will be transferred to the left bank by means of a 34 kV sub-marine type cable to be installed on the bed of the Madeira River downstream of the dam Site.

2.2 Roads

2.2.1 Existing Access Road

Santo Antonio Project Site is accessible by means of the public paved road BR – 364 which connects the town of Porto Velho, capital of the federal state of Rondonia, with the south east federal states of the Country where most of the industrial areas are located (San Paolo, Rio de Janeiro, Belo Horizonte etc.).

From the town of Porto Velho depart the following public roads:

a) BR – 364 which connects the capital of Rondonia with the town of Rio Branco in the state of ACRE; and

b) BR – 319 which connects Porto Velho with the town of Manaus.

For the cost estimate it has been considered that the Contractor will use the above mentioned public roads during the construction of Santo Antonio Hydroelectric Project without costs except for the repair of possible damages caused by the heavy traffic or construction equipment in the area of the Project.

2.2.2 Permanent Service Roads

The following permanent service roads will be constructed for the operation of the plant.

a) Road connecting the public road BR – 364 with the Spillway;

b) Road connecting the Operator's Village with the Powerhouse;

c) Road connecting the left bank dock yard with the Powerhouse;

d) Road connecting the right bank dock yard with the road BR – 364.

The service road a) and b) listed above have been foreseen asphalt paved with the following main characteristics:

- Width of 8.00 m;
- Sub-base thickness: 20 cm
- Base course thickness: 15 cm
- Pavement thickness: 15 cm.

The service road c) listed above has been foreseen concrete paved with the following main characteristics

- Width of 12.00 m;
- Sub-base thickness: 30 cm
- Base course thickness: 15 cm
- Pavement thickness: 20 cm.

The above mentioned permanent access roads will be maintained by the Contractor after the construction up to the termination of the Works.

2.2.3 Construction of Haul Roads

The Contractor will design and construct all the temporary roads for camps, construction buildings, work areas, spoil/stockpile areas, quarries, borrow areas and other areas necessary for the execution of the Works.

Most of the temporary roads foreseen for the Works is shown on the annexed Figure 1 related to the general worksite organization layout.

Two types of haul roads have been considered for the cost estimate, i.e. roads to be executed in the areas where required excavation will be performed and haul roads to be executed along original ground surfaces. For the construction of the first type of roads the estimate mainly includes a sub-base and a base course while for the second type of roads the estimate includes excavation, fills, culverts, retaining walls etc..

The haul roads have been designed with roadway width of 8 m, 12, and 15 m in accordance with the width of the off-highway dump trucks considered for the transport of the excavation materials, fills concrete etc. which have pay loads ranging from 37 to 90 tons.

The cost estimate related to the construction of the roads has been based on the unit prices given in the Price List of Section VI and quantities estimated in accordance with the Site morphology.

2.2.4 Maintenance of Haul Roads

The cost estimate includes items concerning the maintenance of the roads during the construction time according to the traffic and the roadway width.

The maintenance of the haul roads has been mainly based on the following assumptions:

a) Reshaping of the roadway by means of 149 kW motorgraders with time interval according to the traffic and the dry/wet seasons as given below.

No.	Description	Approx. Interval (days)	
		Dry Season	Wet Season
1	Light traffic	30	14
2	Medium traffic	14	7
3	Heavy traffic	7	3

b) Integration of the gravel surfacing where necessary by means of rear tippers outfitted with chipping spreader;

c) Watering of the surface (when dry) after the integration of the gravel surfacing by means of 20,000 liters capacity truck mounted tank;

d) Full rolling after each grading and watering by means of smooth-drum vibrating rollers having a weight of 10.8 t;

e) Employment of at least four unskilled workers every kilometer of road length for executing the routine trimming works necessary to maintain regular surfaces free from stones which can fall from the transport means;

f) Cleaning of the ditches and culverts every month during the wet season and every other month during the dry season.

2.3 Floating Bridge and Dock Yards

2.3.1 Floating Bridge

The Santo Antonio hydroelectric plant is designed with permanent works to be carried out on both right and left banks.

The execution of construction facilities, temporary works and permanent works need a fast and continuous transit across the Madeira River which can only be assured by installing a temporary floating-type bridge.

The bridge, as shown on the annexed Figure 1, has been located close to the area of the works where the river width is the minimum. However the final location of the bridge has to be studied in detail to obtain the most convenient total length taking the river bed width and the lateral ramps into account.

The bridge considered for the cost estimate is composed of 12 m wide steel pontoons for allowing a roadway width of 10 m with ramps in accordance with water level dranges up to 20 m.

The pontoons have been designed with bridge-gaps for facilitating the passage of tree floating trunks.

The floating bridge has been equipped with winches and anchoring steel ropes as well as traffic lights and guard-houses on each bank in order to assure a continuous and regular traffic.

2.3.2 Dock Yards

The cost estimate includes the construction of two dock yards located along the Madeira River of which one on the right bank and the other on the left bank as shown on the annexed Figure 1.

The dock yards considered have the following main characteristics: length 50.0 m, width of 15.0 m, depth of 9.0 m, 250 t capacity gantry type cranes.

The walls of the yards consist of 15 m high, 0.80 m thick reinforced concrete diaphragms anchored by means of tendons to concrete piles designed with interval of 5.0 m.

2.4 Temporary Camps and Buildings

2.4.1 Personnel's Camps

The temporary Contractor's camps have been planned both on the right and left bank as shown on the annexed Figure 2.

Separate camps with the appurtenant facilities have been considered for the management personnel and the workers.

The main offices with the appurtenant facilities have been located on the left bank close to the camp of the management personnel.

Auxiliary offices have been located on the right bank in the area close to the camp of the management personnel.

2.4.2 Workshop Yards

The workshop yards necessary for workshops, stores, laboratory etc. have been located both on the right bank and on the left bank in the areas shown on the annexed Figure 1.

2.4.3 Aggregate Processing Plants

The quantities of conventional concrete and the RCC to be placed for the permanent works is given in the following table.

No.	Description	Unit	Volume
1	Right Bank and River Bed		
1.1	Spillway right bank lateral wall	m^3	138,850
1.2	Spillway left bank lateral wall	m^3	38,800

1.3	Spillway structure	m^3	415,250
1.4	Mato Grosso diversion tunnel	m^3	55,500
1.5	Foundation of rockfill dam	m^3	3,000
Total No. 1		m^3	651,400
2	Left Bank		
2.1	Powerhouse dividing walls	m^3	378,000
2.2	Wall between Powerhouse and rockfill dam	m^3	79,600
2.3	Powerhouse structures	m^3	2,084,500
Total No. 2		m^3	2,542,100

The aggregates necessary for the concretes will come from the required rock excavation.

Two separate aggregate processing plants of which one located on right bank and the other located on the left bank have been considered for the cost estimate. The location of the plants is shown on the annexed Figure 1.

The excavated rock deemed suitable for concrete aggregates will be stockpiled both on the right and left bank areas close to the batching plants.

According to the construction time schedule included in Section III and the concrete volume listed above, the required monthly productions of concrete are as shown on the annexed Figures 3 and 4.

Considering the following: (a) the average weight of aggregates for cubic meter of concrete, (b) the additional concrete for over-breaks, over-thicknesses and wastes, (c) the crushing/screening wastes, and (d) an organization of the works based on 24 working days per month, 3-8 hours shifts per day, 21 actual working hours per day, the capacity of the aggregate processing plants is as follows:

a) Right bank: 300 tons per hour;

b) Left bank: 340 tons per hour.

2.4.4 Batching Plants

Two separate concrete batching plants of which one located on right bank and the other located on the left bank have been considered for the cost estimate.

According to the monthly concrete volume to be placed given before in Paragraph 2.4.3 and considering an organization of the works based on 20 working days per month, 3-8 hours shifts per day, 16 actual working hours per day, the capacity of the batching and mixing plants is as follows:

a) Right Bank: 240 cubic meter per hour.

b) Left bank: 370 cubic meter per hour.

2.5 Operator’s Village

The operator’s village has been located on the left bank where shown on the annexed Figure 2.

The village has been designed for housing 750 persons including managers, chief engineers, operators, specialists and skilled workers for the maintenance of the plant, skilled and semi-skilled workers for the general services, and the guards.

The village considered includes single type houses (areas of 150 m2, 120 m2, and 100 m2), double type houses (areas of 60 m2 and 40 m2), offices, schools, recreation buildings, supermarket and stores.

Grounds for football, basket boll, tennis and swimming pool have also been included in the cost estimate of the village.

The area necessary for the construction of the village including infrastructures (roads, yards, gardens etc.) will range from 60,000 to 65,000 m2.

The operator's village will be built at the beginning of the works and occupied by the Contractor's personnel. When the construction activities of the main work sections will decrease, part of the village units will be handed over to the operators that will be engaged by the Employer for the operation of the first stage generating units while the remaining part of the village will be handed over to the operators according to the progress of the generating unit installation and operation.

3 Disposal, Stockpile and Borrow Areas

3.1 Disposal and Stockpile Areas on the Right Bank

3.1.1 General

The material coming from the topsoil removal will be placed in stockpile areas close as much as possible to the permanent works to be built.

The material coming from the common excavations which is not used for the construction of fills and backfills as well as the materials coming from the removal of the cofferdams will be placed in disposal areas.

The rock excavation deemed suitable to be used for rockfills and transitions of the dam and related cofferdams as well as to be used for concrete aggregates will be stockpiled in an area close as much as possible to the permanent works to be built.

The location of the right bank disposal and stockpile areas is shown on the annexed Figure 1.

3.1.2 Disposal Areas

a) <u>Volume of Common Excavation and Cofferdam Removal</u>

The volumes of common excavation of the right bank and cofferdam removal of right bank and left bank to be stockpiled on the right bank are given in the following table.

No.	Description	Unit	Volume
1	Common Excavation		
1.1	Spillway approach channel	m^3	16,226,810
1.2	Spillway structure	m^3	168,800
1.3	Spillway discharge channel	m^3	823,000

1.4	Spillway left bank lateral wall	m^3	27,400
1.5	Right bank closure embankment	m^3	36,200
1.6	Right bank closure dike	m^3	240,600
1.7	Mato Grosso diversion tunnel	m^3	124,800
Total No. 1		m^3	17,647,610
2	Cofferdam Removal		
2.1	Cofferdam “Auxiliary 1”	m^3	545,600
2.2	Cofferdam “Auxiliary 2”	m^3	208,400
2.3	Cofferdam “Auxiliary 3”	m^3	178,800
2.4	Cofferdam “Auxiliary 4”	m^3	371,900
2.5	Cofferdams “Auxiliaries 8, 9, 10 & 11”	m^3	1,101,510
Total No. 2		m^3	2,406,210

b) Common Excavation to be Used for Fills

The quantities of common excavation which will be used for fills and backfills are given in the following table.

No.	Description	Unit	Volume
1	Backfill along wall of Spillway discharge channel	m^3	603,800
2	Backfill of Mato Grosso diversion tunnel	m^3	65,000
Total		m^3	668,800

c) Volume of Common Excavation to be Disposed

The volume of common excavation to be disposed of is given in the following table.

No.	Description	Unit	Volume
1	Common excavation	m^3	17,647,610
2	Common excavation used in fills	m^3	668,800
Total volume to dispose		m^3	16,978,810

d) Total Volume to Dispose Including Cofferdam Removal

The volume of common excavation and materials from cofferdam removal to dispose of is given in the following table.

No.	Description	Unit	Volume
1	Volume of common excavation	m^3	16,978,810
2	Volume of cofferdam removal	m^3	2,406,210
Total volume to dispose		m^3	19,385,020

e) Total Volume to Dispose Including Swelling Factor

The total volume of common excavation and materials coming from cofferdam removal to dispose of considering a swelling factor of 10% after the settlement that is expected to occur during the construction time is approx. 21,323,522 m3 (19,385,020 x 1.10).

The total volume that the right bank disposal area shown on the Drawings of the Feasibility Study can receive considering the top of the fill at elevation 80 m (a.s.l.) can be approx. 9,000,000 m3.

From the above considerations come out that approx. 12,324,000 m3 of material (21,324,000 m3 – 9,000,000 m3) has to be disposed in an area different from that shown on the Drawings of the Feasibility Study.

f) Disposal Areas

For the cost estimate have been considered two disposal areas of which one in the same area shown the Drawings of the Feasibility Study (named disposal area No. 1) and the other in an area along the River approx. 3 km upstream of the disposal area No. 1 (named disposal area No. 2).

Considering a height of the fill of approx. 20 m, the disposal No. 2 needs an area of approx. 650,000 m2.

3.1.3 Rock Stockpile Area

a) Volume of Rock Excavation

The quantities of rock excavations to be executed on the right bank are given in the following table.

No.	Description	Unit	Volume
1	Spillway approach channel	m^3	1,523,860
2	Spillway structure	m^3	675,300
3	Spillway discharge channel	m^3	3,184,000
4	Spillway right bank lateral wall	m^3	18,200
5	Spillway left bank lateral wall	m^3	6,300
Sub-total		m^3	5,407,660
Excavation in water (disposed close to d/s dam toe)		m^3	400,000
Total		m^3	5,007,660

b) Rock Excavation to be Used for Right Bank Works

The quantities of in-situ rock which will be used for the needs of the right bank are given in the following table.

No.	Description	Unit	Volume
1	Concrete aggregates	m^3	430,000
2	Compacted rockfill for dam and dam cofferdams	m^3	1,550,000
3	Dumped rockfill for dam and dam cofferdams	m^3	2,577,000
4	Spillway closure embankment	m^3	500
5	Mato Grosso dike	m^3	43,000
6	Transitions for auxiliary cofferdams	m^3	49,000
7	Transitions for dam and dam cofferdams	m^3	214,000
8	Rockfill for protection of common excavation surfaces	m^3	630,000

9	Transitions for protection of common excavation surfaces	m^3	346,000
10	Rip-rap for auxiliary cofferdams	m^3	57,000
11	Rip-rap for spillway closure embankment	m^3	2,300
12	Miscellaneous, over-thickness & wastes (±10%)	m^3	600,000
Total		m^3	6,498,800

c) Additional Volume of Rock Excavation

The above tables show that the volume of required excavation is not sufficient for the execution of the works to be performed on the right bank.

The rock excavation on the left bank is in excess of the construction necessities of the same bank area. However a cost comparison has emphasized that the material transported from the left disposal area to the right bank stockpile can be a little more expensive than the execution of additional excavation in the area of the spillway approach channel.

The additional volume of in-situ rock that has to be excavated along the spillway approach channel is given in the table below.

No.	Description	Unit	Volume
1	Rock required for the works of the right bank	m^3	6,498,800
2	Required rock excavation	m^3	5,007,660
Additional excavation		m^3	1,491,140

d) Volume of Rock to be Stockpiled

The volume of rock to be stockpiled for the need of the right bank is the total that given before in the table of Paragraph 3.1.3 b) less the quantities of some materials that do not need stockpiling.

The approx. volume to be stockpiled is given in the following table.

No.	Description	Unit	Volume
1	Total volume of table in Paragraph 3.1.3b)	m^3	6,498,800
2	Volume of materials that do not need stockpiling	m^3	760,000
Volume to be stockpiled		m^3	5,738,800

Considering a swelling factor of 40% and a maximum height of the fill of 20 m, the area necessary for the stockpile is approx. 450,000 m^2.

3.1.4 Topsoil Stockpile Area

The total volume of topsoil to be removed in the areas of the common excavation is 340,000 m3.

Considering a swelling factor of 20% after the settlement that is expected to occur during the construction time, the volume in the stockpile area will be approx. 410,000 m3 (340,000 x 1.20).

For the cost estimate it has been considered that the topsoil will be stockpiled close to the disposal area No. 1.

3.2 Disposal and Stockpile Areas on the Left Bank

3.2.1 General

The material coming from excavations (excluding the soft soil) which is not used for the construction of fills and/or backfills and the material coming from the removal of cofferdams will be disposed of in the area located along the River upstream of the Powerhouse Headrace Channel.

The soft material (mud) coming from the Powerhouse Tailrace Channel will be disposed of in a specific area closed with dikes so that the mud pumped by the dredges can settle and dry up. The dikes of the disposal area will be built with materials of the required excavation.

The location of the right bank disposal and stockpile areas is shown on the annexed Figure 1.

3.2.2 Disposal Areas

a) Volume of Common Excavation and Cofferdam Removal

The volumes of common excavations, dredging of soft soil and cofferdam removal to be executed on the left bank are given in the following table.

No.	Description	Unit	Volume
1	Common Excavation		
1.1	Powerhouse headrace channel	m^3	16,151,200
1.2	Power intakes and generating units area	m^3	2,331,800
1.3	Tailrace channel	m^3	11,408,800
1.4	Wall between Powerhouse and dam	m^3	107,800
Sub-total		m^3	29,998,600
2	Soft Soil (Mud) Dredging		
2.1	Powerhouse tailrace channel	m^3	7,404,200
Total No. 1 & 2		m^3	37,402,800
3	Cofferdam Removal		
3.1	Cofferdam “Auxiliary 5”	m^3	392,710
3.2	Cofferdam “Auxiliary 6”	m^3	229,000
3.3	Cofferdam “Auxiliary 7”	m^3	223,920
Total		m^3	845,630

b) Common Excavation to be Used for Fills

The quantities of common excavation which will be used for fills and backfills are given in the following table.

No.	Description	Unit	Volume
1	Powerhouse loading area backfill	m^3	1,050,000

2	Powerhouse tailrace channel, backfill	m^3	754,340
3	Powerhouse tailrace channel, fill	m^3	265,000
Total		m^3	2,069,340

c) Volume of Common Excavation to be Disposed

The volume of common excavation to be disposed of is given in the following table.

No.	Description	Unit	Volume
1	Common excavation	m^3	29,998,600
2	Common excavation used in fills	m^3	2,069,340
Total volume to dispose		m^3	27,929,260

d) Total Volume to Dispose Including Cofferdam Removal

The volume of common excavation and materials from cofferdam removal to dispose of is given in the following table.

No.	Description	Unit	Volume
1	Volume of common excavation	m^3	27,929,260
2	Volume of cofferdam removal	m^3	845,630
Total volume to dispose		m^3	28,774,890

e) Total Volume of Loose Materials to Dispose Including Swelling Factor

The total volume of common excavation and materials coming from cofferdam removal to dispose of considering a swelling factor of 10% after the settlement that is expected to occur during the construction time is approx. 31,652,380 m3 (28,774,890 x 1.10).

Considering 30 m the max. height of the fill, the area necessary for the stockpile is of approx. 1,100,000 m2.

f) Volume of Soft Soil (Mud) to be Disposed

The mud to be dredged has a volume of 7,404,200 m3.

Considering that dikes around the disposal area have a height of 20 m, the area necessary for disposing the material is of approx. 450,000 m2.

3.2.3 Rock Stockpile and Disposal Area

a) Volume of Rock Excavation

The rock to be excavated on the left bank is given in the following table.

No.	Description	Unit	Volume
1	Headrace channel	m^3	5,105,200
2	Power intakes and generating units	m^3	3,065,200
3	Tailrace channel	m^3	7,767,200
Total		m^3	15,937,600

b) Rock Excavation to be Used for Works on Right Bank

The quantities of in-situ rock which will be used for the needs of the right bank are given in the following table.

No.	Description	Unit	Volume
1	Concrete aggregates	m^3	1,910,000
2	Transition for auxiliary cofferdams	m^3	108,000
3	Transition for protection of common excavation surfaces	m^3	110,000
4	Rockfill for protection of common excavation surfaces	m^3	165,000
5	Rip-rap for protection of common excavation surfaces	m^3	55,000
6	Miscellaneous, over-thickness & wastes (±10%)	m^3	230,000
Total		m^3	2,578,000

c) Volume of Rock to be Stockpiled

The volume of rock to be stockpiled is that necessary for the concrete aggregates, i.e. approx. 2,100,000 m3 considering the waste.

Considering a swelling factor of 40% and a height of the fill of approx. 15 m, the area necessary for stockpiling the rock is approx. 220,000 m2.

d) Volume of Rock to be Disposed of

The volume of rock to be disposed of is given in the following table.

No.	Description	Unit	Volume
1	Total volume of rock excavation	m^3	15,937,600
2	Volume of rock used for the works	m^3	15,937,600
Volume to be disposed of		m^3	13,359,600

Considering a swelling factor of 40% and 30 m the max. height of the fill, the disposal area necessary is of approx. 650,000 m^2.

3.2.4 Topsoil Stockpile Area

The total volume of topsoil to be removed in the areas of the common excavation is 364,000 m3.

Considering a swelling factor of 20% after the settlement that is expected to occur during the construction time, the volume in the stockpile area will be approx. 440,000 m3 (364,000 x 1.20).

For the cost estimate it has been considered that the topsoil will be stockpiled close to the disposal area No. 1.

3.3 Borrow Areas

3.3.1 Sand Borrow Areas

The sand for the concrete will partly be obtained from the granite of the required excavation that will be crushed for producing the coarse aggregates and partly taken from the borrow areas investigated along the Madeira River.

The blending of natural sand and manufactured sand in the proportion of 60% and 40% respectively is deemed less expensive that the full production of the sand by means of processing plants.

The quantity of sand to be used for the concretes of the right and left bank is approx. 340,000 tons and 680,000 tons respectively.

The sand for the concretes of the right bank will be taken from the borrow area named in Feasibility Study Drawings “Praia do Ze Paulino” which has an exploitable volume of approx. 660,000 m3 if a combination of backhoes and draglines loaders are used.

The sand for the concretes of the left bank will be taken from the borrow area named in Feasibility Study Drawings “Praia do Felix” which has an exploitable volume of approx. 3,000,000 m3 if a combination of backhoes and draglines loaders are used.

The sand will be loaded and transported to the concrete aggregate stockpiles during the months when the Madeira River has low capacities.

3.3.2 Clay Borrow Areas

The clayfills to be executed with clay from borrow areas are given in the following table.

No.	Description	Unit	Volume
1	Right Bank		
1.1	Auxiliary cofferdam 1	m^3	486,600
1.2	Auxiliary cofferdam 2	m^3	318,100
1.3	Auxiliary cofferdam 3	m^3	293,500
1.4	Auxiliary cofferdam 4	m^3	348,200
1.5	Dam	m^3	458,100
1.6	Dam upstream cofferdam	m^3	2,025,500
1.7	Dam downstream cofferdam	m^3	412,700
1.8	Closure embankment	m^3	81,500
1.9	Closure dike	m^3	388,900
Total No. 1		m^3	4,813,100
2	Left Bank		
2.1	Auxiliary cofferdam 5	m^3	412,680
2.2	Auxiliary cofferdam 6	m^3	189,200
2.3	Auxiliary cofferdam 7	m^3	243,200
2.4	Auxiliary cofferdam 8 & 10	m^3	314,200

2.5	Auxiliary cofferdam 9 & 11	m^3	650,500
Total No. 2		m^3	1,809,780

The clay for the fills and backfills on the right bank will be taken from the right bank borrow areas named in Feasibility Study Drawings “JT-01, JT-03 AND JT-04” which has an exploitable volume exceeding 6,000,000 m3.

The clay for the fills and backfills on the left bank will be taken from the borrow area located on the left bank and named in Feasibility Study Drawings “JT-02” which has an exploitable volume exceeding 15,000,000 m3.

4 Construction Methods

4.1 Clearing and Grubbing

4.1.1 General

The areas where excavation, fills and other works have to be carried out will be cleared of all vegetable growth such as trees, limbs, bushes, shrubs, rubbish vegetation, grass and other objectionable material.

Clearing and grubbing shall be performed in advance of the top soil removal.

4.1.2 Clearing

Clearing shall consist of cutting all vegetable growth to the minimum height as possible from the ground surface and of moving the resulting materials to areas where it shall be burned and reduced to ashes, except for the timber that can be used which shall be otherwise disposed of.

4.1.3 Grubbing

Grubbing shall consist of removing and satisfactorily disposing of buried logs, stumps and large root mats so that during the removal of the topsoil only limited parts of vegetation has the possibility to remain included in the material.

4.2 Topsoil Removal and Stockpiling

4.2.1 General

The topsoil existing in the areas of common excavation will be removed as much as possible and transported to stockpiles so that it can be used in the future for the reinstatement of the areas where the temporary camps, buildings, roads and other infrastructures where located.

The stockpiles areas have been located close to the disposal areas foreseen for the materials of excavation.

The volumes of topsoil to be stockpiled on the right and left banks are approx. 340,000 m3 and 364,000 m3 respectively.

4.2.2 Excavation and Stockpiling

The following method has been foreseen for the topsoil removal and stockpiling:

- Dozing and piling up of the top soil: by means of 149 kW and 231 kW bulldozers;
- Loading of the material on dump trucks: by means of 161 kW (2.90 m3 heaped bucket) and/or 229 kW (4.20 m3 heaped bucket) wheel loaders;
- Transport of the loaded material to stockpile: by means of 37,3 t and 63.5 t payload off-highway dump trucks;
- Spreading of the unloaded material in stockpile area: by means of 149 kW bulldozer;
- Lighting of the work area during the night shits: by means of mobile diesel powered 10,000 W floodlights.

The transport distances considered for hauling the topsoil are given in the following table:

No.	Topsoil Source	Length (m)
1	Right Bank	
1.1	Spillway approach channel	2,300
1.2	Spillway structure, discharge channel & diversion dike	4,000
2	Left Bank	
2.1	Powerhouse headrace channel	3,400
2.2	Power intakes and tailrace channel	4,300

4.3 Common Excavation

4.3.1 General

Common excavation consist of loose materials such as clay, sand, gravel, soft rock and disintegrated rock that can be removed with conventional equipment including bulldozer outfitted with mono shank ripper where necessary.

The monthly volumes of common excavation are shown on the annexed Figure 5.

4.3.2 Excavation

The following method has been foreseen for the execution of the common excavation:

- Excavation and dozing of the material: by means of 231kW bulldozer;
- Ripping of tough earth and/or weak/disintegrated rock (where necessary): by means of 231 kW crawler type tractors equipped with mono-shank ripper;
- Loading of the material on dump trucks: by means of 229 kW (4.2 m3 heaped bucket) wheel loader, and/or 468 kW (8.90 m3 heaped bucket) wheel loader, and/or 257 kW (3.2 m3 heaped bucket) hydraulic backhoe, and/or 390 kW (5.70 m3 heaped bucket) front shovel according to the volume and location of the specific excavation;
- Transport to the designated spoil areas or stockpile of the material excavated: by means of 37.3 t, and/or 63.5 t, and/or 90.9 t payload off-highway dump trucks according to the volume and location of the specific excavation;

- Rough spreading of the unloaded material in spoil and/or stockpile areas: by means of 149 kW bulldozer;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

The transport distances considered for hauling the common excavations are given in the following table:

No.	Source and Destination of Common Excavation	Length (m)
1	Right Bank	
1.1	Spillway approach channel: - transport to disposal area No. 1 - transport to disposal area No. 2	 2,300 5,900
1.2	Spillway structure, discharge channel & diversion dike: - transport to disposal area No. 2	 7,700
1.3	Mato Groso diversion tunnel	7,800
2	Left Bank	
2.1	Powerhouse headrace channel: - transport to disposal area -Transport to backfills in the area of excavation	 3,400 800
2.2	Power intakes and generating units	4,100
2.3	Tailrace channel: - transport to disposal area - transport to fills and backfills in the area of excavtion	 4,400 800

4.4 Dredging of Soft Soil

The Powerhouse tailrace channel crosses an area of soft soil which the geological reports define “pantano”, i.e. mud.

The soft soil (mud) has a volume of 7,404,200 m3 and according to the construction time schedule has to be removed in a time of approx. 19-20 months.

It was deemed that the material has to be dredged and pumped to a specific disposal area being not possible to use conventional construction equipment for the excavation.

The disposal area (area No. 2) has been located on the left bank close to the main disposal area No 1 as shown on the annexed Figure 1. The disposal area needs a dike all around for the storage of the water/mud to be built with materials from required excavation.

Considering the works organized on three-8 hours shifts per day, 24 working days per month and 20 actual working hours a day, the required hourly production is approx. 770 m3.

The dredged mud has to be pumped up to an average distance of 3,200 m.

The following method has been foreseen for the execution of the excavation and disposal of the soft soil:

- Dredging by means of 250 m3/h capacity dredgers equipped with 1500 m long pipelines;
- Mud type booster pump station along the pipeline of 520 kW nominal power outfitted with 2000 m of pipeline.

The water pumped together with the mud will be drained by means of small spillways to be built on the crest of the retaining dike.

4.5 Protection of Excavation Surfaces

4.5.1 General

The surfaces of common excavation have to be protected where necessary with a layer of transition material and a layer of rockfill.

The transition material shall consist of crushed rock with grading from 5 to 50 mm.

The rockfill will have a size compatible with the thickness of the protection shown on the Drawings.

4.5.2 Transition on Sloped Surfaces

The following method has been foreseen for placing the granular material of transitions placed on sloped surfaces:

- Rock supply: from required excavation of the area;
- Crushing of rock: by means of 320 kW mobile crushing plants;
- Loading of the crusher hopper: by means of 260 kW (3.40 m3 heaped bucket) hydraulic front shovel;
- Placing of transition: partly by means of 257 kW (3.20 m3 bucket) hydraulic backhoe and partly by means of 100 t crawled crane outfitted with orange peel bucket;
- Compaction of transition: by means of tandem smooth drum vibrating roller with weight of 3.2 t;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

4.5.3 Transition on River-bed Surfaces

The following method has been foreseen for placing the granular material of transitions placed on flat surfaces:

- Rock supply and crushing: as described before for transition on sloped surfaces;
- Spreading of transition material: by means of 231 kW bulldozer;
- Compaction of transition material: by means of 10.60 t smooth drum vibrating roller;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

4.5.4 Rockfill on Sloped Surfaces

The following method has been foreseen for placing the rockfill protection on sloped surfaces:

- Rock supply: from required excavation of the area;
- Rock placing: partly by means of 257 kW (3.20 m3 bucket) hydraulic backhoe and partly by means of 100 t crawled crane outfitted with orange peel bucket;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

4.5.5 Rockfill on River-bed Surfaces

The following method has been foreseen for placing the rockfill protection on flat surfaces:

- Rock supply: from required excavation of the area;
- Rock spreading: by means of 231 kW bulldozer;
- Rock compaction: by means of 10.60 t smooth drum vibrating roller;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

4.6 Rock Excavation

4.6.1 General

The rock to be excavated for the Santo Antonio Hydroelectric Project mainly consists of granite from sound to moderately fractured having a compressive strength ranging from 200 to 350 MN/m2.

The rock has been considering with a drillability index ranging (DRI) from 40 to 50 and with a high abrasiveness.

The rock for the production of the concrete aggregates of the left bank will be obtained from the Power Intakes and generating Units excavation which are blasted with narrower hole burden and spacing with reference to the large excavations of the channels.

The monthly volumes of rock excavation are shown on the annexed Figure 6.

4.6.2 Excavation in Dry Conditions

The following methods have been foreseen for the rock excavation in dry conditions:

- Drilling in large areas easily accessible: by means of 147 kW hydraulic type crawler-mounted rock drill outfitted with automatic rod exchanger and suitable for button type bits with size of 76 mm, 89 mm and 102 mm;
- Drilling in limited areas or areas having a not easy accessibility: by means of 48 kW hydraulic type crawler-mounted rock drill and suitable for button type bits with size of 51 mm;
- Drilling in areas not accessible with crawler rock drill: by means of hand-held drills outfitted with 38-40 mm diameter integral drill steels;

- Height of drilling benches: ranging from 8 to 16 m for the crawler drills and from 2 to 4 m for hand held drills;
- Hole pattern for crawler rock drills operating with 102 mm dia. bits: from 3.40 x 4.30 m (burden x spacing) to 3.80 x 4.80 m;
- Hole pattern for crawler rock drills operating with 89 mm dia. bits: from 3.00 x 3.70 m (burden x spacing) to 3.40 x 4.20 m;
- Hole pattern for crawler rock drills operating with 76 mm dia. bits: from 2.60 x 3.20 m (burden x spacing to 3.00 x 3.60 m);
- Hole pattern for crawler rock drills operating with 51 mm dia. bits: from 1.80 x 2.30 m (burden x spacing to 2.0 x 2.50 m);
- Hole pattern for hand held drills: from 1.20 x 1.50 m (burden x spacing) to 1.40 x 1.80 m;
- Transport of emulsion type explosive: by means of 15 t capacity flat-bed lorry outfitted with hydraulic operated crane;
- Transport and placing of ANFO explosive: by means of explosive truck-mounted tank outfitted with charging pump;
- Charging of blasting holes: with emulsion type explosive associated with ANFO;
- Firing: by means of detonating fuse installed along the entire hole length outfitted with delays suitable for detonating fuse;
- Loading of the blasted rock on the dump trucks: by means of 260 kW (4.3 m3 heaped bucket) and 390 kW (5.7 m3 heaped bucket) hydraulic front shovels equipped with bottom dump type bucket;
- Trimming works: by means of 200 kW hydraulic backhoe equipped with 2.55 m3 heaped bucket;
- Dozing of the blasted rock and service around the loaders: by means of 231 kW bulldozer equipped with straight type blade;
- Transport of the blasted rock to the designated spoil area or stockpile: by means of 37.3 t, and/or 63.5 t and/or 90.9 t pay load off-highway dump trucks according to the excavation area and quantity of material to be hauled;
- Spreading of the unloaded material in spoil area or stockpile: by means of 149 kW bulldozer;
- Lighting of the work areas during night shifts: by means of mobile diesel powered 10,000 W floodlights.

4.6.3 Excavation in Water

The following main equipment has been foreseen for the execution of the rock excavation in water:

- Drilling: by means of 147 kW hydraulic type crawler-mounted rock drill outfitted with automatic rod exchanger operating with 76 mm size button bits installed on 12 x 6 m (70 tons capacity) modular float type pontoon;
- Hole pattern of crawler rock drill: 2.00 x 2.50 m (burden x spacing);
- Over-drilling: 1,10 m

- Charging of the holes: with 1.0 kg/m3 of emulsion type explosive to be introduced into the boreholes by means of rigid type 75 mm diameter PVC pipes spanning from the borehole collar to the pontoon deck;
- Loading of the blasted rock on barges: partly by means of 382 kW hydraulic backhoe outfitted with 4.6 m3 struck bucket and partly by means of 100 t crane outfitted with 2.50 m3 orange peel type bucket operating on 210 tons capacity modular float type pontoons;
- Transport of the rock: by means of self propelled 200 tons pay load barge designed with lateral unloading of the material.
- Unloading of the material: in the river bed along the downstream cofferdam of the dam.

4.6.4 Rock Presplitting

The execution of the rock pre-splitting has been foreseen along the final lines of excavation in contact with concrete structures in order to limit the over-breaks and along the final lines of excavation where it is necessary to limit the rock fracturing.

Hydraulic type crawler-mounted rock drills with 147 kW power outfitted with automatic rod exchanger, extensible boom, 3.6 m (12') in length rod guide and device for accurate direction of the rig rod-guide has been considered for drilling the presplitting holes.

The presplitting rigs are equipped with automatic indicator of the inclination of the rod-guide and rods of not less than 38 mm (1 1/2") in diameter.

The line of presplitting will be clearly marked on the ground before starting drilling operations.

The holes will be 76 mm (3”) in size, spaced not more than 60 cm from center to center and drilled to a depth will not exceeding 14 m.

The holes have been loaded with a quantity of emulsion type explosive ranging from 0.45 to 0.55 kg per meter.

4.7 Dewatering

4.7.1 General

The main areas to be dewatered during the execution of the excavation and of the subsequent concrete structures are the following:

- The Spillway area which is protected by the cofferdams Auxiliary 1, 2, 3 and 4 on the right bank;
- The Powerhouse area which is protected by the cofferdams Auxiliary 5, 6 and 7 before starting the power generation and by the cofferdams Auxiliary 8-9 and 10-11 when the first set of Generating Units are in operation;
- The dam foundation area after the construction of the cofferdams and during the construction of the embankment starting from the river bed.

4.7.2 Water Quantity

The average water seepage foreseen for the areas mentioned in the paragraph before are as follows:

- Right bank area, i.e. area closed with the cofferdams Auxiliary 1, 2, 3 and 4: 60 liters per second;
- Left bank area, i.e. area closed with the cofferdams Auxiliary 5, 6 and 7: 100 liters per second.
- Dam area, i.e. the area between the upstream and downstream cofferdams of the dam: 120 liters per second.

To the above water seepages has been added the quantity of rain water the quantity of which has been established according to the recorded mean monthly precipitations and the times foreseen in the Construction Time Schedule included in Section III

The total quantities of water to be pumped out of the working areas have been included in the Revised Bill of Quantities of Section VII.

4.7.3 Ditches and Pits

Besides the dewatering, in the cost estimate has been considered the burdens for the general care of water (ditches, pits, small dikes, ducts etc.) that have to be performed in the drained areas during the work progress.

The design of the dam shows an embankment cross section which has no space for the excavation of a ditch along the upstream toe deemed necessary in order to collect the water inflows coming from the foundation of the upstream cofferdam. Without the possibility to excavate a proper ditch it is deemed impossible to place and compact the dam clay core in dry conditions.

In order to overcome this problem has been considered a small displacement of the upstream and downstream cofferdams so that the dam can have an independent foundation.

4.8 Auxiliary Cofferdams

4.8.1 General

Four main areas protected with auxiliary cofferdams have to be built as follows:

a) Four cofferdams (Auxiliaries 1, 2, 3 & 4) have to be built for the protection of the areas on the right bank (Spillway and appurtenant works) against the high floods of the river;

b) Three cofferdams (Auxiliaries 5, 6 & 7) have to be built for the protection of the areas on the left bank (Powerhouse and related channels) against the high floods of the river;

c) Four cofferdams (Auxiliaries 8, 9, 10 & 11) have to be built for the protection of the areas of Power Intakes and Generating Units from No. 17 to No. 44 on the left bank against the water of the reservoir.

4.8.2 Composition

The auxiliary cofferdams are composed of rockfill, clayfill, transition, and rip rap.

4.8.3 Source of Materials

The materials for the construction of the cofferdams will be obtained from the following sources:

a) Rockfill, Transition and Rip-rap

The rock for rockfills, transition and rip-raps will come from the required excavation in progress in the surrounding areas.

b) Clayfill

The clay for clayfills will come from the borrow areas located on the right and left banks.

The rock for rockfills will be transported straightly from the excavation to the cofferdams.

The rock for transitions will be transported to mobile processing plants installed in the area of the works and then the processed material will be transported to the cofferdams.

The rock for rip raps will be selected in the area of excavation and then transported to the cofferdams.

4.8.4 Hauling

The distances considered for the transport of the cofferdam materials are given in the following table.

No.	Topsoil Source	Length (m)
1	**Right Bank Cofferdams**	
1.1	Rockfill	0
1.2	Transition	1500
1.3	Rip rap	1,000
1.4	Clayfill	2,900
2	**Left Bank Cofferdams**	
2.1	Rockfill	0
2.2	Transition	1,500
2.3	Rip rap	1,000
2.4	Clayfill, auxiliaries 5, 6 & 7	3,300
2.5	Clayfill, auxiliaries 8, 9, 10 & 11	3,800

4.8.5 Construction Method

a) Rockfill

The following methods have been considered for transporting and placing of rockfills in water:

- Loading of the material on dump trucks: by means of 390 kW hydraulic front shovel equipped with 5.7 m3 heaped bucket;
- Transport of the material to the embankment: by means of 63.5 t and/or 90.6 t payload off-highway dump trucks;
- Service in area of unloading: by means of 231 kW bulldozer.

b) Transition

The following methods have been considered for transporting and placing transitions in dry conditions:

- Loading of the material on dump trucks: by means of 229 kW wheel loader equipped with 4.2 m3 heaped bucket;
- Transport of the material to the embankment: by means of 37.3 t payload off-highway dump trucks;
- Placing on the slopes of embankment: by means of 257 kW hydraulic backhoe equipped with 3.2 m3 heaped bucket;
- Compaction by smooth drum vibrating roller having a weight 10.8 t.

The following method has been considered for transitions placed in water:

- Loading and transport of the material: same as described before for dry conditions;
- Placing on the embankment slopes: partly by means of 257 kW hydraulic backhoe and partly by means of 100 tons crawler crane outfitted with 2.5 m3 orange peel type bucket;
- Assistance to hydraulic backhoe and/or crane: by means of 149 kW bulldozer.

c) Clayfill

The following methods have been considered for clayfills placed in dry conditions:

- Excavation: by means of 231 kW bulldozer;
- Loading of the material on dump trucks: by means of 354 kW wheel loaders equipped with 6.60 m3 heaped bucket;
- Transport of the material to the embankment: by means of 37.3 t and/or 63.5 t off-highway dump trucks;
- Coarse spreading on the embankment: by means of 149 kW bulldozer;
- Final spreading on the embankment to approx. 25 cm layers thickness: by means 138 kW motorgrader;
- Compaction: by means of pad-foot drum vibrating roller with a weight of 11.53 t.

The following methods have been considered for clay placed in water:

- Loading and transport : same as described before for clay placed in dry conditions;
- Placing on the embankment slopes: partly by means of 257 kW hydraulic backhoe outfitted with 3.2 m3 heaped bucket and partly by means of 100 tons crawler crane outfitted with 2.5 m3 orange peel type bucket.

d) Rip Rap

The rip-rap will be composed of sound rock fragments selected after the rock blasting.

The following method has been considered for selection, transport and placing the rip-rap both in dry conditions and in water:

- Selection and loading on dump trucks of the rock fragments: by means of 161 kW wheel loader equipped with rock type grapple bucket;
- Transport to embankment: by means of 37.3 ton payload off-highway dump truck;
- Placing on the embankment slopes: by means of 100 tons crawler crane outfitted with 1.70 m wide rock grapple type bucket.

4.8.6 Auxiliary Cofferdam Removal

The following methods have been foreseen for the removal of the auxiliary cofferdams in dry conditions:

- Loading: partly by means of 229 kW wheel loader outfitted with 4.2 m3 heaped bucket and partly by means of 468 kW outfitted with 8.90 m3 heaped bucket;
- Assistance to wheel loaders: by means of 231kW bulldozer;
- Transport to the designated spoil areas or stockpile of the material excavated: by means of 37.3 t, and/or 63.5 t, and/or 90.9 t payload off-highway dump trucks;
- Rough spreading of the unloaded material in disposal areas: by means of 149 kW bulldozer;
- Lighting of the work areas during the night shifts: by means of mobile diesel powered 10,000 W floodlights.

The following methods have been considered for the removal of the cofferdam in water:

- Loading: by means of 257 kW hydraulic backhoe outfitted with 3.2 m3 heaped bucket and 382 kW hydraulic backhoe outfitted with 5.8 m3 heaped bucket;
- Transport and spreading in disposal area: as described before for the removal in dry conditions.

The distances considered for the transport of the material to the disposal areas are given in the following table.

No.	Destination of Removed Material	Length (m)
1	Auxiliary cofferdams 1, 2, 3, & 4, transport to right bank disposal area No. 2	7,000

2	Auxiliary cofferdams 5, 6 and 7, transport to left bank disposal area No. 1	4,300
3	Auxiliary cofferdams 9, 10, 11, and 12, transport to right bank disposal area No. 2	8,500

4.9 Dam and Dam Cofferdams

4.9.1 General

The dam is composed of clayfill, fine filter, coarse filter transition and rockfill to be placed in dry conditions

The dam cofferdams are composed of rockfill, transition and clayfill to be placed partly in water and partly in dry conditions.

The monthly volumes of clayfill and rockfills required for dasm, dam cofferdams and other work sections are shown on the annexed Figures 7 & 8.

4.9.2 Source of Materials

The materials for the construction of the cofferdams and dam will be obtained from the sources listed in the following table.

No.	Material	Material Source
1	Clayfill	Right bank borrow areas JT-1, JT-3, JT-4
2	Fine filter	Sand from borrow area "Praia do Ze Paulino" stockpiled in the right bank main stockpile area
3	Coarse filter	Processed rock from right bank main stockpile area
4	Transition	Processed rock from right bank main stockpile area
5	Rockfill	Rock from main right bank stockpile area

4.9.3 Hauling

The lengths considered for the transport of the fill materials for dam and cofferdams are as follows:

No.	Material Source	Length (m)
1	Clay from right bank borrow areas JT-1, JT-3, JT-4	3,300
2	Sand from right bank main stockpile area including transport from borrow area to stockpile	5,600
3	Processed rock from right bank main stockpile area	3,000
4	Rock from right bank main stockpile area	3,000

4.9.4 Construction Method

a) Rockfill

The following methods have been considered for transporting and placing the rockfill in dry conditions:

- Loading of the material on dump trucks: by means of 390 kW hydraulic front shovel equipped with 5.7 m3 heaped bucket;

- Transport of the material to the embankment: partly by means of 63.5 t and partly by means of 90.6 tons payload off-highway dump trucks.
- Spreading on the embankment to approx. 60 cm layers thickness: by means of 231 kW bulldozer;
- Compaction: by smooth drum vibrating rollers having a weight of 18.6 t.

For the rockfill dumped in water the method related to the loading and transport are the same described before for the compacted fill plus the assistance of a 231 kW bulldozer in the unloading area.

b) Clayfill

The methods considered for the loading, transport and placing of the clayfill are the same described in before in Paragraph 4.8.5 b) for the auxiliary cofferdams.

c) Fine Filter

The following methods have been considered for transporting and placing of the fine filter:

- Loading of the material on dump trucks: by means of 229 kW wheel loader equipped with 4.2 m3 bucket;
- Transport of the material to the stockpile and then from the stockpile to the embankment: by means of 37.3 t payload off-highway dump trucks;
- Placing on the embankment to approx. 30 cm layers thickness: by means of 149 kW bulldozer and 138 kW motorgrader;
- Compaction: by means of vibrating plate compactor having a weight of 10.84 t.

d) Coarse Filter and Transition

The methods considered for the transport and placing of the coarse filter and transition materials are the same described in Paragraph 4.8.5b) for the auxiliary cofferdams.

4.10 Concrete Works

4.10.1 Source of Rock

The rock for the concrete aggregates will be obtained from the required excavations.

4.10.2 Concrete Aggregates

The blasted rock will be transported to the stockpiles located on the right bank and on the left bank close to the aggregate processing plants and then reloaded and transported to the primary crusher of the processing plants.

Two separate aggregate processing plants will be installed for the production of the aggregates to be used for the concretes to be placed on the right and left bank having a capacity of 300 t/h and 340 t/h respectively.

The aggregate processing plants will be composed of primary jaw type crushers, secondary cone type crushers, vibratory screens, rod mills, washing units, conveyor belts and steel hoppers.

The water for washing the aggregates will be taken from the Madeira River pumped to a desilting pond and then used for the processing plant.

The aggregates will be divided into five sizes, i.e. two fine and three coarse as follows:

- Fine sand size from 0 to 3.0 mm,;
- Coarse sand size from 3.0 mm to 5.75 mm;
- Coarse aggregate size from No. 4 to 3/4" (5.75 to 19 mm)
- Coarse aggregate size from 3/4" to 1-1/2" (19 to 37 mm);
- Coarse aggregate size from 1-1/2" to 3" (37 to 75 mm).

The classified aggregates will be used both for the conventional concrete and for the roller compacted concrete.

The classified aggregates will be stockpiled and then transported to the batching plant by means of belt conveyors which will be loaded by vibrating feeders installed under each stockpile.

4.10.3 Batching Plants

Two separate batching plants will be installed for the production of the concrete to be placed for the works of which one located on the right and the other on the left bank having a capacity of 240 m3/h and 370 m3/h respectively.

The batching plants will be of the vertical type and composed of aggregate bins, cement bins, twin horizontal shafts mixers and concrete hoppers.

The cement and natural pozzolan will be stored in steel silos having a capacity sufficient for four (4) consecutive days of material supply to the batching plant at the maximum daily production.

4.10.4 Cooling Plants

a) Temperature of Concrete

The maximum temperature attained by concrete depends on the initial placing temperature, the adiabatic-temperature-rise potential of the cement, and the heat gained by or lost from the concrete during the period of hydration.

The main purpose of temperature control is to prevent the concrete from undergoing a drop in temperature (difference from the peak temperature reached during hydration and the mean annual air temperature of the environment) greater than it can withstand without cracking.

For the concrete structures of Santo Antonio Project it has been established a max. drop temperature in the region of 25 °C.

The best mean for controlling the maximum temperature is to restrict the placing temperature.

The maximum-mean monthly air temperature recorded at Porto Velho ranges from approx. 32°C to 33°C.

The documents related to the feasibility study of the Project do not give records of the river water temperature at the Site and therefore is has been assumed for the water the mean temperature of the air less 2°C.

With the above mentioned air and water temperatures and the above mentioned max. concrete temperature drop, the following measures have to be taken:

- Structural concrete with 300-320 kg of cement:
  - Cooling of the coarse aggregates at the temperature of approx. 17°C;
  - Use chilled water in the mix with a temperature of 4 °C;
  - Add from 80 to 90 kg of ice to the mix;
  - Use cement with a temperature not exceeding 50 °C.
- Mass concrete with 210-230 kg of cement:
  - Use chilled water in the mix with a temperature of 4 °C;
  - Add from 50 to 70 kg of ice to the mix;
  - Use cement with a temperature not exceeding 50 °C.

b) Cooling Plants

In order to meet the most adverse temperature conditions the cooling of the concrete has been based on the combination of three systems as follows:

- chilled water (temperature of 4°C) for the mix;
- chilled water for cooling the coarse aggregates by means of wet-belt method; and
- ice flakes.

The ice plants will be outfitted with a mechanized storage having a capacity sufficient for assuring an uninterrupted supply of flakes to the batching plants.

4.10.5 Transport of Concrete

The concrete will in general be transported from the batching plant to the placing areas by means of the following equipments:

- Conventional truck mixers having a capacity of 10 m3;
- Concrete type tippers having a capacity of 10.6 m3 outfitted with srew-agitator;
- Conventional rear tippers with 28 t pay load.

The truck mixers will in general be used for the transport of high slump concrete with 1 ½" (37 mm) maximum aggregate size to be placed by means of pumps or small size buckets operated by cranes.

The concrete type tippers with crew agitator will in general be used for the transport of medium to low slump concrete both with 1 ½" (37 mm) and 3" (76 mm) maximum aggregate size to be placed by means of buckets or mobile units outfitted with belt conveyor.

The conventional tippers will in general be used for the transport of the RCC.

4.10.6 Pouring of Conventional Concrete

a) Structural Concrete:

The pouring and compaction of the structural concrete has been planned with the following equipment:

- Placing: partly by means of rail mounted tower cranes designed for lifting 3.0 and 5.0 m3 of concrete in heavy type bucket at the tip of the jib and partly by means of electric powered concrete pumps having a nominal power of 63 kW;
- Compaction: by means of 87 mm diameter hand held air powered immersion type vibrators;
- Compressed air for the air powered vibrators and other services for the concrete works: by means of 32.9 m3/min stationary electric powered compressors outfitted with 6”, 5” and 4” size pipelines.

b) Mass Concrete

The pouring and compaction of the mass concrete has been planned with the following equipment:

- Placing: lower part of structures by means of tired concrete placer having a 60 m long conveyor belt (Rotec Crater Crane Model CC-200-24);
- Placing: upper part of structures by means of rail mounted tower cranes designed for lifting 3.0 and 5.0 m3 of concrete in heavy type bucket at the tip of the jib;
- Spreading: by means of LPG bulldozer with 52 kW nominal power;
- Compaction: by means of a unit composed of a set of four hydraulic powered vibrators mounted on 67 kW hydraulic backhoe and supplemented with 87 mm diameter hand held air powered immersion type vibrators;
- Compressed air for the air powered vibrators and other services for the concrete works by means of 32.9 m3/min stationary electric powered compressors outfitted with 6”, 5” and 4” size pipelines.

4.10.7 Placing of RCC

The conventional tippers before reaching the unloading area will cross a tire cleaning platform outfitted with water sprinklers.

As soon as the concrete reaches the placing area will be spread in compacted layers of 40 cm by means of 52 kW LGP bulldozers equipped with universal type blade.

Compaction of RCC will be carried out by means of self-propelled single-smooth drum vibratory rollers having a linear static weight of 10.84 t.

The interfaces enriched with cement grout will be compacted by means of four heavy hydraulic powered vibrators mounted on 67 Kw hydraulic excavators.

The treatment of the surfaces of the warm joints will be done by means of mobile high pressure water blasting machines.

The treatment of the surface of the cold joints will be done by spreading a 10 mm thick layer of cement grout (W/C: 0.5 or 0.75).

After the compaction the RCC will be kept continuously moist by using stationary and portable sprinklers, perforated pipes, and hoses. The outside surface of the upstream and downstream faces will be cured with water.

4.10.8 Formworks and Scaffoldings

a) Formworks

The formworks necessary for the concrete confinement shall have sufficient strength to withstand the most adverse pressure resulting from placing and vibration operation and for the works under consideration have been divided into three basic types as follows:

The formworks for mass concrete will be composed of steel plates welded on a steel structure outfitted with vertical and inclined-adjustable masts as well as of service platform for erection/removal and surface repair works.

The dimension of the panels will in general be 1.50 x 2.50 m.

The formworks for structures will be composed partly of multiple steel pre-assembled panels and partly of plywood integrated with timber planks and squares as necessary to meet the different shapes of the structures and the required finishing.

b) Scaffolding

The scaffoldings to be used in connection with the formworks and the concrete structures have been subdivided into two types as follows:

- Scaffoldings for concrete slabs and support of beams These scaffoldings are composed of vertical, horizontal and inclined steel pipes to form a structure having sufficient strength to supports the formworks and the weight of concrete.
- Scaffoldings for walls These scaffoldings are composed of prefabricated elements designed to form walkways for the personnel along the external surfaces of the structures at interval of approx. 1.80 m in elevation.

4.11 Reinforcing Steel

The preparation, transport and fixing of reinforcing steel has been based on the following construction method:

- Storing on Site of steel bars coming from the steel mill: on the concrete pavement of flat yard(s);
- Cut and bend of steel bars: by means of electric powered equipment suitable to work up to 32 mm diameters bars of high grade steel;
- Loading and unloading of the bars in the yard: by means of 30 tons mobile crane;
- Transport of the worked bars from the yard to the placing locations: by means of 25 tons pay load flat bed truck;

- Lifting of worked re-steel to placing area: by means of the cranes available on the spot for the erection of the formworks and the pouring of concrete;
- Placing and fixing of re-steel in the structures: by hand with the assistance of mobile cranes and the tower cranes.
- The re-steel placed for slabs will be supported with proper U shape trestles while that placed vertically or inclined will be properly spaced with stirrups.

Figure 1 - Worksite Organization Layout

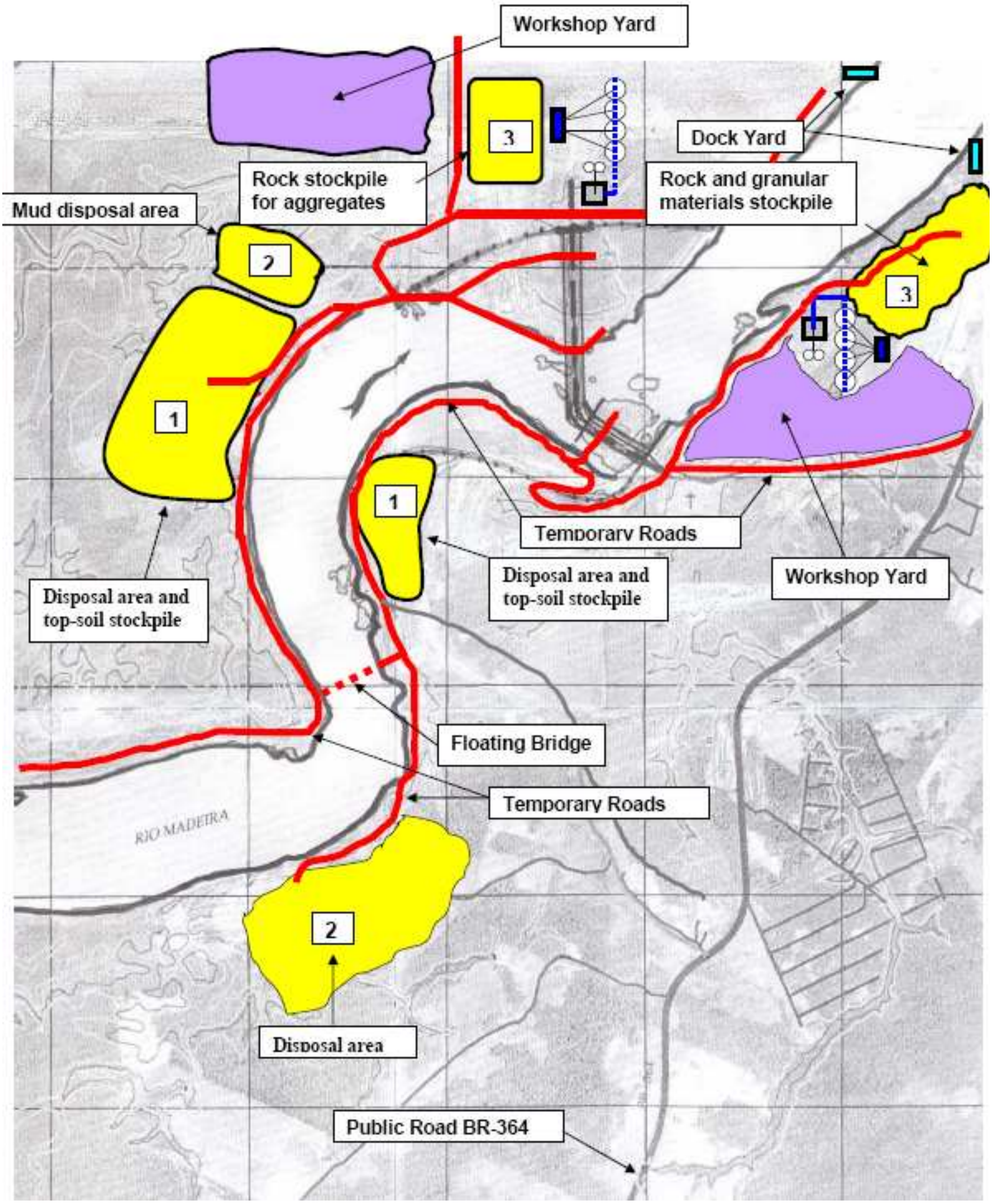


Figure 2 – Camp Areas

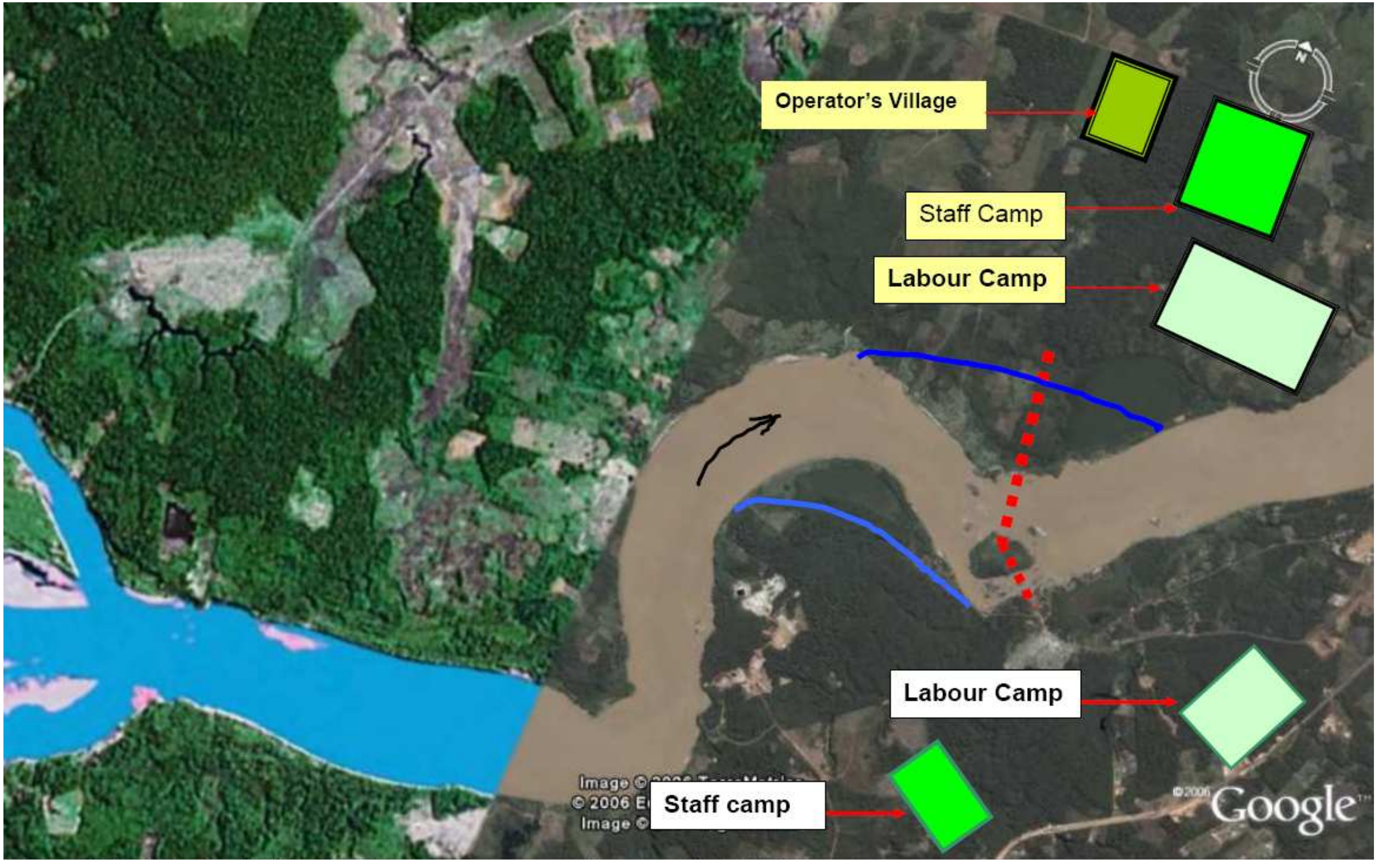


Figure 3 – Monthly Concrete Volumes - Right Bank

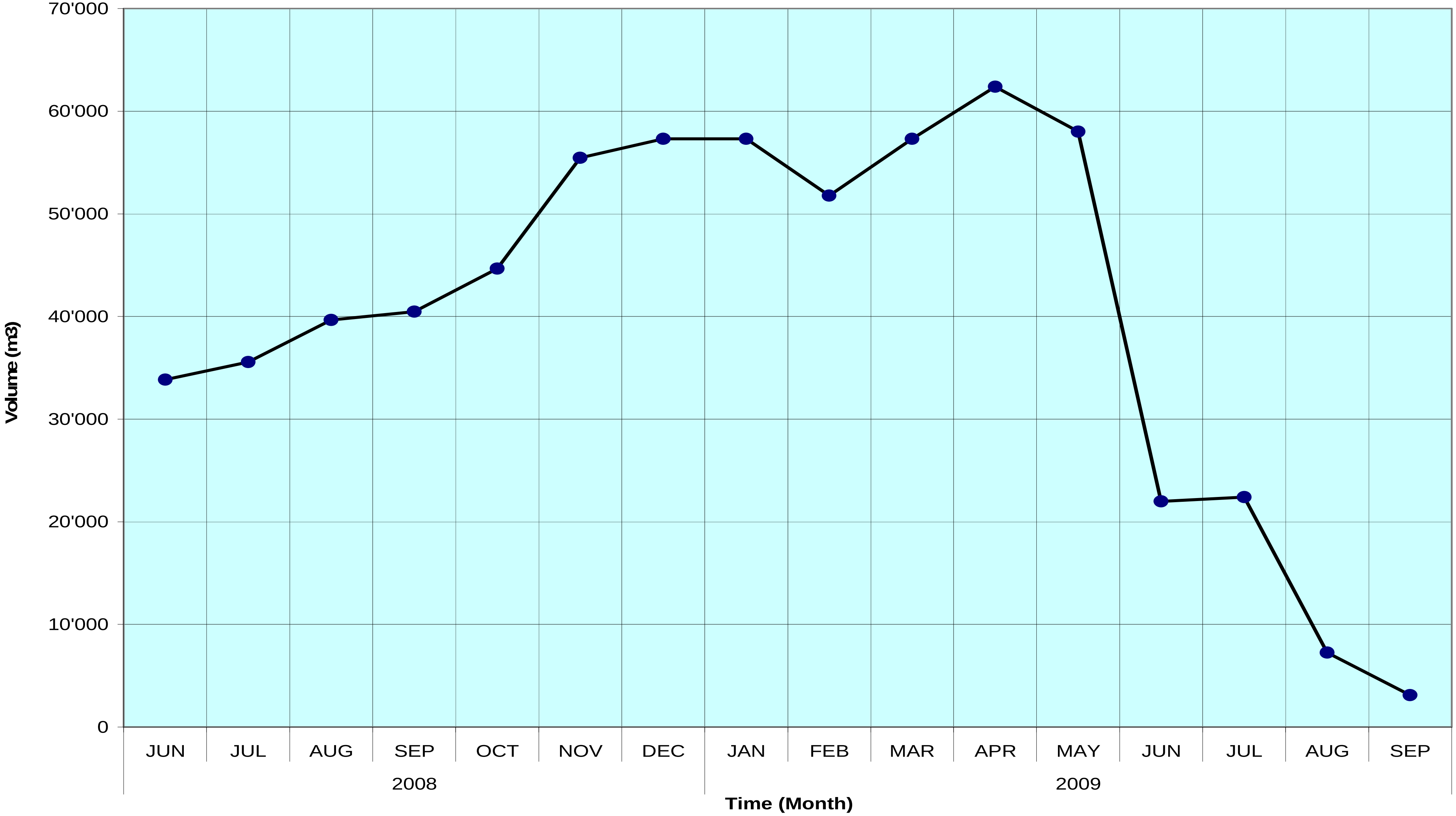


Figure 4 – Monthly Concrete Volumes - Left Bank

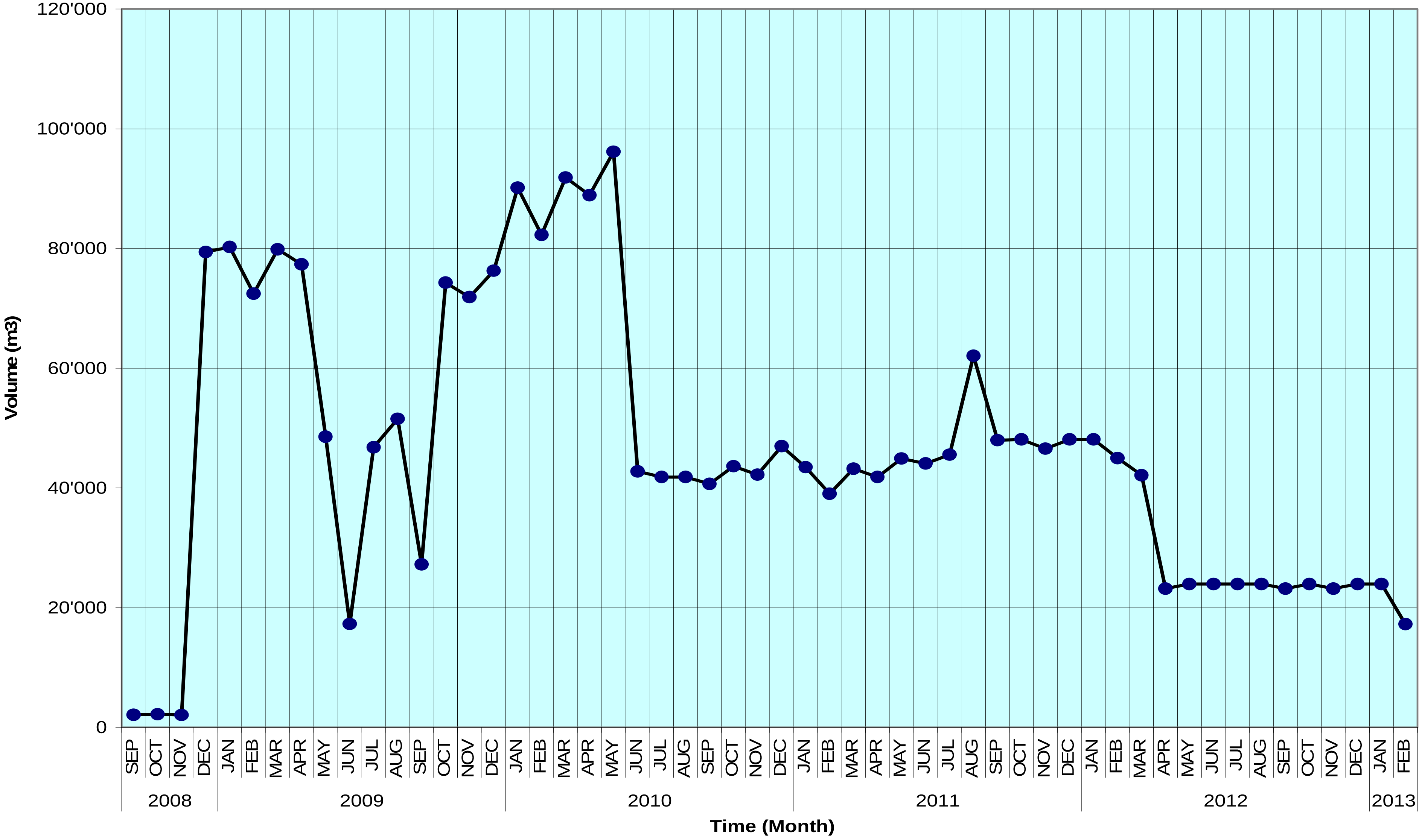


Figure 5 – Monthly Volumes of Common Excavation

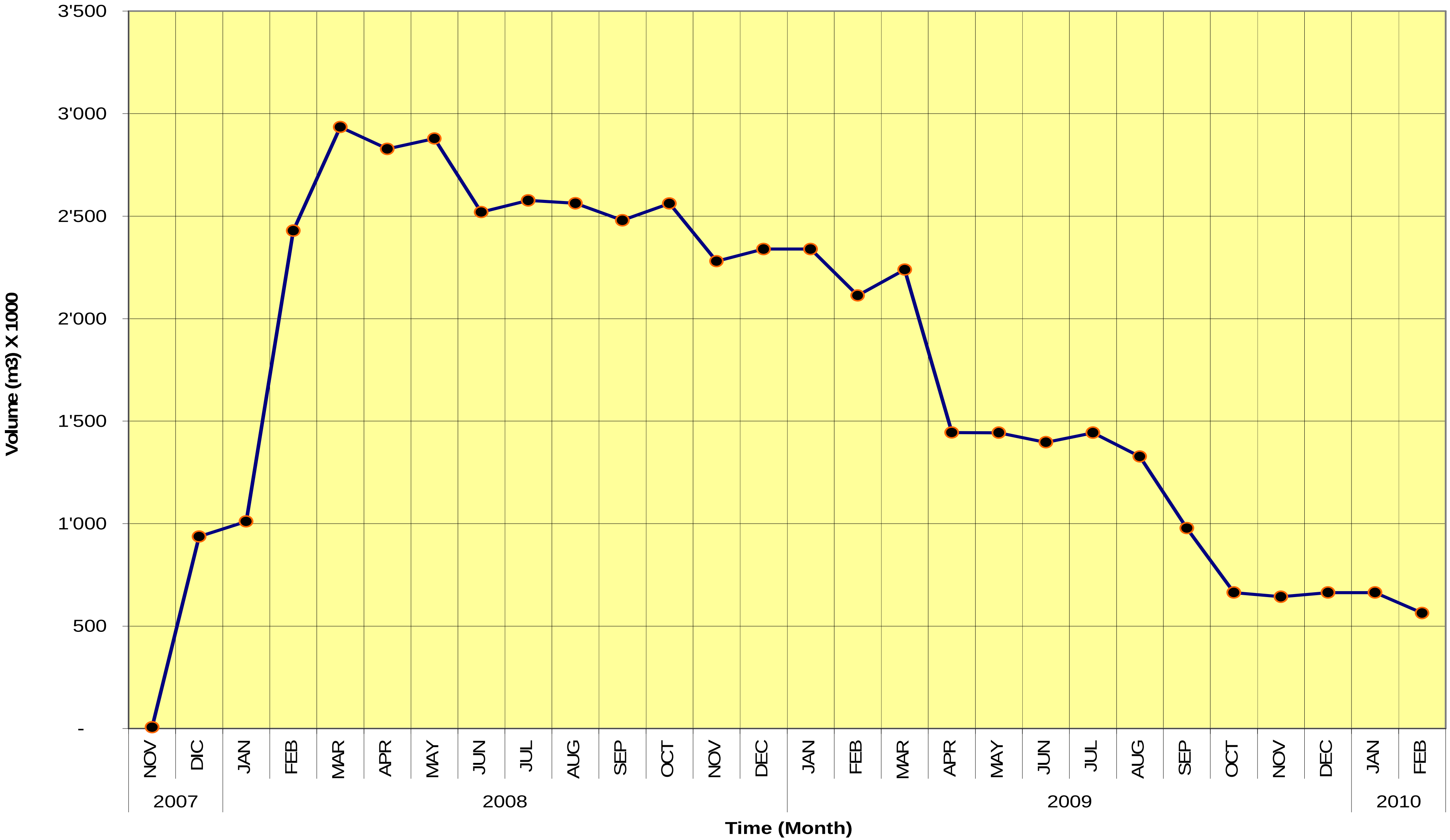


Figure 6 – Monthly Volumes of Rock Excavation

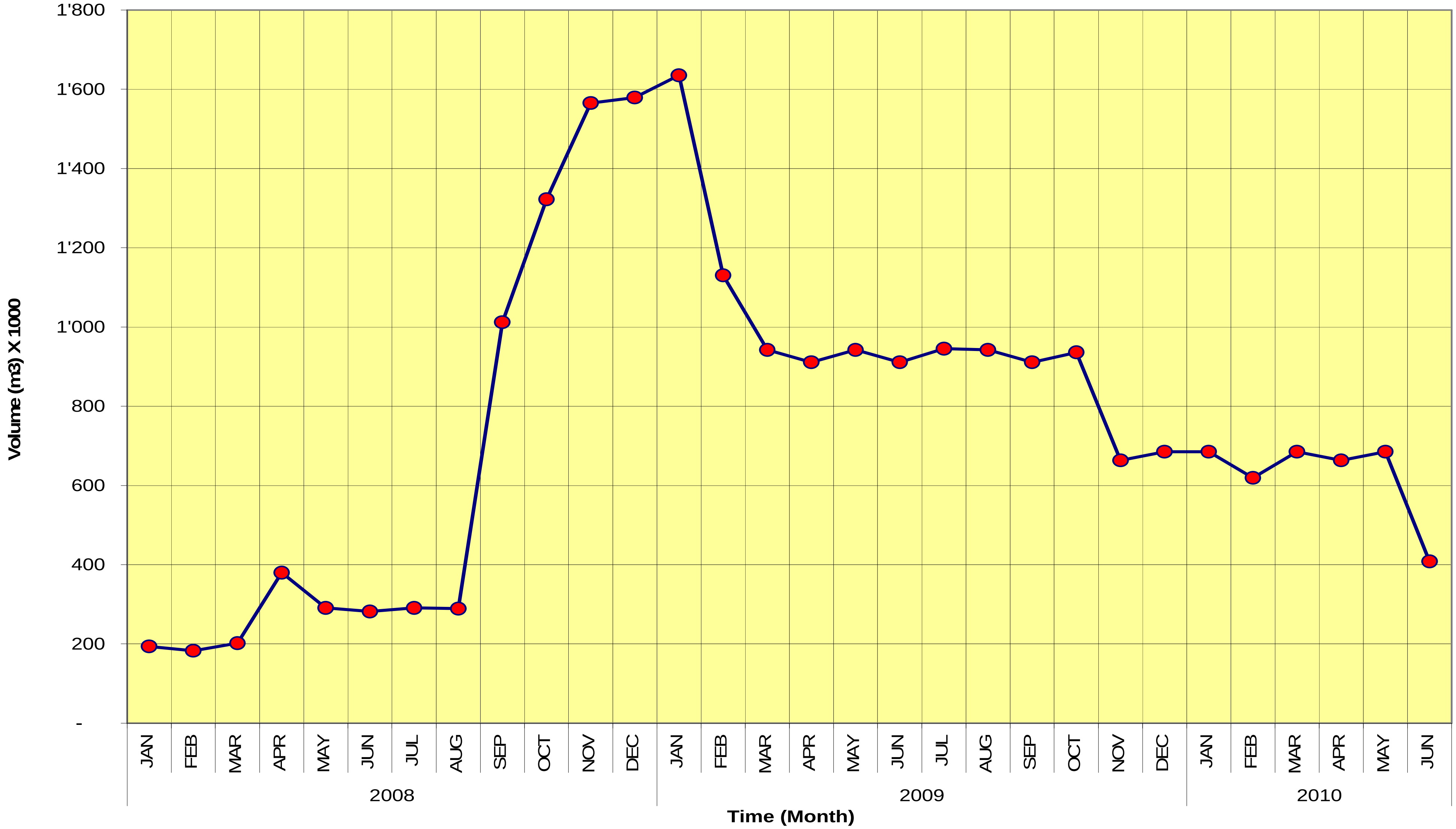


Figure 7 – Monthly Volumes of Clayfills

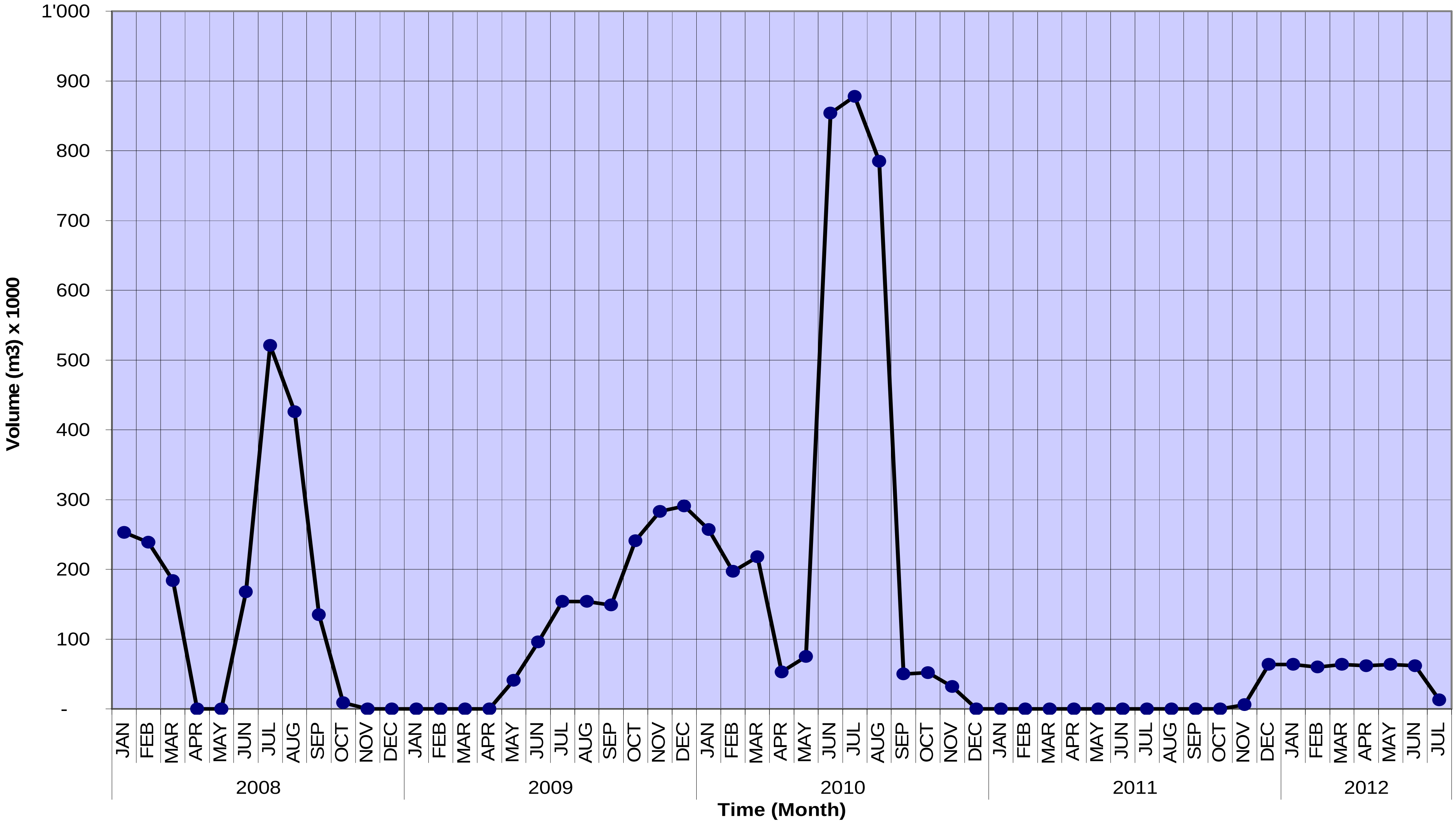


Figure 8 – Monthly Volumes of Rockfills

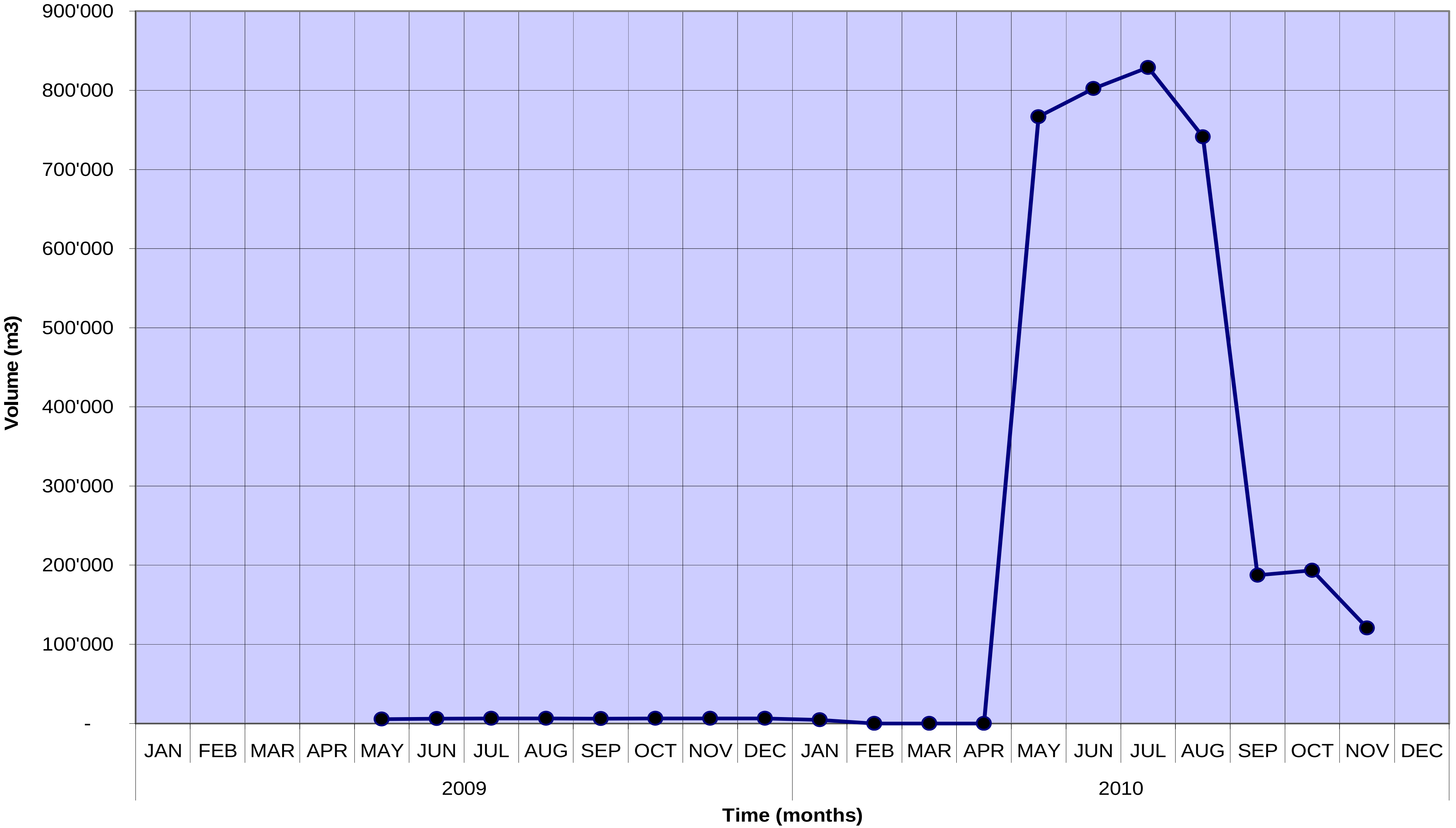
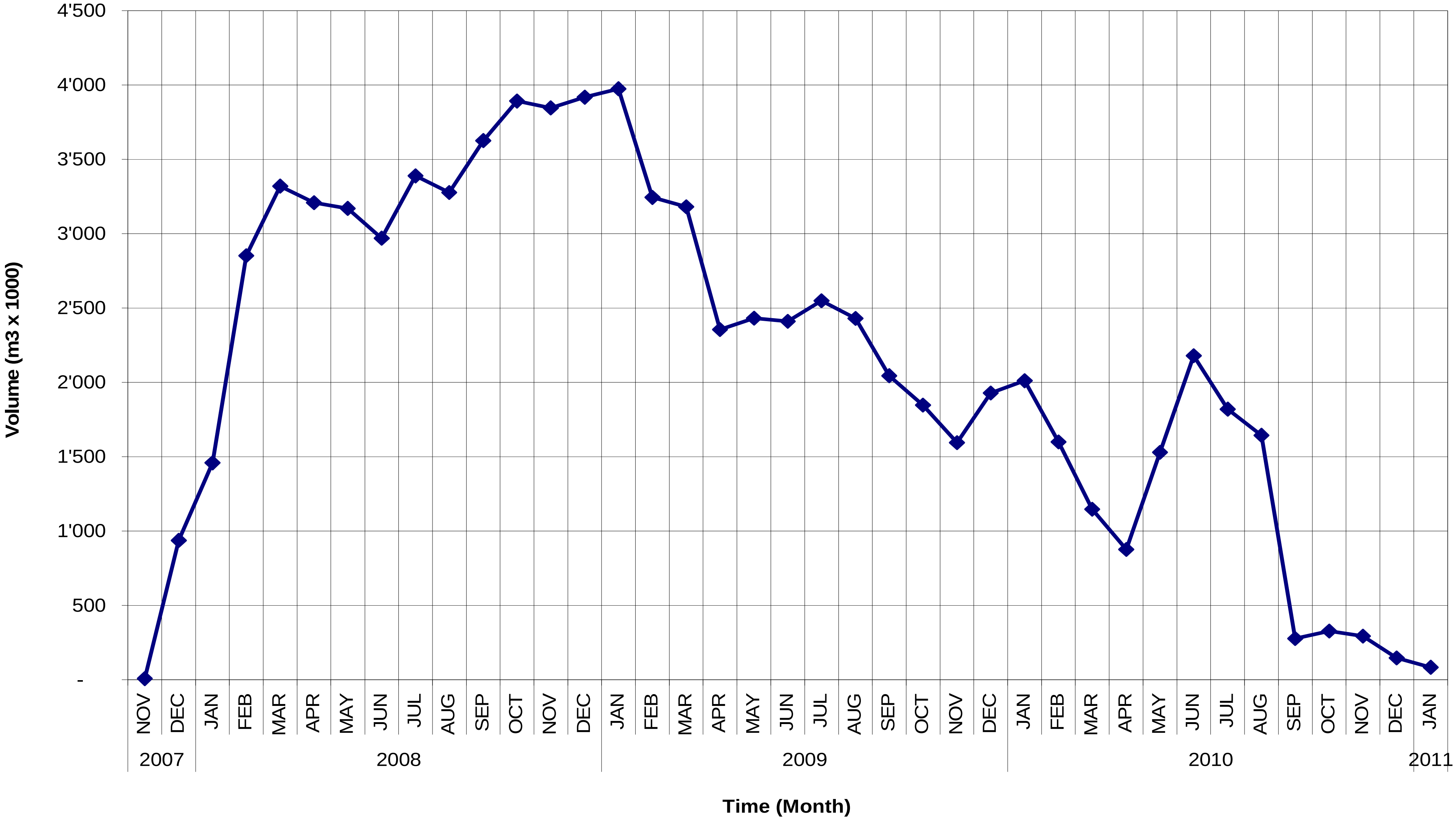


Figure 9 – Monthly Volumes - All Main Earthworks



SECTION V

UNIT PRICE ANALYSES

1 General

The cost estimate has been based on the assumption that the Works are carried out by a Brazilian contractor with the possible participation of subcontractor(s) for the execution of part of the construction activities such as site clearing, construction of camps, dredging, drilling and grouting etc.

The detailed analyses for establishing the unit prices to be included in the Bill of Quantities concern the main works, i.e. common excavation, dredging, rock excavation, slope protection and stabilization, fills and backfills, concrete aggregates, conventional concrete, roller compacted concrete (RCC), Portland cement, pozzolan, and reinforcing steel.

The rates of minor works have been established partly from analogy with the analyzed prices where possible and partly from the PINI bulletin which publishes updated basic price of labour and materials for most of the federal states of Brazil as well as unit prices mainly for construction of buildings.

2 Estimating Procedure

The price analyses carried out take the following main components into account:

a) Basic wages of labour;

b) Basic costs of materials delivered to the Site;

c) Owning and operating costs of the construction equipment;

d) Site construction contingencies;

e) Overheads and profit.

The basic wages of labour and the basic costs of materials are included in Section I of this report.

The owning and operating costs of construction equipment are included in Section II of this report.

The Site construction contingencies, overheads and profit are commented in the paragraphs herein below.

3 Site Construction Contingencies

Site construction contingencies have been considered in the detailed analyses on a percentage basis and added to the total of the direct costs.

These contingencies include minor costs not included in the detailed analyses that are caused by unexpected events that can affect the assumed production rates.

Such events include: equipment breakdown during operation, unexpected work interruptions, equipment refueling, displacement from site to site of the resources, unexpected unfavorable weather conditions, on-spot construction equipment maintenance, etc..

4 Overheads and Profit

The overheads consist of costs that the Contractor incurs both at the job-site and at his headquarter for staff salaries, vehicles for personnel and general services, office expenses, bonds, insurance, camp running costs excluding maintenance of camps, tests, rents, travels, legal fees, medical and hospital care and other expenses that are not part of the direct costs.

The cost related to the maintenance of camps has been included in the Bill of Quantities under the Item “Contractor’s Camps”.

The amount of overheads depends on a lot of variables which are strictly connected to the specific organization of the contractors. For Santo Antonio Project the overheads have been established on the ground of statistical data obtained from the construction of similar projects that have been awarded according to competitive bid procedures.

The percentages of the main overhead components and of the Contractor’s profit considered for the Project are listed in the following table.

No.	Description	Percentage
1	Site running costs, personnel	8.0%
2	mobility	3.5%
3	other	5.0%
4	Travels	3.0%
5	Head office expenses	2.5%
6	Guarantees and insurances	3.5%
7	Financial costs	5.0%
8	General tests	0.2%
9	Defects repair	0.5%
10	Income tax and miscellaneous	6.6%
11	Contractor’s profit	10.0%
Total -->		**47.8%**
Rounded Total --->		**48.0%**

The above percentage of indirect costs has been added to all direct costs analyzed including the supply of reinforcing steel, cement, concrete admixtures in spite of the fact that for the procurement of these materials the Contractor incurs only limited costs.

The percentage of 48% for indirect costs have been applied to the sum direct costs in local and foreign costs and added 100% to the local currency.

5 Annexed Tables

The analyses performed for establishing the unit prices of the main civil works are listed herein below and are given in the tables which follow.

No.	Work Section	Part	Tables
1	Topsoil removal and stockpiling	1	1-1 to 1-4
2	Common excavation and dredging	2	2-1 to 2-10
3	Rock excavation	3	3-1 to 3-13
4	Protection of common excavation surfaces	4	4-1 to 4-7
5	Auxiliary cofferdams removal	5	5-1 to 5-4
6	Fills and backfills	6	6-1 to 6-20
7	Concrete aggregates	7	7-1 to 7-4
8	Concrete works	8	8-1 to 8-21

Part 1 - Topsoil Removal and Stockpiling

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 1-01*
CIVIL WORKS COST ESTIMATE
TOP SOIL REMOVAL AND STOCKPILING - POWERHOUSE HEADRACE CHANNEL

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	1'497	11.81		17'674	
1.02	Operator, bulldozer in excavation area	----	hr	1'228	8.14		9'996	
1.03	Helper for ditto	----	hr	1'228	4.48		5'502	
1.06	Operator, wheel loader	----	hr	789	8.14		6'426	
1.07	Helper for ditto	----	hr	789	4.48		3'537	
1.10	Operator, rear dumper	----	hr	3'265	8.14		26'577	
1.11	Helper for ditto	----	hr	3'265	4.48		14'627	
1.12	Operator, bulldozer in stockpile area	----	hr	286	8.14		2'328	
1.13	Helper for ditto	----	hr	286	4.48		1'281	
1.14	General services, skilled	----	hr	278	4.48		1'247	
1.15	General services, semiskilled	----	hr	557	2.26		1'258	
2	**EQUIPMENT**							
2.01	Bulldozer 149 kW, excavation	O	hr	350	89.80		31'392	
		R	hr	70	37.40		2'615	
2.02	Bulldozer 231 kW, excavation	O	hr	767	127.61		97'854	
		R	hr	153	49.71		7'624	
2.03	Wheel loader, 161 kW , 2.90 m3 heaped capacity	O	hr	181	66.49		12'026	
		R	hr	36	32.52		1'176	
2.04	Wheel loader, 229 kW , 4.2 m3 heaped capacity	O	hr	537	50.23	33.99	26'962	18'245
		R	hr	107	15.84	25.15	1'701	2'700
2.05	Dumper, 37.3 ton pay load	O	hr	2'863	65.37	53.83	187'158	154'118
		R	hr	573	20.21	32.45	11'572	18'581
2.06	Dumper, 63.5 ton pay load	O	hr	105	100.64	80.60	10'578	8'472
		R	hr	21	33.71	50.86	709	1'069
2.07	Bulldozer 149 kW in stockpile area	O	hr	260	89.80		23'348	
		R	hr	52	37.34		1'942	
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	79	9.72		765	
		R	hr	16	6.20		98	
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			507'972	203'185
Construction Contingencies			%	2.00%	------------------------->>		10'159	4'064
Total Direct Costs				--->>			518'131	207'249
Overhead and Profit			%	48.00%	------------------------->>		348'183	
Unit Price in Currency Portions			**m3**	**208'000**	------------------------->>		**4.16**	**1.00**
AGGREGATE UNIT PRICE			**m3**	--->>				**5.16**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 1-02*

CIVIL WORKS COST ESTIMATE

TOP SOIL REMOVAL AND STOCKPILING - POWERHOUSE, POWER INTAKES, AND TAILRACE CHANNEL

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	1'238	11.81		14'619	
1.02	Operator, bulldozer in excavation area	----	hr	921	8.14		7'497	
1.03	Helper for ditto	----	hr	921	4.48		4'126	
1.06	Operator, wheel loader	----	hr	592	8.14		4'819	
1.07	Helper for ditto	----	hr	592	4.48		2'652	
1.10	Operator, rear dumper	----	hr	2'878	8.14		23'430	
1.11	Helper for ditto	----	hr	2'878	4.48		12'895	
1.12	Operator, bulldozer in stockpile area	----	hr	215	8.14		1'746	
1.13	Helper for ditto	----	hr	215	4.48		961	
1.14	General services, skilled	----	hr	230	4.48		1'032	
1.15	General services, semiskilled	----	hr	461	2.26		1'041	
2	**EQUIPMENT**							
2.01	Bulldozer 149 kW, excavation	O	hr	262	89.80		23'544	
		R	hr	52	37.40		1'961	
2.02	Bulldozer 231 kW, excavation	O	hr	575	127.61		73'390	
		R	hr	115	49.71		5'718	
2.03	Wheel loader, 161 kW , 2.90 m3 heaped capacity	O	hr	136	66.49		9'020	
		R	hr	27	32.52		882	
2.04	Wheel loader, 229 kW , 4.2 m3 heaped capacity	O	hr	403	50.23	33.99	20'222	13'684
		R	hr	81	15.84	25.15	1'275	2'025
2.05	Dumper, 37.3 ton pay load	O	hr	2'524	65.37	53.83	164'994	135'867
		R	hr	505	20.21	32.45	10'202	16'381
2.06	Dumper, 63.5 ton pay load	O	hr	93	100.64	80.60	9'326	7'469
		R	hr	19	33.71	50.86	625	943
2.07	Bulldozer 149 kW in stockpile area	O	hr	195	89.80		17'511	
		R	hr	39	37.34		1'456	
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	59	9.72		573	
		R	hr	12	6.20		73	
	O=Oprating units *R=Reserve units*							
Sub-total				--->>			415'591	176'368
Construction Contingencies			%	2.00%	------------------------->>		8'312	3'527
Total Direct Costs				--->>			423'903	179'895
Overhead and Profit			%	48.00%	------------------------->>		289'823	
Unit Price in Currency Portions			**m3**	**156'000**	------------------------->>		**4.58**	**1.15**
AGGREGATE UNIT PRICE			**m3**	--->>				**5.73**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 1-03*
CIVIL WORKS COST ESTIMATE
TOP SOIL REMOVAL AND STOCKPILING - SPILLWAY APPROACH CHANNEL

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	1'670	11.81		19'727	
1.02	Operator, bulldozer in excavation area	----	hr	1'582	8.14		12'880	
1.03	Helper for ditto	----	hr	1'582	4.48		7'089	
1.06	Operator, wheel loader	----	hr	1'017	8.14		8'279	
1.07	Helper for ditto	----	hr	1'017	4.48		4'557	
1.10	Operator, rear dumper	----	hr	3'247	8.14		26'433	
1.11	Helper for ditto	----	hr	3'247	4.48		14'548	
1.12	Operator, bulldozer in stockpile area	----	hr	369	8.14		3'000	
1.13	Helper for ditto	----	hr	369	4.48		1'651	
1.14	General services, skilled	----	hr	311	4.48		1'392	
1.15	General services, semiskilled	----	hr	622	2.26		1'405	
2	**EQUIPMENT**							
2.01	Bulldozer 149 kW, excavation	O	hr	450	89.80		40'448	
		R	hr	90	37.40		3'369	
2.02	Bulldozer 231 kW, excavation	O	hr	988	127.61		126'081	
		R	hr	198	49.71		9'823	
2.03	Wheel loader, 161 kW , 2.90 m3 heaped capacity	O	hr	233	66.49		15'495	
		R	hr	47	32.52		1'516	
2.04	Wheel loader, 229 kW , 4.2 m3 heaped capacity	O	hr	692	50.23	33.99	34'740	23'508
		R	hr	138	15.84	25.15	2'191	3'479
2.05	Dumper, 37.3 ton pay load	O	hr	2'848	65.37	53.83	186'147	153'286
		R	hr	570	20.21	32.45	11'510	18'481
2.06	Dumper, 63.5 ton pay load	O	hr	105	100.64	80.60	10'521	8'426
		R	hr	21	33.71	50.86	705	1'063
2.07	Bulldozer 149 kW in stockpile area	O	hr	335	89.80		30'083	
		R	hr	67	37.34		2'502	
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	101	9.72		985	
		R	hr	20	6.20		126	
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			577'201	208'243
Construction Contingencies			%	2.00%	---------------------------->>		11'544	4'165
Total Direct Costs				--->>			588'745	212'408
Overhead and Profit			%	48.00%	---------------------------->>		384'554	
Unit Price in Currency Portions			**m3**	**268'000**	---------------------------->>		**3.63**	**0.79**
AGGREGATE UNIT PRICE			**m3**	--->>				**4.42**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 1-04*
CIVIL WORKS COST ESTIMATE
TOP SOIL REMOVAL AND STOCKPILING - SPILLWAY, DICHARGE CHANNEL & M. G. DIKE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	539	11.81		6'370	
1.02	Operator, bulldozer in excavation area	----	hr	425	8.14		3'460	
1.03	Helper for ditto	----	hr	425	4.48		1'904	
1.06	Operator, wheel loader	----	hr	273	8.14		2'224	
1.07	Helper for ditto	----	hr	273	4.48		1'224	
1.10	Operator, rear dumper	----	hr	1'209	8.14		9'845	
1.11	Helper for ditto	----	hr	1'209	4.48		5'419	
1.12	Operator, bulldozer in stockpile area	----	hr	99	8.14		806	
1.13	Helper for ditto	----	hr	99	4.48		444	
1.14	General services, skilled	----	hr	100	4.48		450	
1.15	General services, semiskilled	----	hr	201	2.26		454	
2	**EQUIPMENT**							
2.01	Bulldozer 149 kW, excavation	O	hr	121	89.80		10'867	
		R	hr	24	37.40		905	
2.02	Bulldozer 231 kW, excavation	O	hr	265	127.61		33'873	
		R	hr	53	49.71		2'639	
2.03	Wheel loader, 161 kW , 2.90 m3 heaped capacity	O	hr	63	66.49		4'163	
		R	hr	13	32.52		407	
2.04	Wheel loader, 229 kW , 4.2 m3 heaped capacity	O	hr	186	50.23	33.99	9'333	6'316
		R	hr	37	15.84	25.15	589	935
2.05	Dumper, 37.3 ton pay load	O	hr	1'061	65.37	53.83	69'332	57'092
		R	hr	212	20.21	32.45	4'287	6'883
2.06	Dumper, 63.5 ton pay load	O	hr	39	100.64	80.60	3'919	3'138
		R	hr	8	33.71	50.86	263	396
2.07	Bulldozer 149 kW in stockpile area	O	hr	90	89.80		8'082	
		R	hr	18	37.34		672	
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	27	9.72		265	
		R	hr	5	6.20		34	
	O=Oprating units							
	R=Reserve units							
Sub-total				------------------------------->>			182'226	74'760
Construction Contingencies			%	2.00%	------------------>>		3'645	1'495
Total Direct Costs				------------------------------->>			185'871	76'255
Overhead and Profit			%	48.00%	------------------>>		125'821	
Unit Price in Currency Portions			**m3**	**72'000**	------------------>>		**4.33**	**1.06**
AGGREGATE UNIT PRICE			**m3**	--->>				**5.39**

Part 2 - Common Excavation and Dredging

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-01*

CIVIL WORKS COST ESTIMATE

COMMON EXCAVATION - POWERHOUSE HEADRACE CHANNEL (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	71'916	11.81		849'324	
1.02	Operator, bulldozer excavation	----	hr	26'792	8.14		218'091	
1.03	Helper for ditto	----	hr	26'792	4.48		120'030	
1.04	Operator, bulldozer ripping	----	hr	1'384	8.14		11'268	
1.05	Helper for ditto	----	hr	1'384	4.48		6'202	
1.06	Operator, wheel loader	----	hr	17'016	8.14		138'507	
1.07	Helper for ditto	----	hr	17'016	4.48		76'230	
1.08	Operator, hydraulic excavator	----	hr	16'802	8.14		136'770	
1.09	Helper for ditto	----	hr	16'802	4.48		75'274	
1.10	Operator, rear dumper	----	hr	184'834	8.14		1'504'552	
1.11	Helper for ditto	----	hr	184'834	4.48		828'058	
1.12	Operator, bulldozer in disposal area	----	hr	20'764	8.14		169'020	
1.13	Helper for ditto	----	hr	20'764	4.48		93'023	
1.14	General services, skilled	----	hr	13'380	4.48		59'941	
1.15	General services, semiskilled	----	hr	26'759	2.26		60'476	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	24'357	126.61		3'108'168	-
		R	hr	4'871	49.71		242'155	-
2.02	Bulldozer 231 kW, ripping	O	hr	1'258	157.40		194'302	-
		R	hr	252	60.10		15'126	-
2.03	Wheel loader, 229 kW , 4.20 m³ heaped capacity	O	hr	4'871	50.23	43.99	244'688	214'291
		R	hr	974	15.84	25.15	15'432	24'503
2.04	Wheel loader, 468 kW , 8.90 m³ heaped capacity	O	hr	10'597	116.86	112.58	1'238'404	1'193'048
		R	hr	2'119	40.63	64.82	86'114	137'384
2.05	Hydraulic backhoe, 257 kW , 3.20 m³ heaped cap.	O	hr	5'207	71.29	40.56	371'229	211'209
		R	hr	1'041	16.70	27.61	17'392	28'755
2.06	Hydraulic front shovel, 390 kW, 5.70 m³ heaped c.	O	hr	10'067	106.81	80.15	1'075'306	806'907
		R	hr	2'013	34.34	56.99	69'143	114'749
2.07	Dumper, 37.3 ton pay load	O	hr	32'164	65.37	53.83	2'102'542	1'731'373
		R	hr	6'433	20.21	32.45	130'006	208'742
2.08	Dumper, 63.5 ton pay load	O	hr	56'679	100.64	80.60	5'704'179	4'568'331
		R	hr	11'336	33.71	50.86	382'130	576'539
2.09	Dumper, 90.9 ton pay load	O	hr	79'189	119.00	94.66	9'423'437	7'495'988
		R	hr	15'838	40.59	56.50	642'853	894'831
2.10	Bulldozer 149 kW in disposal area	O	hr	18'877	89.80		1'695'110	-
		R	hr	3'775	37.34		140'970	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	5'480	9.72		53'268	-
		R	hr	1'096	6.20		6'796	-
	O=Oprating units							
	R=Reserve units							
Sub-total				----------------------	----------------------	------------>>	31'305'517	18'206'649
Construction Contingencies			%	2.00%	----------------------	------------>>	626'110	364'133
Total Direct Costs				----------------------	----------------------	------------>>	31'931'627	18'570'782
Overhead and Profit			%	48.00%	----------------------	------------>>	24'241'156	
Unit price in Currency Portions			m³	**15'101'200**	----------------------	------------>>	**3.72**	**1.23**
AGGREGATE UNIT PRICE			m³	----------------------	----------------------	----------------------	------------>>	**4.95**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-02*
CIVIL WORKS COST ESTIMATE
COMMON EXCAVATION - POWERHOUSE HEADRACE CHANNEL (TRANSPORT TO FILLS OF LEFT BANK AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	3'368	11.81		39'771	
1.02	Operator, bulldozer excavation	----	hr	1'863	8.14		15'164	
1.03	Helper for ditto	----	hr	1'863	4.48		8'346	
1.04	Operator, bulldozer ripping	----	hr	96	8.14		783	
1.05	Helper for ditto	----	hr	96	4.48		431	
1.06	Operator, wheel loader	----	hr	1'183	8.14		9'630	
1.07	Helper for ditto	----	hr	1'183	4.48		5'300	
1.08	Operator, hydraulic excavator	----	hr	1'168	8.14		9'510	
1.09	Helper for ditto	----	hr	1'168	4.48		5'234	
1.10	Operator, rear dumper	----	hr	6'776	8.14		55'160	
1.11	Helper for ditto	----	hr	6'776	4.48		30'358	
1.12	Operator, bulldozer in disposal area	----	hr	1'444	8.14		11'752	
1.13	Helper for ditto	----	hr	1'444	4.48		6'468	
1.14	General services, skilled	----	hr	627	4.48		2'807	
1.15	General services, semiskilled	----	hr	1'253	2.26		2'832	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	1'694	126.61		216'114	-
		R	hr	339	49.71		16'837	-
2.02	Bulldozer 231 kW, ripping	O	hr	88	157.40		13'510	-
		R	hr	18	60.10		1'052	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	339	50.23	43.99	17'013	14'900
		R	hr	68	15.84	25.15	1'073	1'704
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	737	116.86	112.58	86'107	82'954
		R	hr	147	40.63	64.82	5'988	9'552
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	362	71.29	40.56	25'812	14'686
		R	hr	72	16.70	27.61	1'209	1'999
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	700	106.81	80.15	74'767	56'105
		R	hr	140	34.34	56.99	4'808	7'979
2.07	Dumper, 37.3 ton pay load	O	hr	1'179	65.37	53.83	77'083	63'475
		R	hr	236	20.21	32.45	4'766	7'653
2.08	Dumper, 63.5 ton pay load	O	hr	2'078	100.64	80.60	209'125	167'483
		R	hr	416	33.71	50.86	14'010	21'137
2.09	Dumper, 90.9 ton pay load	O	hr	2'903	119.00	94.66	345'480	274'816
		R	hr	581	40.59	56.50	23'568	32'806
2.10	Bulldozer 149 kW in disposal area	O	hr	1'313	89.80		117'863	-
		R	hr	263	37.34		9'802	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	381	9.72		3'704	-
		R	hr	76	6.20		473	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			1'473'709	757'248
Construction Contingencies			%	2.00%	------------------------>>		29'474	15'145
Total Direct Costs				-->>			1'503'183	772'393
Overhead and Profit			%	48.00%	------------------------>>		1'092'277	
Unit price in Currency Portions			**m^3**	**1'050'000**	------------------------>>		**2.47**	**0.74**
AGGREGATE UNIT PRICE			**m^3**	-->>				**3.21**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-03*

CIVIL WORKS COST ESTIMATE

COMMON EXCAVATION - POWER INTAKES AND GENERATING UNITS (TRANSPORT TO L.B. DISPOSAL AREA 1

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	12'081	11.81		142'675	
1.02	Operator, bulldozer excavation	----	hr	4'137	8.14		33'676	
1.03	Helper for ditto	----	hr	4'137	4.48		18'534	
1.04	Operator, bulldozer ripping	----	hr	214	8.14		1'740	
1.05	Helper for ditto	----	hr	214	4.48		958	
1.06	Operator, wheel loader	----	hr	2'627	8.14		21'387	
1.07	Helper for ditto	----	hr	2'627	4.48		11'771	
1.08	Operator, hydraulic excavator	----	hr	2'594	8.14		21'119	
1.09	Helper for ditto	----	hr	2'594	4.48		11'623	
1.10	Operator, rear dumper	----	hr	32'173	8.14		261'888	
1.11	Helper for ditto	----	hr	32'173	4.48		144'135	
1.12	Operator, bulldozer in disposal area	----	hr	3'206	8.14		26'099	
1.13	Helper for ditto	----	hr	3'206	4.48		14'364	
1.14	General services, skilled	----	hr	2'248	4.48		10'069	
1.15	General services, semiskilled	----	hr	4'495	2.26		10'159	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	3'761	126.61		479'937	-
		R	hr	752	49.71		37'392	-
2.02	Bulldozer 231 kW, ripping	O	hr	194	157.40		30'002	-
		R	hr	39	60.10		2'336	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	752	50.23	43.99	37'783	33'089
		R	hr	150	15.84	25.15	2'383	3'784
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	1'636	116.86	112.58	191'224	184'220
		R	hr	327	40.63	64.82	13'297	21'214
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	804	71.29	40.56	57'322	32'613
		R	hr	161	16.70	27.61	2'686	4'440
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	1'555	106.81	80.15	166'040	124'596
		R	hr	311	34.34	56.99	10'677	17'719
2.07	Dumper, 37.3 ton pay load	O	hr	5'599	65.37	53.83	365'977	301'370
		R	hr	1'120	20.21	32.45	22'629	36'335
2.08	Dumper, 63.5 ton pay load	O	hr	9'866	100.64	80.60	992'892	795'182
		R	hr	1'973	33.71	50.86	66'515	100'355
2.09	Dumper, 90.9 ton pay load	O	hr	13'784	119.00	94.66	1'640'281	1'304'781
		R	hr	2'757	40.59	56.50	111'897	155'758
2.10	Bulldozer 149 kW in disposal area	O	hr	2'915	89.80		261'745	-
		R	hr	583	37.34		21'767	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	846	9.72		8'225	-
		R	hr	169	6.20		1'049	-
	O=Oprating units							
	R=Reserve units							
Sub-total				------------------------->>			5'254'251	3'115'454
Construction Contingencies			%	2.00%	------------------------->>		105'085	62'309
Total Direct Costs				------------------------->>			5'359'336	3'177'763
Overhead and Profit			%	48.00%	------------------------->>		4'097'807	
Unit price in Currency Portions			**m^3**	**2'331'800**	------------------------->>		**4.06**	**1.36**
AGGREGATE UNIT PRICE			**m^3**	------------------------->>				**5.42**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-04*

CIVIL WORKS COST ESTIMATE

COMMON EXCAVATION - POWERHOUSE TAILRACE CHANNEL (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	55'691	11.81		657'709	
1.02	Operator, bulldozer excavation	----	hr	18'433	8.14		150'044	
1.03	Helper for ditto	----	hr	18'433	4.48		82'579	
1.04	Operator, bulldozer ripping	----	hr	952	8.14		7'752	
1.05	Helper for ditto	----	hr	952	4.48		4'267	
1.06	Operator, wheel loader	----	hr	11'707	8.14		95'291	
1.07	Helper for ditto	----	hr	11'707	4.48		52'445	
1.08	Operator, hydraulic excavator	----	hr	11'560	8.14		94'097	
1.09	Helper for ditto	----	hr	11'560	4.48		51'788	
1.10	Operator, rear dumper	----	hr	150'285	8.14		1'223'318	
1.11	Helper for ditto	----	hr	150'285	4.48		673'276	
1.12	Operator, bulldozer in disposal area	----	hr	14'286	8.14		116'284	
1.13	Helper for ditto	----	hr	14'286	4.48		63'999	
1.14	General services, skilled	----	hr	10'361	4.48		46'418	
1.15	General services, semiskilled	----	hr	20'722	2.26		46'832	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	16'757	126.61		2'138'385	-
		R	hr	3'351	49.71		166'600	-
2.02	Bulldozer 231 kW, ripping	O	hr	866	157.40		133'678	-
		R	hr	173	60.10		10'407	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	3'351	50.23	43.99	168'343	147'430
		R	hr	670	15.84	25.15	10'617	16'858
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	7'291	116.86	112.58	852'009	820'804
		R	hr	1'458	40.63	64.82	59'245	94'519
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	3'583	71.29	40.56	255'402	145'309
		R	hr	717	16.70	27.61	11'966	19'783
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	6'926	106.81	80.15	739'799	555'143
		R	hr	1'385	34.34	56.99	47'570	78'946
2.07	Dumper, 37.3 ton pay load	O	hr	26'152	65.37	53.83	1'709'530	1'407'741
		R	hr	5'230	20.21	32.45	105'705	169'724
2.08	Dumper, 63.5 ton pay load	O	hr	46'084	100.64	80.60	4'637'942	3'714'409
		R	hr	9'217	33.71	50.86	310'702	468'771
2.09	Dumper, 90.9 ton pay load	O	hr	64'386	119.00	94.66	7'661'989	6'094'822
		R	hr	12'877	40.59	56.50	522'689	727'567
2.10	Bulldozer 149 kW in disposal area	O	hr	12'987	89.80		1'166'217	-
		R	hr	2'597	37.34		96'986	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	3'770	9.72		36'648	-
		R	hr	754	6.20		4'675	-
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			24'213'202	14'461'826
Construction Contingencies			%	2.00%	------------------------>>		484'264	289'237
Total Direct Costs				--->>			24'697'466	14'751'063
Overhead and Profit			%	48.00%	------------------------>>		18'935'294	
Unit price in Currency Portions			**m^3**	**10'389'460**	------------------------>>		**4.20**	**1.42**
AGGREGATE UNIT PRICE			**m^3**	--->>				**5.62**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-05*
CIVIL WORKS COST ESTIMATE
COMMON EXCAVATION - POWERHOUSE TAILRACE CHANNEL (TRANSPORT TO FILLS OF L.B. AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	3'269	11.81		38'610	
1.02	Operator, bulldozer excavation	----	hr	1'809	8.14		14'721	
1.03	Helper for ditto	----	hr	1'809	4.48		8'102	
1.04	Operator, bulldozer ripping	----	hr	93	8.14		761	
1.05	Helper for ditto	----	hr	93	4.48		419	
1.06	Operator, wheel loader	----	hr	1'149	8.14		9'349	
1.07	Helper for ditto	----	hr	1'149	4.48		5'146	
1.08	Operator, hydraulic excavator	----	hr	1'134	8.14		9'232	
1.09	Helper for ditto	----	hr	1'134	4.48		5'081	
1.10	Operator, rear dumper	----	hr	6'578	8.14		53'549	
1.11	Helper for ditto	----	hr	6'578	4.48		29'472	
1.12	Operator, bulldozer in disposal area	----	hr	1'402	8.14		11'409	
1.13	Helper for ditto	----	hr	1'402	4.48		6'279	
1.14	General services, skilled	----	hr	608	4.48		2'725	
1.15	General services, semiskilled	----	hr	1'216	2.26		2'749	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	1'644	126.61		209'803	-
		R	hr	329	49.71		16'346	-
2.02	Bulldozer 231 kW, ripping	O	hr	85	157.40		13'116	-
		R	hr	17	60.10		1'021	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	329	50.23	43.99	16'517	14'465
		R	hr	66	15.84	25.15	1'042	1'654
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	715	116.86	112.58	83'593	80'531
		R	hr	143	40.63	64.82	5'813	9'273
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	351	71.29	40.56	25'058	14'257
		R	hr	70	16.70	27.61	1'174	1'941
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	680	106.81	80.15	72'584	54'467
		R	hr	136	34.34	56.99	4'667	7'746
2.07	Dumper, 37.3 ton pay load	O	hr	1'145	65.37	53.83	74'832	61'622
		R	hr	229	20.21	32.45	4'627	7'429
2.08	Dumper, 63.5 ton pay load	O	hr	2'017	100.64	80.60	203'019	162'592
		R	hr	403	33.71	50.86	13'600	20'520
2.09	Dumper, 90.9 ton pay load	O	hr	2'818	119.00	94.66	335'392	266'791
		R	hr	564	40.59	56.50	22'880	31'848
2.10	Bulldozer 149 kW in disposal area	O	hr	1'274	89.80		114'421	-
		R	hr	255	37.34		9'516	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	370	9.72		3'596	-
		R	hr	74	6.20		459	-
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			1'430'677	735'136
Construction Contingencies			%	2.00%	------------------------->>		28'614	14'703
Total Direct Costs				--->>			1'459'290	749'839
Overhead and Profit			%	48.00%	------------------------->>		1'060'382	
Unit price in Currency Portions			m^3	**1'019'340**	------------------------->>		**2.47**	**0.74**
AGGREGATE UNIT PRICE			m^3	-->>				**3.21**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-06*

CIVIL WORKS COST ESTIMATE

COMMON EXCAVATION - SPILLWAY APPROACH CHANNEL (TRANSPORT TO R. B. DISPOSAL AREA 1)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	32'835	11.81		387'780	
1.02	Operator, bulldozer excavation	----	hr	14'194	8.14		115'535	
1.03	Helper for ditto	----	hr	14'194	4.48		63'587	
1.04	Operator, bulldozer ripping	----	hr	733	8.14		5'969	
1.05	Helper for ditto	----	hr	733	4.48		3'285	
1.06	Operator, wheel loader	----	hr	9'014	8.14		73'375	
1.07	Helper for ditto	----	hr	9'014	4.48		40'383	
1.08	Operator, hydraulic excavator	----	hr	8'901	8.14		72'455	
1.09	Helper for ditto	----	hr	8'901	4.48		39'877	
1.10	Operator, rear dumper	----	hr	78'334	8.14		637'640	
1.11	Helper for ditto	----	hr	78'334	4.48		350'937	
1.12	Operator, bulldozer in disposal area	----	hr	11'000	8.14		89'540	
1.13	Helper for ditto	----	hr	11'000	4.48		49'280	
1.14	General services, skilled	----	hr	6'109	4.48		27'368	
1.15	General services, semiskilled	----	hr	12'218	2.26		27'612	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	12'903	126.61		1'646'581	-
		R	hr	2'581	49.71		128'284	-
2.02	Bulldozer 231 kW, ripping	O	hr	667	157.40		102'933	-
		R	hr	133	60.10		8'013	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	2'581	50.23	43.99	129'626	113'523
		R	hr	516	15.84	25.15	8'175	12'981
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	5'614	116.86	112.58	656'056	632'028
		R	hr	1'123	40.63	64.82	45'620	72'780
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	2'759	71.29	40.56	196'662	111'890
		R	hr	552	16.70	27.61	9'214	15'233
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	5'333	106.81	80.15	569'653	427'467
		R	hr	1'067	34.34	56.99	36'629	60'789
2.07	Dumper, 37.3 ton pay load	O	hr	13'631	65.37	53.83	891'073	733'768
		R	hr	2'726	20.21	32.45	55'097	88'467
2.08	Dumper, 63.5 ton pay load	O	hr	24'021	100.64	80.60	2'417'473	1'936'092
		R	hr	4'804	33.71	50.86	161'950	244'342
2.09	Dumper, 90.9 ton pay load	O	hr	33'561	119.00	94.66	3'993'722	3'176'855
		R	hr	6'712	40.59	56.50	272'446	379'236
2.10	Bulldozer 149 kW in disposal area	O	hr	10'000	89.80		898'000	-
		R	hr	2'000	37.34		74'680	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	2'903	9.72		28'219	-
		R	hr	581	6.20		3'600	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			14'318'332	8'005'450
Construction Contingencies			%	2.00%	------------------------>>		286'367	160'109
Total Direct Costs				-->>			14'604'699	8'165'559
Overhead and Profit			%	48.00%	------------------------>>		10'929'724	
Unit price in Currency Portions			m^3	8'000'000	------------------------>>		**3.19**	**1.02**
AGGREGATE UNIT PRICE			m^3	-->>				**4.21**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-07*
CIVIL WORKS COST ESTIMATE
COMMON EXCAVATION - SPILLWAY APPROACH CHANNEL (TRANSPORT TO R. B. DISPOSAL AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	49'802	11.81		588'159	
1.02	Operator, bulldozer excavation	----	hr	14'120	8.14		114'941	
1.03	Helper for ditto	----	hr	14'120	4.48		63'260	
1.04	Operator, bulldozer ripping	----	hr	730	8.14		5'939	
1.05	Helper for ditto	----	hr	730	4.48		3'268	
1.06	Operator, wheel loader	----	hr	8'968	8.14		72'997	
1.07	Helper for ditto	----	hr	8'968	4.48		40'175	
1.08	Operator, hydraulic excavator	----	hr	8'855	8.14		72'082	
1.09	Helper for ditto	----	hr	8'855	4.48		39'672	
1.10	Operator, rear dumper	----	hr	141'692	8.14		1'153'377	
1.11	Helper for ditto	----	hr	141'692	4.48		634'782	
1.12	Operator, bulldozer in disposal area	----	hr	10'943	8.14		89'079	
1.13	Helper for ditto	----	hr	10'943	4.48		49'026	
1.14	General services, skilled	----	hr	9'265	4.48		41'509	
1.15	General services, semiskilled	----	hr	18'531	2.26		41'880	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	12'837	126.61		1'638'103	-
		R	hr	2'567	49.71		127'623	-
2.02	Bulldozer 231 kW, ripping	O	hr	663	157.40		102'403	-
		R	hr	133	60.10		7'972	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	2'567	50.23	43.99	128'958	112'938
		R	hr	513	15.84	25.15	8'133	12'914
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	5'585	116.86	112.58	652'678	628'774
		R	hr	1'117	40.63	64.82	45'385	72'406
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	2'744	71.29	40.56	195'650	111'314
		R	hr	549	16.70	27.61	9'166	15'155
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	5'306	106.81	80.15	566'720	425'266
		R	hr	1'061	34.34	56.99	36'441	60'476
2.07	Dumper, 37.3 ton pay load	O	hr	24'656	65.37	53.83	1'611'791	1'327'255
		R	hr	4'931	20.21	32.45	99'661	160'020
2.08	Dumper, 63.5 ton pay load	O	hr	43'450	100.64	80.60	4'372'775	3'502'044
		R	hr	8'690	33.71	50.86	292'938	441'970
2.09	Dumper, 90.9 ton pay load	O	hr	60'705	119.00	94.66	7'223'926	5'746'360
		R	hr	12'141	40.59	56.50	492'805	685'969
2.10	Bulldozer 149 kW in disposal area	O	hr	9'949	89.80		893'376	-
		R	hr	1'990	37.34		74'295	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	2'888	9.72		28'074	-
		R	hr	578	6.20		3'581	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			21'622'604	13'302'860
Construction Contingencies			%	2.00%	-------------------------->>		432'452	266'057
Total Direct Costs				-->>			22'055'056	13'568'918
Overhead and Profit			%	48.00%	-------------------------->>		17'099'507	
Unit price in Currency Portions			m^3	**7'958'810**	-------------------------->>		**4.92**	**1.70**
AGGREGATE UNIT PRICE			m^3	--->>				**6.62**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-08*
CIVIL WORKS COST ESTIMATE
COMMON EXCAVATION - SPILLWAY STRU. & DISCHARGE CHANNEL (TRANSPORT TO R. B. DISPOSAL AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	6'842	11.81		80'809	
1.02	Operator, bulldozer excavation	----	hr	1'662	8.14		13'529	
1.03	Helper for ditto	----	hr	1'662	4.48		7'446	
1.04	Operator, bulldozer ripping	----	hr	86	8.14		699	
1.05	Helper for ditto	----	hr	86	4.48		385	
1.06	Operator, wheel loader	----	hr	1'056	8.14		8'592	
1.07	Helper for ditto	----	hr	1'056	4.48		4'729	
1.08	Operator, hydraulic excavator	----	hr	1'042	8.14		8'485	
1.09	Helper for ditto	----	hr	1'042	4.48		4'670	
1.10	Operator, rear dumper	----	hr	20'326	8.14		165'457	
1.11	Helper for ditto	----	hr	20'326	4.48		91'062	
1.12	Operator, bulldozer in disposal area	----	hr	1'288	8.14		10'485	
1.13	Helper for ditto	----	hr	1'288	4.48		5'771	
1.14	General services, skilled	----	hr	1'273	4.48		5'703	
1.15	General services, semiskilled	----	hr	2'546	2.26		5'754	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	1'511	126.61		192'815	-
		R	hr	302	49.71		15'022	-
2.02	Bulldozer 231 kW, ripping	O	hr	78	157.40		12'053	-
		R	hr	16	60.10		938	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	302	50.23	43.99	15'179	13'293
		R	hr	60	15.84	25.15	957	1'520
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	657	116.86	112.58	76'824	74'010
		R	hr	131	40.63	64.82	5'342	8'523
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	323	71.29	40.56	23'029	13'102
		R	hr	65	16.70	27.61	1'079	1'784
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	625	106.81	80.15	66'706	50'056
		R	hr	125	34.34	56.99	4'289	7'118
2.07	Dumper, 37.3 ton pay load	O	hr	3'537	65.37	53.83	231'218	190'400
		R	hr	707	20.21	32.45	14'297	22'956
2.08	Dumper, 63.5 ton pay load	O	hr	6'233	100.64	80.60	627'293	502'383
		R	hr	1'247	33.71	50.86	42'023	63'402
2.09	Dumper, 90.9 ton pay load	O	hr	8'708	119.00	94.66	1'036'303	824'340
		R	hr	1'742	40.59	56.50	70'695	98'405
2.10	Bulldozer 149 kW in disposal area	O	hr	1'171	89.80		105'156	-
		R	hr	234	37.34		8'745	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	340	9.72		3'304	-
		R	hr	68	6.20		422	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			2'967'267	1'871'294
Construction Contingencies			%	2.00%	-------------------------->>		59'345	37'426
Total Direct Costs				-->>			3'026'612	1'908'720
Overhead and Profit			%	48.00%	-------------------------->>		2'368'959	
Unit price in Currency Portions			m^3	936'800	-------------------------->>		**5.76**	**2.04**
AGGREGATE UNIT PRICE			m^3	--->>				**7.80**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 2-09*

CIVIL WORKS COST ESTIMATE

COMMON EXCAVATION - MATO GROSSO DIVERSION TUNNEL (TRANSPORT TO R. B. DISPOSAL AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	581	11.81		6'861	
1.02	Operator, bulldozer excavation	----	hr	64	8.14		518	
1.03	Helper for ditto	----	hr	64	4.48		285	
1.04	Operator, bulldozer ripping	----	hr	-	8.14		-	
1.05	Helper for ditto	----	hr	-	4.48		-	
1.06	Operator, wheel loader	----	hr	64	8.14		518	
1.07	Helper for ditto	----	hr	64	4.48		285	
1.08	Operator, hydraulic excavator	----	hr	159	8.14		1'292	
1.09	Helper for ditto	----	hr	159	4.48		711	
1.10	Operator, rear dumper	----	hr	1'793	8.14		14'599	
1.11	Helper for ditto	----	hr	1'793	4.48		8'035	
1.12	Operator, bulldozer in disposal area	----	hr	82	8.14		669	
1.13	Helper for ditto	----	hr	82	4.48		368	
1.14	General services, skilled	----	hr	108	4.48		484	
1.15	General services, semiskilled	----	hr	216	2.26		489	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, excavation	O	hr	58	126.61		7'385	-
		R	hr	12	49.71		575	-
2.02	Bulldozer 231 kW, ripping	O	hr	-	157.40		-	-
		R	hr	-	60.10		-	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	58	50.23	43.99	2'907	2'546
		R	hr	12	15.84	25.15	183	291
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	-	116.86	112.58	-	-
		R	hr	-	40.63	64.82	-	-
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	144	71.29	40.56	10'290	5'855
		R	hr	29	16.70	27.61	482	797
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	-	106.81	80.15	-	-
		R	hr	-	34.34	56.99	-	-
2.07	Dumper, 37.3 ton pay load	O	hr	688	65.37	53.83	44'960	37'023
		R	hr	138	20.21	32.45	2'780	4'464
2.08	Dumper, 63.5 ton pay load	O	hr	943	100.64	80.60	94'871	75'980
		R	hr	189	33.71	50.86	6'356	9'589
2.09	Dumper, 90.9 ton pay load	O	hr	-	119.00	94.66	-	-
		R	hr	-	40.59	56.50	-	-
2.10	Bulldozer 149 kW in disposal area	O	hr	75	89.80		6'713	-
		R	hr	15	37.34		558	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	13	9.72		127	-
		R	hr	3	6.20		16	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			213'319	136'544
Construction Contingencies			%	2.00%	------------------------>>		4'266	2'731
Total Direct Costs				-->>			217'586	139'275
Overhead and Profit			%	48.00%	------------------------>>		171'293	
Unit price in Currency Portions			m^3	59'800	------------------------>>		**6.50**	**2.33**
AGGREGATE UNIT PRICE			m^3	--->>				**8.83**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 2-10*

CIVIL WORKS COST ESTIMATE

EXCAVATION OF SOFT SOIL (MUD DREDGING) - POWERHOUSE TAILRACE CHANNEL

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	DREDGING							
1.1	**Labour**							
1.1.01	Foreman	---	hr	51'300	11.81		605'853	
1.1.02	Dredger operator	---	hr	34'200	8.14		278'388	
1.1.03	Dredger helper	---	hr	68'400	4.48		306'432	
1.1.04	Dredger general services, specialist	---	hr	34'200	5.75		196'650	
1.1.04	Dredger general services, skilled	---	hr	68'400	4.48		306'432	
1.1.05	Dredger general services, semiskilled	---	hr	68'400	2.26		154'584	
1.1.04	Pipeline mainetenance, skilled	---	hr	34'200	4.48		153'216	
1.1.05	Pipeline mainetenance, semiskilled	---	hr	102'600	2.26		231'876	
1.2	**Equipment**							
1.2.01	Dredger 600 kW, 250 m3/h capacity	3	m.th	57	91'489.84		5'214'921	
			hr	29'617	323.38		9'577'481	
1.2.02	Pipeline .300 mm dia., length 2 x 1500 m	3	m.th	57	70'350.00		4'009'950	
			hr	29'617	60.00		1'777'008	
1.2.03	Conventional barge with 50 kW engine	3	hr	8'885	32.50		288'764	
			hr	1'777	12.37		21'982	
2	BUSTER STATION ALONG PIPELINE							
2.1	**Labour**						-	
							-	
2.1.01	Foreman	---	hr	11'477	11.81		135'538	
2.1.02	Specialist	---	hr	32'578	8.14		265'189	
2.1.03	Skilled	---	hr	29'617	11.81		349'774	
2.1.04	Semiskilled	---	hr	29'617	8.14		241'081	
2.2	**Equipment**							
2.2.01	Booster mud type pump, 520 kW	3	m.th	57	22'872.46		1'303'730	
			hr	29'617	80.85		2'394'370	
2.2.02	Pipeline 300 mm dia., length 2 x 2000 m	3	m.th	57	23'450.00		1'336'650	
			hr	29'617	20.00		592'336	
2.2.03	Steel tank, 200 m3 capacity	3	m.th	57	568.90		32'427	
2.2.04	Transformer cabin, 750 KVA	3	m.th	57	1'223.56		69'743	
2.3	**Additional Costs**							
2.3.01	Additional costs for work executed by subcontractor		l.s.				6'000'000	
Sub-total -->>							35'844'374	
Construction Contingencies			%	5.00%	----------------------->>		1'792'219	
Total Direct Costs -->>							37'636'593	
Overhead and Profit			%	48.00%	----------------------->>		18'065'565	
Unit Price in Currency Portions			m^3	**7'404'200**	----------------------->>		**7.52**	
AGGREGATE UNIT PRICE			m^3	-->>				**7.52**

Part 3 - Rock Excavation

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-1*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE HEADRACE CHANNEL (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	22'229	11.81		262'522	-
1.1.02	Crawler drill operator	---	hr	18'784	8.14		152'903	-
1.1.03	Helper for ditto	---	hr	37'568	4.48		168'306	-
1.1.04	Hand held drill miner	---	hr	6'645	4.48		29'769	-
1.1.05	Helper for ditto	---	hr	13'290	2.26		30'035	-
1.1.06	Explosive truck driver	---	hr	827	3.39		2'803	-
1.1.07	Helper for ditto	---	hr	827	2.26		1'868	-
1.1.08	ANFO truck driver	---	hr	2'051	3.39		6'954	-
1.1.09	Helper for ditto	---	hr	4'102	2.26		9'272	-
1.1.10	Explosive charging and firing, specialist	---	hr	36'902	5.76		212'556	-
1.1.11	Explosive charging and firing, skilled	---	hr	18'451	4.48		82'661	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	2'817	8.14		22'927	-
1.1.13	General services, skilled	---	hr	14'226	4.48		63'734	-
01:01:14	General services, semiskilled	---	hr	21'340	2.28		48'654	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	1'640	23.81	32.02	39'049	52'513
		R	hr	410	13.65	26.67	5'597	10'935
1.2.02	Crawler rock drill, 147 kw	O	hr	14'013	51.30	51.50	718'888	721'691
		R	hr	3'503	23.43	41.31	82'084	144'724
1.2.03	Hand-held rock drill, heavy weight type	O	hr	6'645	1.30	2.54	8'638	16'878
		R	hr	1'661	1.17	2.29	1'944	3'804
1.2.04	Motorcompressor, 17 m3/min	O	hr	1'440	41.24		59'375	-
		R	hr	288	13.96		4'020	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	591	39.20		23'149	-
		R	hr	118	14.72		1'739	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	1'465	47.10		69'010	-
		R	hr	293	17.65		5'172	-
1.2.07	Integral drill steel grinder	O	hr	454	3.03	1.56	1'374	708
		R	hr	91	0.92	1.45	83	132
01:02:08	Button bits grinder	O	hr	1'894	2.74	1.37	5'189	2'594
		R	hr	379	0.81	1.28	307	485
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	4'151	9.72		40'345	-
		R	hr	830	6.20		5'147	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	970'778	1.99		1'931'847	-
1.3.02	Explosive, ANFO type	---	kg	1'852'878	1.24		2'297'569	-
1.3.03	Detonating fuse	---	m	606'489	0.30		181'947	-
1.3.04	Ordinary low burning fuse	---	ea	47	0.34		16	-
1.3.05	Delay for detonating fuse	---	ea	44'293	3.82		169'201	-
1.3.06	Common detonator	---	ea	31	0.24		7	-
1.3.07	Detonator with connector to detonating fuse	---	ea	609	3.34		2'035	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	37		612.81	-	22'669
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	703		516.19	-	363'078
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	26		396.12	-	10'151
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	229		469.27	-	107'343
	O=Operating unit							
	R=Reserve unit							
Total brought forward --->							6'748'695	1'457'704

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-1*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE HEADRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
	Materials (Cont.d)						6'748'695	1'457'704
1.3.12	Coupling for rod n. 1.3.09	---	ea	1'023		111.80	-	114'382
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	68		162.86	-	11'129
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	49		296.36	-	14'655
1.3.14	Crawler drill button type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	561		448.57	-	251'440
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	302		143.80	-	43'483
1.3.17	Grease for rods, couplings and shanks	---	kg	1'831	2.86		5'238	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	30'793	11.81		363'671	-
2.1.02	Operator, front shovel	----	hr	18'266	8.14		148'689	-
2.1.03	Helper for ditto	----	hr	18'266	4.48		81'834	-
2.1.04	Operator, backhoe	----	hr	913	8.14		7'434	-
2.1.05	Helper for ditto	----	hr	913	4.48		4'092	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	4'567	8.14		37'172	-
2.1.07	Helper for ditto	----	hr	4'567	4.48		20'458	-
2.1.08	Operator, off-highway dumper	----	hr	73'946	8.14		601'920	-
2.1.09	Helper for ditto	----	hr	73'946	4.48		331'278	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	16'888	8.14		137'467	-
2.1.11	Helper for ditto	----	hr	16'888	4.48		75'658	-
2.1.12	General services, skilled	----	hr	5'729	4.48		25'666	-
2.1.13	General services, semiskilled	----	hr	11'458	2.26		25'895	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	2'121	92.97	71.61	197'232	151'917
		R	hr	424	29.96	49.75	12'712	21'108
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	14'484	122.83	92.17	1'779'121	1'335'028
		R	hr	2'897	39.49	65.54	114'398	189'862
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	830	91.71		76'146	-
		R	hr	166	38.51		6'395	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	4'151	154.40		640'987	-
		R	hr	830	60.10		49'901	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	13'582	71.90	59.21	976'531	804'178
		R	hr	2'716	22.23	35.69	60'385	96'947
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	15'571	110.78	88.66	1'724'949	1'380'520
		R	hr	3'114	37.08	55.95	115'474	174'239
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	38'071	119.00	94.66	4'530'434	3'603'789
		R	hr	7'614	44.65	62.15	339'973	473'221
2.2.08	Bulldozer 149 kW in disposal area	O	hr	15'353	107.76		1'654'400	-
		R	hr	3'071	44.81		137'590	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	9'713	9.72		94'409	-
		R	hr	1'943	6.20		12'044	-
Sub-total ---->>							21'138'247	10'123'603
Construction Contingencies			%	2.00%	---->>		422'765	202'472
Total Direct Costs ---->>							21'561'011	10'326'075
Overheads and Profit			%	48.00%	---->>		15'305'801	
Unit Price in Currency Portions			**m^3**	**4'667'200**	---->>		**7.90**	**2.21**
AGGREGATE UNIT PRICE			**m^3**	---->>				**10.11**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-2*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE HEADRACE CHANNEL (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	2'088	11.81		24'653	-
1.1.02	Crawler drill operator	---	hr	1'763	8.14		14'349	-
1.1.03	Helper for ditto	---	hr	3'526	4.48		15'795	-
1.1.04	Hand held drill miner	---	hr	624	4.48		2'794	-
1.1.05	Helper for ditto	---	hr	1'247	2.26		2'819	-
1.1.06	Explosive truck driver	---	hr	78	3.39		263	-
1.1.07	Helper for ditto	---	hr	78	2.26		175	-
1.1.08	ANFO truck driver	---	hr	193	3.39		653	-
1.1.09	Helper for ditto	---	hr	385	2.26		870	-
1.1.10	Explosive charging and firing, specialist	---	hr	3'469	5.76		19'982	-
1.1.11	Explosive charging and firing, skilled	---	hr	1'735	4.48		7'771	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	264	8.14		2'152	-
1.1.13	General services, skilled	---	hr	1'336	4.48		5'985	-
01:01:14	General services, semiskilled	---	hr	2'004	2.28		4'569	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	154	23.81	32.02	3'665	4'928
		R	hr	38	13.65	26.67	525	1'026
1.2.02	Crawler rock drill, 147 kw	O	hr	1'315	51.30	51.50	67'465	67'728
		R	hr	329	23.43	41.31	7'703	13'582
1.2.03	Hand-held rock drill, heavy weight type	O	hr	624	1.30	2.54	811	1'584
		R	hr	156	1.17	2.29	182	357
1.2.04	Motorcompressor, 17 m3/min	O	hr	135	41.24		5'572	-
		R	hr	27	13.96		377	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	55	39.20		2'172	-
		R	hr	11	14.72		163	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	138	47.10		6'476	-
		R	hr	28	17.65		485	-
1.2.07	Integral drill steel grinder	O	hr	43	3.03	1.56	129	66
		R	hr	9	0.92	1.45	8	12
01:02:08	Button bits grinder	O	hr	178	2.74	1.37	487	243
		R	hr	36	0.81	1.28	29	45
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	390	9.72		3'786	-
		R	hr	78	6.20		483	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	91'104	1.99		181'297	-
1.3.02	Explosive, ANFO type	---	kg	173'886	1.24		215'619	-
1.3.03	Detonating fuse	---	m	56'917	0.30		17'075	-
1.3.04	Ordinary low burning fuse	---	ea	4	0.34		1	-
1.3.05	Delay for detonating fuse	---	ea	4'157	3.82		15'879	-
1.3.06	Common detonator	---	ea	3	0.24		1	-
1.3.07	Detonator with connector to detonating fuse	---	ea	57	3.34		191	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	3		612.81	-	2'127
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	66		516.19	-	34'074
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	2		396.12	-	953
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	21		469.27	-	10'074
	O=Operating unit							
	R=Reserve unit							
Total brought forward --->							633'413	136'800

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-2*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE HEADRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						633'413	136'800
1.3.12	Coupling for rod n. 1.3.09	---	ea	96		111.80	-	10'734
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	6		162.86	-	1'044
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	5		296.36	-	1'375
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	53		448.57	-	23'597
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	28		143.80	-	4'081
1.3.17	Grease for rods, couplings and shanks	---	kg	172	2.86		492	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	2'076	11.81		24'518	-
2.1.02	Operator, front shovel	----	hr	1'714	8.14		13'954	-
2.1.03	Helper for ditto	----	hr	1'714	4.48		7'680	-
2.1.04	Operator, backhoe	----	hr	86	8.14		698	-
2.1.05	Helper for ditto	----	hr	86	4.48		384	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	429	8.14		3'488	-
2.1.07	Helper for ditto	----	hr	429	4.48		1'920	-
2.1.08	Operator, off-highway dumper	----	hr	3'911	8.14		31'839	-
2.1.09	Helper for ditto	----	hr	3'911	4.48		17'523	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	1'585	8.14		12'901	-
2.1.11	Helper for ditto	----	hr	1'585	4.48		7'100	-
2.1.12	General services, skilled	----	hr	386	4.48		1'730	-
2.1.13	General services, semiskilled	----	hr	772	2.26		1'746	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	199	92.97	71.61	18'509	14'257
		R	hr	40	29.96	49.75	1'193	1'981
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	1'359	122.83	92.17	166'964	125'288
		R	hr	272	39.49	65.54	10'736	17'818
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	78	91.71		7'146	-
		R	hr	16	38.51		600	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	390	154.40		60'154	-
		R	hr	78	60.10		4'683	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	718	71.90	59.21	51'654	42'537
		R	hr	144	22.23	35.69	3'194	5'128
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	824	110.78	88.66	91'242	73'023
		R	hr	165	37.08	55.95	6'108	9'216
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	2'014	119.00	94.66	239'638	190'623
		R	hr	403	44.65	62.15	17'983	25'031
2.2.08	Bulldozer 149 kW in disposal area	O	hr	1'441	107.76		155'259	-
		R	hr	288	44.81		12'912	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	912	9.72		8'860	-
		R	hr	182	6.20		1'130	-
Sub-total ---->>							1'617'352	682'534
Construction Contingencies			%	2.00%	---->>		32'347	13'651
Total Direct Costs ---->>							1'649'699	696'185
Overheads and Profit			%	48.00%	---->>		1'126'024	
Unit Price in Currency Portions			m^3	**438'000**	---->>		**6.34**	**1.59**
AGGREGATE UNIT PRICE			m^3	---->>				**7.93**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-3*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENERATING UNITS (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	5'329	11.81		62'931	-
1.1.02	Crawler drill operator	---	hr	4'502	8.14		36'645	-
1.1.03	Helper for ditto	---	hr	9'004	4.48		40'336	-
1.1.04	Hand held drill miner	---	hr	1'593	4.48		7'135	-
1.1.05	Helper for ditto	---	hr	3'185	2.26		7'198	-
1.1.06	Explosive truck driver	---	hr	198	3.39		672	-
1.1.07	Helper for ditto	---	hr	198	2.26		448	-
1.1.08	ANFO truck driver	---	hr	492	3.39		1'667	-
1.1.09	Helper for ditto	---	hr	983	2.26		2'222	-
1.1.10	Explosive charging and firing, specialist	---	hr	8'849	5.76		50'971	-
1.1.11	Explosive charging and firing, skilled	---	hr	4'425	4.48		19'822	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	675	8.14		5'495	-
1.1.13	General services, skilled	---	hr	3'410	4.48		15'278	-
01:01:14	General services, semiskilled	---	hr	5'115	2.28		11'663	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	393	23.81	32.02	9'359	12'585
		R	hr	98	13.65	26.67	1'341	2'621
1.2.02	Crawler rock drill, 147 kw	O	hr	3'358	51.30	51.50	172'290	172'962
		R	hr	840	23.43	41.31	19'672	34'685
1.2.03	Hand-held rock drill, heavy weight type	O	hr	1'593	1.30	2.54	2'070	4'045
		R	hr	398	1.17	2.29	466	912
1.2.04	Motorcompressor, 17 m3/min	O	hr	345	41.24		14'230	-
		R	hr	69	13.96		963	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	142	39.20		5'548	-
		R	hr	28	14.72		417	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	351	47.10		16'539	-
		R	hr	70	17.65		1'240	-
1.2.07	Integral drill steel grinder	O	hr	109	3.03	1.56	329	170
		R	hr	22	0.92	1.45	20	32
01:02:08	Button bits grinder	O	hr	454	2.74	1.37	1'243	622
		R	hr	91	0.81	1.28	74	116
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	995	9.72		9'669	-
		R	hr	199	6.20		1'234	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	232'658	1.99		462'990	-
1.3.02	Explosive, ANFO type	---	kg	444'064	1.24		550'640	-
1.3.03	Detonating fuse	---	m	145'352	0.30		43'606	-
1.3.04	Ordinary low burning fuse	---	ea	11	0.34		4	-
1.3.05	Delay for detonating fuse	---	ea	10'615	3.82		40'551	-
1.3.06	Common detonator	---	ea	7	0.24		2	-
1.3.07	Detonator with connector to detonating fuse	---	ea	146	3.34		488	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	9		612.81	-	5'433
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	169		516.19	-	87'016
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	6		396.12	-	2'433
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	55		469.27	-	25'726
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							1'617'465	349'356

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-3*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENERATING UNITS (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						1'617'465	349'356
1.3.12	Coupling for rod n. 1.3.09	---	ea	245		111.80	-	27'413
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	16		162.86	-	2'667
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	12		296.36	-	3'512
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	134		448.57	-	60'261
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	72		143.80	-	10'421
1.3.17	Grease for rods, couplings and shanks	---	kg	439	2.86		1'255	-
2	LOADING AND TRANSPORT							
2.1	Labor							
2.1.01	Foreman	----	hr	7'986	11.81		94'317	-
2.1.02	Operator, front shovel	----	hr	4'378	8.14		35'635	-
2.1.03	Helper for ditto	----	hr	4'378	4.48		19'612	-
2.1.04	Operator, backhoe	----	hr	219	8.14		1'782	-
2.1.05	Helper for ditto	----	hr	219	4.48		981	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	1'094	8.14		8'909	-
2.1.07	Helper for ditto	----	hr	1'094	4.48		4'903	-
2.1.08	Operator, off-highway dumper	----	hr	19'978	8.14		162'617	-
2.1.09	Helper for ditto	----	hr	19'978	4.48		89'499	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	4'047	8.14		32'946	-
2.1.11	Helper for ditto	----	hr	4'047	4.48		18'132	-
2.1.12	General services, skilled	----	hr	1'486	4.48		6'656	-
2.1.13	General services, semiskilled	----	hr	2'972	2.26		6'716	-
2.2	Equipment							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	508	92.97	71.61	47'269	36'409
		R	hr	102	29.96	49.75	3'047	5'059
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	3'471	122.83	92.17	426'387	319'955
		R	hr	694	39.49	65.54	27'417	45'503
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	199	91.71		18'249	-
		R	hr	40	38.51		1'533	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	995	154.40		153'620	-
		R	hr	199	60.10		11'959	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	3'669	71.90	59.21	263'824	217'260
		R	hr	734	22.23	35.69	16'314	26'192
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	4'207	110.78	88.66	466'020	372'967
		R	hr	841	37.08	55.95	31'197	47'073
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	10'285	119.00	94.66	1'223'962	973'615
		R	hr	2'057	44.65	62.15	91'849	127'847
2.2.08	Bulldozer 149 kW in disposal area	O	hr	3'679	107.76		396'497	-
		R	hr	736	44.81		32'975	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	2'328	9.72		22'626	-
		R	hr	466	6.20		2'886	-
Sub-total ---------->>							5'339'057	2'625'511
Construction Contingencies			%	2.00%	---------->>		106'781	52'510
Total Direct Costs ---------->>							5'445'838	2'678'021
Overheads and Profit			%	48.00%	---------->>		3'899'452	
Unit Price in Currency Portions			m^3	**1'118'550**	---------->>		**8.35**	**2.39**
AGGREGATE UNIT PRICE			m^3	---------->>				**10.75**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-4*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENER. UNITS (TRANSPORT TO AGGREG. STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	7'620	11.81		89'995	-
1.1.02	Crawler drill operator	---	hr	6'439	8.14		52'410	-
1.1.03	Helper for ditto	---	hr	12'877	4.48		57'689	-
1.1.04	Hand held drill miner	---	hr	2'278	4.48		10'204	-
1.1.05	Helper for ditto	---	hr	4'555	2.26		10'295	-
1.1.06	Explosive truck driver	---	hr	283	3.39		961	-
1.1.07	Helper for ditto	---	hr	283	2.26		640	-
1.1.08	ANFO truck driver	---	hr	703	3.39		2'383	-
1.1.09	Helper for ditto	---	hr	1'406	2.26		3'178	-
1.1.10	Explosive charging and firing, specialist	---	hr	12'653	5.76		72'882	-
1.1.11	Explosive charging and firing, skilled	---	hr	6'327	4.48		28'343	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	965	8.14		7'859	-
1.1.13	General services, skilled	---	hr	4'877	4.48		21'849	-
01:01:14	General services, semiskilled	---	hr	7'315	2.28		16'679	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	562	23.81	32.02	13'385	18'000
		R	hr	141	13.65	26.67	1'918	3'748
1.2.02	Crawler rock drill, 147 kw	O	hr	4'803	51.30	51.50	246'409	247'370
		R	hr	1'201	23.43	41.31	28'135	49'606
1.2.03	Hand-held rock drill, heavy weight type	O	hr	2'278	1.30	2.54	2'961	5'785
		R	hr	569	1.17	2.29	666	1'304
1.2.04	Motorcompressor, 17 m3/min	O	hr	493	41.24		20'352	-
		R	hr	99	13.96		1'378	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	202	39.20		7'935	-
		R	hr	40	14.72		596	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	502	47.10		23'654	-
		R	hr	100	17.65		1'773	-
1.2.07	Integral drill steel grinder	O	hr	155	3.03	1.56	471	243
		R	hr	31	0.92	1.45	29	45
01:02:08	Button bits grinder	O	hr	649	2.74	1.37	1'778	889
		R	hr	130	0.81	1.28	105	166
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	1'423	9.72		13'829	-
		R	hr	285	6.20		1'764	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	332'748	1.99		662'169	-
1.3.02	Explosive, ANFO type	---	kg	635'101	1.24		787'525	-
1.3.03	Detonating fuse	---	m	207'883	0.30		62'365	-
1.3.04	Ordinary low burning fuse	---	ea	16	0.34		5	-
1.3.05	Delay for detonating fuse	---	ea	15'182	3.82		57'996	-
1.3.06	Common detonator	---	ea	11	0.24		3	-
1.3.07	Detonator with connector to detonating fuse	---	ea	209	3.34		698	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	13		612.81	-	7'770
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	241		516.19	-	124'450
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	9		396.12	-	3'479
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	78		469.27	-	36'793
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							2'313'265	499'649

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-4*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENER. UNITS (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						2'313'265	499'649
1.3.12	Coupling for rod n. 1.3.09	---	ea	351		111.80	-	39'206
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	23		162.86	-	3'815
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	17		296.36	-	5'023
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	192		448.57	-	86'185
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	104		143.80	-	14'905
1.3.17	Grease for rods, couplings and shanks	---	kg	628	2.86		1'795	-
2	LOADING AND TRANSPORT							
2.1	Labor							
2.1.01	Foreman	----	hr	11'298	11.81		133'429	-
2.1.02	Operator, front shovel	----	hr	6'261	8.14		50'965	-
2.1.03	Helper for ditto	----	hr	6'261	4.48		28'050	-
2.1.04	Operator, backhoe	----	hr	313	8.14		2'548	-
2.1.05	Helper for ditto	----	hr	313	4.48		1'402	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	1'565	8.14		12'741	-
2.1.07	Helper for ditto	----	hr	1'565	4.48		7'012	-
2.1.08	Operator, off-highway dumper	----	hr	28'111	8.14		228'824	-
2.1.09	Helper for ditto	----	hr	28'111	4.48		125'938	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	5'789	8.14		47'119	-
2.1.11	Helper for ditto	----	hr	5'789	4.48		25'933	-
2.1.12	General services, skilled	----	hr	2'102	4.48		9'417	-
2.1.13	General services, semiskilled	----	hr	4'204	2.26		9'501	-
2.2	Equipment							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	727	92.97	71.61	67'604	52'072
		R	hr	145	29.96	49.75	4'357	7'235
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	4'965	122.83	92.17	609'819	457'600
		R	hr	993	39.49	65.54	39'212	65'078
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	285	91.71		26'100	-
		R	hr	57	38.51		2'192	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	1'423	154.40		219'707	-
		R	hr	285	60.10		17'104	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	5'163	71.90	59.21	371'235	305'714
		R	hr	1'033	22.23	35.69	22'956	36'855
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	5'919	110.78	88.66	655'751	524'814
		R	hr	1'184	37.08	55.95	43'898	66'238
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	14'473	119.00	94.66	1'722'276	1'370'005
		R	hr	2'895	44.65	62.15	129'243	179'898
2.2.08	Bulldozer 149 kW in disposal area	O	hr	5'262	107.76		567'069	-
		R	hr	1'052	44.81		47'161	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	3'329	9.72		32'360	-
		R	hr	666	6.20		4'128	-
Sub-total ---->>							7'580'113	3'714'292
Construction Contingencies			%	2.00%	---->>		151'602	74'286
Total Direct Costs ---->>							7'731'715	3'788'578
Overheads and Profit			%	48.00%	---->>		5'529'741	
Unit Price in Currency Portions			m^3	**1'599'750**	---->>		**8.29**	**2.37**
AGGREGATE UNIT PRICE			m^3	---->>				**10.66**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-5*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION (CONTROLLED) - POWER INTAKES & GENER. UNITS (TRANSPORT TO AGGREG. STOCK.)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	3'076	11.81		36'332	-
1.1.02	Crawler drill operator	---	hr	1'255	8.14		10'213	-
1.1.03	Helper for ditto	---	hr	2'509	4.48		11'241	-
1.1.04	Hand held drill miner	---	hr	2'106	4.48		9'434	-
1.1.05	Helper for ditto	---	hr	4'211	2.26		9'518	-
1.1.06	Explosive truck driver	---	hr	194	3.39		659	-
1.1.07	Helper for ditto	---	hr	194	2.26		439	-
1.1.08	ANFO truck driver	---	hr	374	3.39		1'267	-
1.1.09	Helper for ditto	---	hr	747	2.26		1'689	-
1.1.10	Explosive charging and firing, specialist	---	hr	5'113	5.76		29'448	-
1.1.11	Explosive charging and firing, skilled	---	hr	2'556	4.48		11'452	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	429	8.14		3'493	-
1.1.13	General services, skilled	---	hr	1'969	4.48		8'820	-
01:01:14	General services, semiskilled	---	hr	2'953	2.28		6'733	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	1'046	23.81	32.02	24'894	33'477
		R	hr	261	13.65	26.67	3'568	6'971
1.2.02	Crawler rock drill, 147 kw	O	hr	-	51.30	51.50	-	-
		R	hr	-	23.43	41.31	-	-
1.2.03	Hand-held rock drill, heavy weight type	O	hr	2'106	1.30	2.54	2'737	5'348
		R	hr	526	1.17	2.29	616	1'206
1.2.04	Motorcompressor, 17 m3/min	O	hr	456	41.24		18'815	-
		R	hr	91	13.96		1'274	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	139	39.20		5'442	-
		R	hr	28	14.72		409	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	267	47.10		12'570	-
		R	hr	53	17.65		942	-
1.2.07	Integral drill steel grinder	O	hr	135	3.03	1.56	410	211
		R	hr	27	0.92	1.45	25	39
01:02:08	Button bits grinder	O	hr	222	2.74	1.37	609	305
		R	hr	44	0.81	1.28	36	57
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	741	9.72		7'206	-
		R	hr	148	6.20		919	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	66'462	1.99		132'259	-
1.3.02	Explosive, ANFO type	---	kg	129'148	1.24		160'143	-
1.3.03	Detonating fuse	---	m	115'888	0.30		34'766	-
1.3.04	Ordinary low burning fuse	---	ea	8	0.34		3	-
1.3.05	Delay for detonating fuse	---	ea	12'863	3.82		49'137	-
1.3.06	Common detonator	---	ea	5	0.24		1	-
1.3.07	Detonator with connector to detonating fuse	---	ea	166	3.34		554	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	23		612.81	-	14'123
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	81		516.19	-	41'671
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	16		396.12	-	6'471
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	30		469.27	-	14'077
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							598'074	123'957

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-5*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENER. UNITS (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						598'074	123'957
1.3.12	Coupling for rod n. 1.3.09	---	ea	117		111.80	-	13'128
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	44		162.86	-	7'095
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	80		296.36	-	23'708
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	-		448.57	-	-
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	90		143.80	-	12'963
1.3.17	Grease for rods, couplings and shanks	---	kg	334	2.86		954	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	2'356	11.81		27'826	-
2.1.02	Operator, front shovel	----	hr	1'182	8.14		9'624	-
2.1.03	Helper for ditto	----	hr	1'182	4.48		5'297	-
2.1.04	Operator, backhoe	----	hr	59	8.14		481	-
2.1.05	Helper for ditto	----	hr	59	4.48		265	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	296	8.14		2'406	-
2.1.07	Helper for ditto	----	hr	296	4.48		1'324	-
2.1.08	Operator, off-highway dumper	----	hr	6'137	8.14		49'955	-
2.1.09	Helper for ditto	----	hr	6'137	4.48		27'493	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	1'093	8.14		8'898	-
2.1.11	Helper for ditto	----	hr	1'093	4.48		4'897	-
2.1.12	General services, skilled	----	hr	438	4.48		1'964	-
2.1.13	General services, semiskilled	----	hr	877	2.26		1'981	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	137	92.97	71.61	12'766	9'833
		R	hr	27	29.96	49.75	823	1'366
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	938	122.83	92.17	115'159	86'414
		R	hr	188	39.49	65.54	7'405	12'289
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	54	91.71		4'929	-
		R	hr	11	38.51		414	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	269	154.40		41'490	-
		R	hr	54	60.10		3'230	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	1'950	71.90	59.21	140'210	115'463
		R	hr	390	22.23	35.69	8'670	13'920
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	1'677	110.78	88.66	185'750	148'660
		R	hr	335	37.08	55.95	12'435	18'763
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	1'952	119.00	94.66	232'313	184'796
		R	hr	390	44.65	62.15	17'433	24'266
2.2.08	Bulldozer 149 kW in disposal area	O	hr	994	107.76		107'087	-
		R	hr	199	44.81		8'906	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	629	9.72		6'111	-
		R	hr	126	6.20		780	-
Sub-total ---->>							1'647'350	796'622
Construction Contingencies			%	2.50%	---->>		41'184	19'916
Total Direct Costs ---->>							1'688'534	816'537
Overheads and Profit			%	48.00%	---->>		1'202'434	
Unit Price in Currency Portions			m^3	302'100	---->>		**9.57**	**2.70**
AGGREGATE UNIT PRICE			m^3	---->>				**12.27**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-6*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (TRANSPORT TO DISPOSAL AREA)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	36'992	11.81		436'879	-
1.1.02	Crawler drill operator	---	hr	31'261	8.14		254'462	-
1.1.03	Helper for ditto	---	hr	62'521	4.48		280'096	-
1.1.04	Hand held drill miner	---	hr	11'059	4.48		49'542	-
1.1.05	Helper for ditto	---	hr	22'117	2.26		49'985	-
1.1.06	Explosive truck driver	---	hr	1'376	3.39		4'664	-
1.1.07	Helper for ditto	---	hr	1'376	2.26		3'110	-
1.1.08	ANFO truck driver	---	hr	3'414	3.39		11'572	-
1.1.09	Helper for ditto	---	hr	6'827	2.26		15'430	-
1.1.10	Explosive charging and firing, specialist	---	hr	61'408	5.76		353'713	-
1.1.11	Explosive charging and firing, skilled	---	hr	30'704	4.48		137'555	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	4'687	8.14		38'156	-
1.1.13	General services, skilled	---	hr	23'675	4.48		106'064	-
01:01:14	General services, semiskilled	---	hr	35'513	2.28		80'969	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	2'729	23.81	32.02	64'985	87'393
		R	hr	682	13.65	26.67	9'314	18'198
1.2.02	Crawler rock drill, 147 kw	O	hr	23'321	51.30	51.50	1'196'381	1'201'045
		R	hr	5'830	23.43	41.31	136'604	240'850
1.2.03	Hand-held rock drill, heavy weight type	O	hr	11'059	1.30	2.54	14'376	28'089
		R	hr	2'765	1.17	2.29	3'235	6'331
1.2.04	Motorcompressor, 17 m3/min	O	hr	2'396	41.24		98'812	-
		R	hr	479	13.96		6'690	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	983	39.20		38'525	-
		R	hr	197	14.72		2'893	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	2'438	47.10		114'846	-
		R	hr	488	17.65		8'607	-
1.2.07	Integral drill steel grinder	O	hr	755	3.03	1.56	2'287	1'178
		R	hr	151	0.92	1.45	139	219
01:02:08	Button bits grinder	O	hr	3'151	2.74	1.37	8'635	4'317
		R	hr	630	0.81	1.28	511	807
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	6'908	9.72		67'142	-
		R	hr	1'382	6.20		8'565	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	1'615'578	1.99		3'214'999	-
1.3.02	Explosive, ANFO type	---	kg	3'083'578	1.24		3'823'637	-
1.3.03	Detonating fuse	---	m	1'009'325	0.30		302'797	-
1.3.04	Ordinary low burning fuse	---	ea	78	0.34		26	-
1.3.05	Delay for detonating fuse	---	ea	73'713	3.82		281'585	-
1.3.06	Common detonator	---	ea	52	0.24		12	-
1.3.07	Detonator with connector to detonating fuse	---	ea	1'014	3.34		3'387	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	62		612.81	-	37'726
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	1'171		516.19	-	604'237
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	43		396.12	-	16'893
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	381		469.27	-	178'641
	O=Operating unit							
	R=Reserve unit							
Total brought forward --->							11'231'191	2'425'925

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-6*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						11'231'191	2'425'925
1.3.12	Coupling for rod n. 1.3.09	---	ea	1'703		111.80	-	190'356
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	114		162.86	-	18'521
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	82		296.36	-	24'389
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	933		448.57	-	418'449
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	503		143.80	-	72'366
1.3.17	Grease for rods, couplings and shanks	---	kg	3'048	2.86		8'717	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	57'260	11.81		676'241	-
2.1.02	Operator, front shovel	----	hr	30'399	8.14		247'450	-
2.1.03	Helper for ditto	----	hr	30'399	4.48		136'188	-
2.1.04	Operator, backhoe	----	hr	1'520	8.14		12'372	-
2.1.05	Helper for ditto	----	hr	1'520	4.48		6'809	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	7'600	8.14		61'862	-
2.1.07	Helper for ditto	----	hr	7'600	4.48		34'047	-
2.1.08	Operator, off-highway dumper	----	hr	145'436	8.14		1'183'853	-
2.1.09	Helper for ditto	----	hr	145'436	4.48		651'555	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	28'105	8.14		228'775	-
2.1.11	Helper for ditto	----	hr	28'105	4.48		125'910	-
2.1.12	General services, skilled	----	hr	10'653	4.48		47'726	-
2.1.13	General services, semiskilled	----	hr	21'306	2.26		48'152	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	3'531	92.97	71.61	328'235	252'822
		R	hr	706	29.96	49.75	21'155	35'129
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	24'105	122.83	92.17	2'960'830	2'221'767
		R	hr	4'821	39.49	65.54	190'382	315'970
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	1'382	91.71		126'723	-
		R	hr	276	38.51		10'642	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	6'909	154.40		1'066'736	-
		R	hr	1'382	60.10		83'045	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	26'713	71.90	59.21	1'920'635	1'581'653
		R	hr	5'343	22.23	35.69	118'764	190'674
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	30'625	110.78	88.66	3'392'619	2'715'197
		R	hr	6'125	37.08	55.95	227'114	342'692
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	74'878	119.00	94.66	8'910'428	7'087'908
		R	hr	14'976	44.65	62.15	668'656	930'728
2.2.08	Bulldozer 149 kW in disposal area	O	hr	25'550	107.76		2'753'268	-
		R	hr	5'110	44.81		228'979	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	16'164	9.72		157'117	-
		R	hr	3'233	6.20		20'044	-
Sub-total -------->>							37'886'221	18'824'546
Construction Contingencies			%	2.00%	-------->>		757'724	376'491
Total Direct Costs -------->>							38'643'945	19'201'037
Overheads and Profit			%	48.00%	-------->>		27'765'591	
Unit Price in Currency Portions			m^3	7'767'200	-------->>		**8.55**	**2.47**
AGGREGATE UNIT PRICE			m^3	-------->>				**11.02**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-7*
CIVIL WORKS COST ESTIMATE
REQUIRED ROCK EXCAVATION - SPILLWAY APPROACH CHANNEL (TRANSPORT TO DISPOSAL STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	2'242	11.81		26'484	-
1.1.02	Crawler drill operator	---	hr	1'894	8.14		15'415	-
1.1.03	Helper for ditto	---	hr	3'788	4.48		16'968	-
1.1.04	Hand held drill miner	---	hr	670	4.48		3'001	-
1.1.05	Helper for ditto	---	hr	1'340	2.26		3'028	-
1.1.06	Explosive truck driver	---	hr	83	3.39		283	-
1.1.07	Helper for ditto	---	hr	83	2.26		188	-
1.1.08	ANFO truck driver	---	hr	207	3.39		701	-
1.1.09	Helper for ditto	---	hr	414	2.26		935	-
1.1.10	Explosive charging and firing, specialist	---	hr	3'726	5.76		21'464	-
1.1.11	Explosive charging and firing, skilled	---	hr	1'863	4.48		8'347	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	284	8.14		2'312	-
1.1.13	General services, skilled	---	hr	1'435	4.48		6'430	-
01:01:14	General services, semiskilled	---	hr	2'153	2.28		4'908	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	165	23.81	32.02	3'937	5'294
		R	hr	41	13.65	26.67	564	1'102
1.2.02	Crawler rock drill, 147 kw	O	hr	1'413	51.30	51.50	72'477	72'760
		R	hr	353	23.43	41.31	8'276	14'591
1.2.03	Hand-held rock drill, heavy weight type	O	hr	670	1.30	2.54	871	1'702
		R	hr	167	1.17	2.29	196	384
1.2.04	Motorcompressor, 17 m3/min	O	hr	145	41.24		5'986	-
		R	hr	29	13.96		405	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	60	39.20		2'334	-
		R	hr	12	14.72		175	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	148	47.10		6'957	-
		R	hr	30	17.65		521	-
1.2.07	Integral drill steel grinder	O	hr	46	3.03	1.56	139	71
		R	hr	9	0.92	1.45	8	13
01:02:08	Button bits grinder	O	hr	191	2.74	1.37	523	262
		R	hr	38	0.81	1.28	31	49
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	418	9.72		4'068	-
		R	hr	84	6.20		519	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	97'872	1.99		194'766	-
1.3.02	Explosive, ANFO type	---	kg	186'804	1.24		231'637	-
1.3.03	Detonating fuse	---	m	61'145	0.30		18'344	-
1.3.04	Ordinary low burning fuse	---	ea	5	0.34		2	-
1.3.05	Delay for detonating fuse	---	ea	4'466	3.82		17'059	-
1.3.06	Common detonator	---	ea	3	0.24		1	-
1.3.07	Detonator with connector to detonating fuse	---	ea	61	3.34		205	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	4		612.81	-	2'285
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	71		516.19	-	36'605
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	3		396.12	-	1'023
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	23		469.27	-	10'822
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							680'465	146'963

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-7*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						680'465	146'963
1.3.12	Coupling for rod n. 1.3.09	---	ea	103		111.80	-	11'532
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	7		162.86	-	1'122
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	5		296.36	-	1'477
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	57		448.57	-	25'350
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	30		143.80	-	4'384
1.3.17	Grease for rods, couplings and shanks	---	kg	185	2.86		528	-
2	**LOADING AND TRANSPORT**							
2.1	**Labor**							
2.1.01	Foreman	----	hr	3'068	11.81		36'234	-
2.1.02	Operator, front shovel	----	hr	1'842	8.14		14'991	-
2.1.03	Helper for ditto	----	hr	1'842	4.48		8'250	-
2.1.04	Operator, backhoe	----	hr	92	8.14		750	-
2.1.05	Helper for ditto	----	hr	92	4.48		413	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	460	8.14		3'748	-
2.1.07	Helper for ditto	----	hr	460	4.48		2'063	-
2.1.08	Operator, off-highway dumper	----	hr	7'320	8.14		59'581	-
2.1.09	Helper for ditto	----	hr	7'320	4.48		32'792	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	1'703	8.14		13'859	-
2.1.11	Helper for ditto	----	hr	1'703	4.48		7'628	-
2.1.12	General services, skilled	----	hr	571	4.48		2'557	-
2.1.13	General services, semiskilled	----	hr	1'142	2.26		2'580	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	214	92.97	71.61	19'885	15'316
		R	hr	43	29.96	49.75	1'282	2'128
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	1'460	122.83	92.17	179'368	134'596
		R	hr	292	39.49	65.54	11'533	19'142
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	84	91.71		7'677	-
		R	hr	17	38.51		645	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	419	154.40		64'623	-
		R	hr	84	60.10		5'031	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	1'344	71.90	59.21	96'662	79'602
		R	hr	269	22.23	35.69	5'977	9'596
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	1'541	110.78	88.66	170'745	136'651
		R	hr	308	37.08	55.95	11'430	17'247
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	3'768	119.00	94.66	448'447	356'723
		R	hr	754	44.65	62.15	33'652	46'842
2.2.08	Bulldozer 149 kW in disposal area	O	hr	1'548	107.76		166'794	-
		R	hr	310	44.81		13'872	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	979	9.72		9'518	-
		R	hr	196	6.20		1'214	-
Sub-total ---->>							2'114'793	1'008'671
Construction Contingencies			%	2.00%	---->>		42'296	20'173
Total Direct Costs ---->>							2'157'089	1'028'844
Overheads and Profit			%	48.00%	---->>		1'529'248	
Unit Price in Currency Portions			m^3	**470'540**	---->>		**7.83**	**2.19**
AGGREGATE UNIT PRICE			m^3	---->>				**10.02**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-8*
CIVIL WORKS COST ESTIMATE
ADDITIONAL ROCK EXCAVAT. - SPILLWAY APPROACH CHANNEL (TRANSPORT TO ROCKFILLS, RIP-RAP ETC.)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	DRILLING AND BLASTING							
1.1	Labor							
1.1.01	Foreman	---	hr	4'862	11.81		57'421	-
1.1.02	Crawler drill operator	---	hr	4'108	8.14		33'436	-
1.1.03	Helper for ditto	---	hr	8'215	4.48		36'804	-
1.1.04	Hand held drill miner	---	hr	1'453	4.48		6'510	-
1.1.05	Helper for ditto	---	hr	2'906	2.26		6'568	-
1.1.06	Explosive truck driver	---	hr	181	3.39		613	-
1.1.07	Helper for ditto	---	hr	181	2.26		409	-
1.1.08	ANFO truck driver	---	hr	449	3.39		1'521	-
1.1.09	Helper for ditto	---	hr	897	2.26		2'027	-
1.1.10	Explosive charging and firing, specialist	---	hr	8'075	5.76		46'511	-
1.1.11	Explosive charging and firing, skilled	---	hr	4'037	4.48		18'087	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	616	8.14		5'014	-
1.1.13	General services, skilled	---	hr	3'112	4.48		13'941	-
01:01:14	General services, semiskilled	---	hr	4'668	2.28		10'642	-
1.2	Equipment							
1.2.01	Crawler rock drill, 48 kw	O	hr	359	23.81	32.02	8'539	11'483
		R	hr	90	13.65	26.67	1'224	2'391
1.2.02	Crawler rock drill, 147 kw	O	hr	3'064	51.30	51.50	157'203	157'816
		R	hr	766	23.43	41.31	17'950	31'647
1.2.03	Hand-held rock drill, heavy weight type	O	hr	1'453	1.30	2.54	1'889	3'691
		R	hr	363	1.17	2.29	425	832
1.2.04	Motorcompressor, 17 m3/min	O	hr	315	41.24		12'984	-
		R	hr	63	13.96		879	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	129	39.20		5'062	-
		R	hr	26	14.72		380	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	320	47.10		15'091	-
		R	hr	64	17.65		1'131	-
1.2.07	Integral drill steel grinder	O	hr	99	3.03	1.56	301	155
		R	hr	20	0.92	1.45	18	29
01:02:08	Button bits grinder	O	hr	414	2.74	1.37	1'135	567
		R	hr	83	0.81	1.28	67	106
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	908	9.72		8'822	-
		R	hr	182	6.20		1'125	-
1.3	Materials							
1.3.01	Explosive, emulsion type	---	kg	212'285	1.99		422'447	-
1.3.02	Explosive, ANFO type	---	kg	405'178	1.24		502'421	-
1.3.03	Detonating fuse	---	m	132'624	0.30		39'787	-
1.3.04	Ordinary low burning fuse	---	ea	10	0.34		3	-
1.3.05	Delay for detonating fuse	---	ea	9'686	3.82		37'000	-
1.3.06	Common detonator	---	ea	7	0.24		2	-
1.3.07	Detonator with connector to detonating fuse	---	ea	133	3.34		445	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	8		612.81	-	4'957
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	154		516.19	-	79'396
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	6		396.12	-	2'220
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	50		469.27	-	23'473
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							1'475'833	318'763

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-8*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						1'475'833	318'763
1.3.12	Coupling for rod n. 1.3.09	---	ea	224		111.80	-	25'013
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	15		162.86	-	2'434
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	11		296.36	-	3'205
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	123		448.57	-	54'984
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	66		143.80	-	9'509
1.3.17	Grease for rods, couplings and shanks	---	kg	400	2.86		1'145	-
2	**LOADING AND TRANSPORT**							
2.1	**Labor**							
2.1.01	Foreman	----	hr	4'837	11.81		57'130	-
2.1.02	Operator, front shovel	----	hr	3'994	8.14		32'515	-
2.1.03	Helper for ditto	----	hr	3'994	4.48		17'895	-
2.1.04	Operator, backhoe	----	hr	200	8.14		1'626	-
2.1.05	Helper for ditto	----	hr	200	4.48		895	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	999	8.14		8'129	-
2.1.07	Helper for ditto	----	hr	999	4.48		4'474	-
2.1.08	Operator, off-highway dumper	----	hr	9'114	8.14		74'189	-
2.1.09	Helper for ditto	----	hr	9'114	4.48		40'831	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	3'693	8.14		30'061	-
2.1.11	Helper for ditto	----	hr	3'693	4.48		16'544	-
2.1.12	General services, skilled	----	hr	900	4.48		4'032	-
2.1.13	General services, semiskilled	----	hr	1'800	2.26		4'068	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	464	92.97	71.61	43'130	33'221
		R	hr	93	29.96	49.75	2'780	4'616
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	3'167	122.83	92.17	389'049	291'937
		R	hr	633	39.49	65.54	25'016	41'518
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	182	91.71		16'651	-
		R	hr	36	38.51		1'398	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	908	154.40		140'168	-
		R	hr	182	60.10		10'912	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	1'674	71.90	59.21	120'361	99'118
		R	hr	335	22.23	35.69	7'443	11'949
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	1'919	110.78	88.66	212'605	170'153
		R	hr	384	37.08	55.95	14'233	21'475
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	4'692	119.00	94.66	558'390	444'178
		R	hr	938	44.65	62.15	41'903	58'326
2.2.08	Bulldozer 149 kW in disposal area	O	hr	3'357	107.76		361'776	-
		R	hr	671	44.81		30'088	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	2'124	9.72		20'645	-
		R	hr	425	6.20		2'634	-
Sub-total ---->>							3'768'546	1'590'398
Construction Contingencies			%	2.00%	---->>		75'371	31'808
Total Direct Costs ---->>							3'843'917	1'622'206
Overheads and Profit			%	48.00%	---->>		2'623'739	
Unit Price in Currency Portions			**m^3**	**1'020'600**	---->>		**6.34**	**1.59**
AGGREGATE UNIT PRICE			**m^3**	---->>				**7.93**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-9*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - SPILLWAY STRUCTURE (TRANSPORT TO STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	2'639	11.81		31'167	-
1.1.02	Crawler drill operator	---	hr	2'229	8.14		18'143	-
1.1.03	Helper for ditto	---	hr	4'458	4.48		19'971	-
1.1.04	Hand held drill miner	---	hr	788	4.48		3'532	-
1.1.05	Helper for ditto	---	hr	1'577	2.26		3'564	-
1.1.06	Explosive truck driver	---	hr	98	3.39		333	-
1.1.07	Helper for ditto	---	hr	98	2.26		222	-
1.1.08	ANFO truck driver	---	hr	243	3.39		825	-
1.1.09	Helper for ditto	---	hr	487	2.26		1'100	-
1.1.10	Explosive charging and firing, specialist	---	hr	4'385	5.76		25'255	-
1.1.11	Explosive charging and firing, skilled	---	hr	2'192	4.48		9'821	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	334	8.14		2'721	-
1.1.13	General services, skilled	---	hr	1'689	4.48		7'567	-
01:01:14	General services, semiskilled	---	hr	2'533	2.28		5'776	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	195	23.81	32.02	4'633	6'231
		R	hr	49	13.65	26.67	664	1'298
1.2.02	Crawler rock drill, 147 kw	O	hr	1'663	51.30	51.50	85'302	85'634
		R	hr	416	23.43	41.31	9'740	17'173
1.2.03	Hand-held rock drill, heavy weight type	O	hr	788	1.30	2.54	1'025	2'003
		R	hr	197	1.17	2.29	231	451
1.2.04	Motorcompressor, 17 m3/min	O	hr	171	41.24		7'045	-
		R	hr	34	13.96		477	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	70	39.20		2'747	-
		R	hr	14	14.72		206	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	174	47.10		8'189	-
		R	hr	35	17.65		614	-
1.2.07	Integral drill steel grinder	O	hr	54	3.03	1.56	163	84
		R	hr	11	0.92	1.45	10	16
01:02:08	Button bits grinder	O	hr	225	2.74	1.37	616	308
		R	hr	45	0.81	1.28	36	58
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	493	9.72		4'787	-
		R	hr	99	6.20		611	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	115'190	1.99		229'229	-
1.3.02	Explosive, ANFO type	---	kg	219'859	1.24		272'625	-
1.3.03	Detonating fuse	---	m	71'965	0.30		21'589	-
1.3.04	Ordinary low burning fuse	---	ea	6	0.34		2	-
1.3.05	Delay for detonating fuse	---	ea	5'256	3.82		20'077	-
1.3.06	Common detonator	---	ea	4	0.24		1	-
1.3.07	Detonator with connector to detonating fuse	---	ea	72	3.34		241	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	4		612.81	-	2'690
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	83		516.19	-	43'082
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	3		396.12	-	1'204
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	27		469.27	-	12'737
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							800'856	172'968

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-9*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
	Materials (Cont.d)						800'856	172'968
1.3.12	Coupling for rod n. 1.3.09	---	ea	121		111.80	-	13'572
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	8		162.86	-	1'321
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	6		296.36	-	1'739
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	67		448.57	-	29'835
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	36		143.80	-	5'160
1.3.17	Grease for rods, couplings and shanks	---	kg	217	2.86		622	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	3'225	11.81		38'089	-
2.1.02	Operator, front shovel	----	hr	2'167	8.14		17'643	-
2.1.03	Helper for ditto	----	hr	2'167	4.48		9'710	-
2.1.04	Operator, backhoe	----	hr	108	8.14		882	-
2.1.05	Helper for ditto	----	hr	108	4.48		486	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	542	8.14		4'411	-
2.1.07	Helper for ditto	----	hr	542	4.48		2'428	-
2.1.08	Operator, off-highway dumper	----	hr	7'179	8.14		58'437	-
2.1.09	Helper for ditto	----	hr	7'179	4.48		32'162	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	2'004	8.14		16'312	-
2.1.11	Helper for ditto	----	hr	2'004	4.48		8'977	-
2.1.12	General services, skilled	----	hr	600	4.48		2'688	-
2.1.13	General services, semiskilled	----	hr	1'200	2.26		2'712	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	252	92.97	71.61	23'403	18'026
		R	hr	50	29.96	49.75	1'508	2'505
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	1'719	122.83	92.17	211'107	158'412
		R	hr	344	39.49	65.54	13'574	22'529
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	99	91.71		9'035	-
		R	hr	20	38.51		759	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	493	154.40		76'058	-
		R	hr	99	60.10		5'921	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	1'319	71.90	59.21	94'805	78'073
		R	hr	264	22.23	35.69	5'862	9'412
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	1'512	110.78	88.66	167'464	134'026
		R	hr	302	37.08	55.95	11'211	16'916
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	3'696	119.00	94.66	439'831	349'869
		R	hr	739	44.65	62.15	33'006	45'942
2.2.08	Bulldozer 149 kW in disposal area	O	hr	1'822	107.76		196'308	-
		R	hr	364	44.81		16'326	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	1'153	9.72		11'202	-
		R	hr	231	6.20		1'429	-
Sub-total ------------>>							2'315'224	1'060'303
Construction Contingencies			%	2.00%	------------>>		46'304	21'206
Total Direct Costs ------------>>							2'361'528	1'081'510
Overheads and Profit			%	48.00%	------------>>		1'652'658	
Unit Price in Currency Portions			m^3	553'800	------------>>		**7.25**	**1.95**
AGGREGATE UNIT PRICE			m^3	------------>>				**9.20**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-10*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION (CONTROLLED) - SPILLWAY STRUCTURE (TRANSPORT TO AGGREG. STOCK.)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	1'238	11.81		14'623	-
1.1.02	Crawler drill operator	---	hr	505	8.14		4'107	-
1.1.03	Helper for ditto	---	hr	1'009	4.48		4'521	-
1.1.04	Hand held drill miner	---	hr	847	4.48		3'794	-
1.1.05	Helper for ditto	---	hr	1'694	2.26		3'828	-
1.1.06	Explosive truck driver	---	hr	78	3.39		265	-
1.1.07	Helper for ditto	---	hr	78	2.26		177	-
1.1.08	ANFO truck driver	---	hr	150	3.39		509	-
1.1.09	Helper for ditto	---	hr	301	2.26		679	-
1.1.10	Explosive charging and firing, specialist	---	hr	2'060	5.76		11'867	-
1.1.11	Explosive charging and firing, skilled	---	hr	1'030	4.48		4'615	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	173	8.14		1'405	-
1.1.13	General services, skilled	---	hr	792	4.48		3'550	-
01:01:14	General services, semiskilled	---	hr	1'189	2.28		2'710	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	420	23.81	32.02	10'012	13'464
		R	hr	105	13.65	26.67	1'435	2'804
1.2.02	Crawler rock drill, 147 kw	O	hr	-	51.30	51.50	-	-
		R	hr	-	23.43	41.31	-	-
1.2.03	Hand-held rock drill, heavy weight type	O	hr	847	1.30	2.54	1'101	2'151
		R	hr	212	1.17	2.29	248	485
1.2.04	Motorcompressor, 17 m3/min	O	hr	183	41.24		7'567	-
		R	hr	37	13.96		512	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	56	39.20		2'189	-
		R	hr	11	14.72		164	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	107	47.10		5'056	-
		R	hr	21	17.65		379	-
1.2.07	Integral drill steel grinder	O	hr	54	3.03	1.56	165	85
		R	hr	11	0.92	1.45	10	16
01:02:08	Button bits grinder	O	hr	89	2.74	1.37	245	123
		R	hr	18	0.81	1.28	14	23
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	298	9.72		2'898	-
		R	hr	60	6.20		370	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	26'730	1.99		53'193	-
1.3.02	Explosive, ANFO type	---	kg	51'941	1.24		64'407	-
1.3.03	Detonating fuse	---	m	46'608	0.30		13'983	-
1.3.04	Ordinary low burning fuse	---	ea	3	0.34		1	-
1.3.05	Delay for detonating fuse	---	ea	5'173	3.82		19'762	-
1.3.06	Common detonator	---	ea	2	0.24		0	-
1.3.07	Detonator with connector to detonating fuse	---	ea	67	3.34		223	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	9		612.81	-	5'680
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	32		516.19	-	16'760
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	7		396.12	-	2'603
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	12		469.27	-	5'662
	O=Operating unit							
	R=Reserve unit							
Total brought forward --->							240'584	49'854

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-10*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION (NORMAL) - POWER INTAKES & GENER. UNITS (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
	Materials (Cont.d)						240'584	49'854
1.3.12	Coupling for rod n. 1.3.09	---	ea	47		111.80	-	5'280
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	18		162.86	-	2'853
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	32		296.36	-	9'535
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	-		448.57	-	-
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	36		143.80	-	5'214
1.3.17	Grease for rods, couplings and shanks	---	kg	134	2.86		384	-
2	**LOADING AND TRANSPORT**							
2.1	**Labor**							
2.1.01	Foreman	----	hr	774	11.81		9'137	-
2.1.02	Operator, front shovel	----	hr	476	8.14		3'871	-
2.1.03	Helper for ditto	----	hr	476	4.48		2'130	-
2.1.04	Operator, backhoe	----	hr	24	8.14		194	-
2.1.05	Helper for ditto	----	hr	24	4.48		107	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	119	8.14		968	-
2.1.07	Helper for ditto	----	hr	119	4.48		533	-
2.1.08	Operator, off-highway dumper	----	hr	1'821	8.14		14'821	-
2.1.09	Helper for ditto	----	hr	1'821	4.48		8'157	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	440	8.14		3'579	-
2.1.11	Helper for ditto	----	hr	440	4.48		1'970	-
2.1.12	General services, skilled	----	hr	144	4.48		645	-
2.1.13	General services, semiskilled	----	hr	288	2.26		651	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	55	92.97	71.61	5'134	3'955
		R	hr	11	29.96	49.75	331	550
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	377	122.83	92.17	46'315	34'754
		R	hr	75	39.49	65.54	2'978	4'943
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	22	91.71		1'982	-
		R	hr	4	38.51		166	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	108	154.40		16'687	-
		R	hr	22	60.10		1'299	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	579	71.90	59.21	41'599	34'257
		R	hr	116	22.23	35.69	2'572	4'130
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	497	110.78	88.66	55'111	44'107
		R	hr	99	37.08	55.95	3'689	5'567
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	579	119.00	94.66	68'926	54'828
		R	hr	116	44.65	62.15	5'172	7'200
2.2.08	Bulldozer 149 kW in disposal area	O	hr	400	107.76		43'069	-
		R	hr	80	44.81		3'582	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	253	9.72		2'458	-
		R	hr	51	6.20		314	-
Sub-total ---->>							589'112	267'025
Construction Contingencies			%	2.50%	---->>		14'728	6'676
Total Direct Costs ---->>							603'840	273'700
Overheads and Profit			%	48.00%	---->>		421'219	
Unit Price in Currency Portions			**m^3**	**121'500**	---->>		**8.44**	**2.25**
AGGREGATE UNIT PRICE			**m^3**	---->>				**10.69**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-11*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION - SPILLWAY DISCHARGE CHANNEL (TRANSPORT TO STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	13'260	11.81		156'603	-
1.1.02	Crawler drill operator	---	hr	11'205	8.14		91'207	-
1.1.03	Helper for ditto	---	hr	22'410	4.48		100'395	-
1.1.04	Hand held drill miner	---	hr	3'964	4.48		17'758	-
1.1.05	Helper for ditto	---	hr	7'927	2.26		17'916	-
1.1.06	Explosive truck driver	---	hr	493	3.39		1'672	-
1.1.07	Helper for ditto	---	hr	493	2.26		1'115	-
1.1.08	ANFO truck driver	---	hr	1'224	3.39		4'148	-
1.1.09	Helper for ditto	---	hr	2'447	2.26		5'531	-
1.1.10	Explosive charging and firing, specialist	---	hr	22'015	5.76		126'806	-
1.1.11	Explosive charging and firing, skilled	---	hr	11'007	4.48		49'313	-
1.1.12	Integral drill steel and bit grinding specialist	---	hr	1'680	8.14		13'676	-
1.1.13	General services, skilled	---	hr	8'487	4.48		38'020	-
01:01:14	General services, semiskilled	---	hr	12'730	2.28		29'024	-
1.2	**Equipment**							
1.2.01	Crawler rock drill, 48 kw	O	hr	978	23.81	32.02	23'293	31'324
		R	hr	245	13.65	26.67	3'338	6'523
1.2.02	Crawler rock drill, 147 kw	O	hr	8'359	51.30	51.50	428'819	430'491
		R	hr	2'090	23.43	41.31	48'963	86'328
1.2.03	Hand-held rock drill, heavy weight type	O	hr	3'964	1.30	2.54	5'153	10'068
		R	hr	991	1.17	2.29	1'159	2'269
1.2.04	Motorcompressor, 17 m3/min	O	hr	859	41.24		35'417	-
		R	hr	172	13.96		2'398	-
1.2.05	Flat bed truck with crane, 15 tons capacity	O	hr	352	39.20		13'808	-
		R	hr	70	14.72		1'037	-
1.2.06	ANFO truck oufitted with explosive injector	O	hr	874	47.10		41'164	-
		R	hr	175	17.65		3'085	-
1.2.07	Integral drill steel grinder	O	hr	271	3.03	1.56	820	422
		R	hr	54	0.92	1.45	50	78
01:02:08	Button bits grinder	O	hr	1'130	2.74	1.37	3'095	1'547
		R	hr	226	0.81	1.28	183	289
01:02:09	Portable diesel powered floodlight, 10000 W	O	hr	2'476	9.72		24'066	-
		R	hr	495	6.20		3'070	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	579'072	1.99		1'152'353	-
1.3.02	Explosive, ANFO type	---	kg	1'105'248	1.24		1'370'508	-
1.3.03	Detonating fuse	---	m	361'773	0.30		108'532	-
1.3.04	Ordinary low burning fuse	---	ea	28	0.34		9	-
1.3.05	Delay for detonating fuse	---	ea	26'421	3.82		100'929	-
1.3.06	Common detonator	---	ea	19	0.24		4	-
1.3.07	Detonator with connector to detonating fuse	---	ea	363	3.34		1'214	-
1.3.08	Wagondrill drill steel, rod 4,915 mm	---	ea	22		612.81	-	13'522
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	420		516.19	-	216'577
1.3.10	Shank adaptor for rod n. 1.3.08	---	ea	15		396.12	-	6'055
1.3.11	Shank adaptor for rod n. 1.3.09	---	ea	136		469.27	-	64'030
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							4'025'650	869'525

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-11*
CIVIL WORKS COST ESTIMATE
ROCK EXCAVATION - POWERHOUSE TAILRACE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
	Materials (Cont.d)						4'025'650	869'525
1.3.12	Coupling for rod n. 1.3.09	---	ea	610		111.80	-	68'229
1.3.11	Wagon drill button type bit, 51 mm diameter	---	ea	41		162.86	-	6'638
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	29		296.36	-	8'742
1.3.14	Crawler drillbutton type bit, 89 mm diameter	---	ea	-		368.51	-	-
1.3.15	Crawler drill button type bit, 102 mm diameter	---	ea	334		448.57	-	149'985
1.3.16	Integrall drill steel, 800/4000 mm (average)	---	ea	180		143.80	-	25'938
1.3.17	Grease for rods, couplings and shanks	---	kg	1'092	2.86		3'124	-
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	15'351	11.81		181'295	-
2.1.02	Operator, front shovel	----	hr	10'896	8.14		88'693	-
2.1.03	Helper for ditto	----	hr	10'896	4.48		48'814	-
2.1.04	Operator, backhoe	----	hr	545	8.14		4'435	-
2.1.05	Helper for ditto	----	hr	545	4.48		2'441	-
2.1.06	Operator, bulldozer (excavation area)	----	hr	2'724	8.14		22'173	-
2.1.07	Helper for ditto	----	hr	2'724	4.48		12'204	-
2.1.08	Operator, off-highway dumper	----	hr	32'881	8.14		267'654	-
2.1.09	Helper for ditto	----	hr	32'881	4.48		147'308	-
2.1.10	Operator, bulldozer (disposal area)	----	hr	10'074	8.14		82'000	-
2.1.11	Helper for ditto	----	hr	10'074	4.48		45'130	-
2.1.12	General services, skilled	----	hr	2'856	4.48		12'795	-
2.1.13	General services, semiskilled	----	hr	5'712	2.26		12'909	-
2.2	**Equipment**							
2.2.01	Hydraulic front shovel, 260 kW, 4.3 m^3 heaped	O	hr	1'265	92.97	71.61	117'649	90'619
		R	hr	253	29.96	49.75	7'583	12'591
2.2.02	Hydraulic front shovel, 390 kW, 5.7 m^3 heaped	O	hr	8'640	122.83	92.17	1'061'251	796'349
		R	hr	1'728	39.49	65.54	68'239	113'253
2.2.03	Hydraulic backhoe 200 kW for trimming woks	O	hr	495	91.71		45'421	-
		R	hr	99	38.51		3'815	-
2.2.04	Bulldozer 231 kW for shovel assistance	O	hr	2'476	154.40		382'351	-
		R	hr	495	60.10		29'766	-
2.2.05	Off-highway dumper, 37.3 ton pay load	O	hr	6'039	71.90	59.21	434'230	357'591
		R	hr	1'208	22.23	35.69	26'851	43'109
2.2.06	Off-highway dumper, 63.5 ton pay load	O	hr	6'924	110.78	88.66	767'026	613'870
		R	hr	1'385	37.08	55.95	51'347	77'478
2.2.07	Off-highway dumper, 90.9 ton pay load	O	hr	16'929	119.00	94.66	2'014'530	1'602'483
		R	hr	3'386	44.65	62.15	151'174	210'425
2.2.08	Bulldozer 149 kW in disposal area	O	hr	9'158	107.76		986'855	-
		R	hr	1'832	44.81		82'073	-
2.2.09	Portable diesel powered floodlight, 10000 W	O	hr	5'794	9.72		56'315	-
		R	hr	1'159	6.20		7'184	-
Sub-total ------>>							11'250'286	5'046'826
Construction Contingencies			%	2.00%	------>>		225'006	100'937
Total Direct Costs ------>>							11'475'292	5'147'762
Overheads and Profit			%	48.00%	------>>		7'979'066	
Unit Price in Currency Portions			m^3	2'784'000	------>>		**6.99**	**1.85**
AGGREGATE UNIT PRICE			m^3	------>>				**8.84**

RIO MADEIRA HYDROPOWER DEVELOPMENT. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-12*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION IN WATER - SPILLWAY DISCHARGE CHANNEL (TRANSPORT TO RIGHT BANK STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**DRILLING AND BLASTING**							
1.1	**Labor**							
1.1.01	Foreman	---	hr	14'577	11.81		172'160	-
1.1.02	Crawler drill operator	---	hr	9'074	8.14		73'860	-
1.1.03	Helper for ditto	---	hr	27'221	4.48		121'951	-
1.1.04	Explosive truck driver	---	hr	222	3.39		752	-
1.1.05	Helper for ditto	---	hr	222	2.26		501	-
1.1.06	Explosive charging and firing, specialist	---	hr	20'309	5.76		116'983	-
1.1.07	Explosive charging and firing, skilled	---	hr	20'309	4.48		90'986	-
1.1.08	Button bit grinding specialist	---	hr	389	8.14		3'165	-
1.1.09	General services, skilled	---	hr	15'549	4.48		69'661	-
1.1.10	General services, semiskilled	---	hr	23'324	2.28		53'179	-
1.2	**Equipment**							
							-	-
1.2.01	Crawler rock drill, 147 kw	O	hr	6'481	51.30	51.50	332'487	333'783
		R	hr	1'620	23.43	41.31	37'964	66'935
01:02:02	Pontoon of modular type, 70 tons capacity	O	hr	1'620	81.96		132'800	-
		R	hr	405	60.13		24'358	-
01:02:03	Conventional barge with 50 kW engine	O	hr	810	32.50		26'330	-
		R	hr	162	12.37		2'004	-
01:02:04	Flat bed truck with crane, 15 tons capacity	O	hr	139	39.20		5'436	-
		R	hr	28	14.72		408	-
01:02:05	Button bits grinder	O	hr	324	2.74	1.37	888	444
		R	hr	65	0.81	1.28	52	83
01:02:06	Portable diesel powered floodlight, 10000 W	O	hr	810	9.72		7'875	-
		R	hr	162	6.20		1'005	-
1.3	**Materials**							
1.3.01	Explosive, emulsion type	---	kg	400'000	1.99		796'000	-
1.3.02	Explosive, ANFO type	---	kg	-	1.24		-	-
1.3.03	Detonating fuse	---	m	79'208	0.30		23'762	-
1.3.04	Ordinary low burning fuse	---	ea		0.34		-	-
1.3.05	Delay for detonating fuse	---	ea	4'161	3.82		15'893	-
1.3.06	Common detonator	---	ea	-	0.24		-	-
1.3.07	Detonator with connector to detonating fuse	---	ea	139	3.34		463	-
1.3.08	Rigid plastic pipes for explosive charging	---	m	50'000	7.19		359'500	-
1.3.09	Crawler drill steel, rod 3,660 mm	---	ea	124		516.19	-	63'852
1.3.10	Crawler drill shank adaptor	---	ea	41		469.27	-	19'009
1.3.12	Crawler drill rod coupling	---	ea	180		111.80	-	20'116
1.3.13	Crawler drill button type bit, 76 mm diameter	---	ea	108		296.36	-	32'013
1.3.14	Grease for rods, couplings and shanks	---	kg	292	2.86		834	-
	O=Operating unit							
	R=Reserve unit							
Total brought forward -->							2'470'425	484'107

RIO MADEIRA HYDROPOWER DEVELOPMENT. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-12*

CIVIL WORKS COST ESTIMATE

ROCK EXCAVATION IN WATER - SPILLWAY DISCHARGE CHANNEL (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
							2'470'425	484'107
2	LOADING AND TRANSPORT							
2.1	**Labor**							
2.1.01	Foreman	----	hr	6'555	11.81		77'415	-
2.1.02	Operator, cranes and botoom-dump barge	----	hr	14'360	8.14		116'890	-
2.1.03	Helper for ditto	----	hr	28'720	4.48		128'666	-
2.1.04	Operator, barge	----	hr	4'680	8.14		38'095	-
2.1.05	Helper for ditto	----	hr	4'680	4.48		20'966	-
2.1.06	General services, skilled	----	hr	2'622	4.48		11'747	-
2.1.07	General services, semiskilled	----	hr	5'244	2.26		11'851	-
2.2	**Equipment**							
2.2.01	Pontoon of modular type, 210 tons capacity	O	hr	29'714	245.88		2'435'383	-
		R	hr	5'943	180.40		357'356	-
2.2.02	Hydraulic backhoe, 382 kW, 5.8 m3 heaped b.	O	hr	1'500	148.48	74.70	222'720	112'050
		R	hr	300	35.10	30.95	10'530	9'285
2.2.03	Crawler crane, 100 t capacity excluding bucket	O	hr	2'667	193.47		515'920	-
		R	hr	533	134.76		71'872	-
2.2.04	Orange peel bucket for crane, 2.5 m3 capacity	O	hr	2'667	9.09		24'240	-
		R	hr	533	8.28		4'416	-
02:02:05	Self-propelled lateral-dump barge, 200 t capacity	O	hr	7'800	156.13		1'217'814	-
		R	hr	1'560	84.89		132'428	-
02:02:06	Conventional barge with 50 kW engine	O	hr	3'900	32.50		126'750	-
		R	hr	780	12.37		9'649	-
Sub-total ---------->>							8'005'133	605'442
Construction Contingencies			%	5.00%	---------->>		400'257	30'272
Total Direct Costs ---------->>							8'405'390	635'714
Overheads and Profit			%	48.00%	---------->>		4'339'730	
Unit Price in Currency Portions			**m3**	**400'000**	---------->>		**31.86**	**1.59**
AGGREGATE UNIT PRICE			**m3**	---------->>				**33.45**

RIO MADEIRA HYDROPOWER DEVELOPMENT. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 3-13*
CIVIL WORKS COST ESTIMATE
ROCK PRESPLITTING - ALL WORK SECTIONS OF THE PROJECT

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman		hr	4'083	11.81		48'216	-
1.02	Truck drill operator		hr	3'342	5.76		19'251	-
1.03	Helper for ditto		hr	6'684	2.26		15'107	-
1.04	Truck driver		hr	67	3.39		226	-
1.05	Helper for ditto		hr	133	2.26		301	-
1.06	Explosive specialist		hr	175	5.76		1'011	-
1.07	Helper for ditto		hr	526	2.26		1'190	-
1.08	Bit grinding specialist		hr	334	8.14		2'721	-
1.09	General services, skilled		hr	2'253	4.48		10'091	-
1.1	General services, semiskilled		hr	2'816	2.28		6'420	-
2	**EQUIPMENT**							
2.01	Crawler rock drill, 147 kw	O	hr	2'785	45.99	44.58	128'091	124'164
		R	hr	557	21.04	35.27	11'720	19'647
2.02	Flat bed truck with crane, 15 tons capacity	O	hr	51	39.20	10.91	2'008	559
		R	hr	10	14.72	6.72	151	69
2.03	Button bits grinder	O	hr	279	2.74	1.37	763	382
		R	hr	70	0.81	1.28	56	89
2.04	Portable d. powered floodlight, 10 kW	O	hr	1'393	9.72		13'536	-
		R	hr	348	6.20		2'159	-
3	**MATERIALS**							
3.01	Explosive, emulsion type		kg	11'280	1.99		22'447	-
3.02	Detonating fuse		m	18'800	0.30		5'640	-
3.03	Plain fuse		m	174	0.34		59	-
3.04	Detonator with connector to detonating fuse		ea	70	3.34		233	-
3.05	Crawler drill rod, 3660 mm		ea	72		516.19	-	37'297
3.06	Crawler drill shank		ea	42		469.27	-	19'605
3.07	Crawler drill coupling		ea	105		111.80	-	11'750
3.08	Crawler drill bits, 76 mm dia.		ea	111		296.36	-	33'017
							-	-
Sub-total ------------------>>							291'395	246'578
Construction Contingencies			%	2.00%	------------------>>		5'828	4'932
Total Direct Costs ------------------>>							297'223	251'509
Overheads and Profit			%	48.00%	------------------>>		263'391	
Unit Price in Currency Portions			**m3**	**37'600**	------------------>>		**14.91**	**6.69**
AGGREGATE UNIT PRICE			**m3**	------------------>>				**21.60**

Part 4 - Protection of Common Excavation Surfaces

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 4-01*
CIVIL WORKS COST ESTIMATE
PROTECTION OF SLOPES IN COMMON EXCAVATION - ROCKFILL (ROCK FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**PLACING**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	3'835	11.81		45'297	
1.1.02	Equipment operator	---	hr	9'025	8.14		73'460	
1.1.03	Operator's helper	---	hr	9'025	4.48		40'430	
1.1.04	General services, skilled	---	hr	5'415	4.48		24'258	
1.1.05	General services, semiskilled	---	hr	7'220	2.26		16'316	
1.2	**Equipment**							
1.2.01	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	4'628	71.29	40.56	329'930	187'712
		R	hr	926	16.70	27.61	15'458	25'556
1.2.02	Crawler crane 100 t capacity	O	hr	2'893	193.47		559'612	
		R	hr	579	134.76		77'959	
1.2.03	Orange peel bucket, 2.50 m3 capacity	O	hr	2'893	9.09		26'293	
		R	hr	579	8.28		4'790	
1.2.04	Portable diesel pow. floodlight, 10 k W	O	hr	3'008	9.72		29'240	
Sub-total							1'243'043	213'267
Construction Contingencies			%	2.50%	------------------------->>		31'076	5'332
Total Direct Costs							1'274'119	218'599
Overheads and Profit			%	48.00%	------------------------->>		716'505	
Unit Price in Currency Portions			**m3**	**578'500**	------------------------->>		**3.44**	**0.32**
AGGREGATE UNIT PRICE			**m3**	--->>				**3.76**

RIO MADEIRA HYDROPOWER DEVELOP. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 4-02*
CIVIL WORKS COST ESTIMATE
PROTECTION OF RIVER BED IN COMMON EXCAVATION - ROCKFILL (ROCK FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**PLACING**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	3'026	11.81		35'737	
1.1.02	Equipment operator	---	hr	7'120	8.14		57'957	
1.1.03	Operator's helper	---	hr	7'120	4.48		31'898	
1.1.04	General services, skilled	---	hr	4'272	4.48		19'139	
1.1.05	General services, semiskilled	---	hr	5'696	2.26		12'873	
1.2	**Equipment**							
1.2.01	Bulldozer 231 kW	O	hr	4'495	154.40		694'028	
		R	hr	1'124	60.10		67'537	
1.2.02	Smooth drum vibrating roller, 18600 kg	O	hr	1'438	56.71		81'572	-
		R	hr	360	22.62		8'134	-
1.2.03	Portable diesel pow. floodlight, 10 k W	O	hr	1'798	9.72		17'477	
		R	hr	360	6.20		2'230	
Sub-total							1'028'582	
Construction Contingencies			%	2.50%	------------------------->>		25'715	
Total Direct Costs							1'054'297	
Overheads and Profit			%	48.00%	------------------------->>		506'062	
Unit Price in Currency Portions			**m3**	**719'200**	------------------------->>		**2.17**	
AGGREGATE UNIT PRICE			**m3**	-->>				**2.17**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 4-03*
CIVIL WORKS COST ESTIMATE
PROTECTION OF SLOPES IN COMMON EXCAVATION - COMPACTED TRANSITION

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.1	**Processed granular material at the pl**	---	t	371'700	3.12	0.15	1'159'704	55'755
2	**LOADING AND TRANSPORT**							
2.1	**Labour**							
2.1.02	Foreman	---	hr	1'414	11.81		16'703	
2.1.03	Equipment operator	---	hr	4'041	8.14		32'893	
2.1.04	Operator's helper	---	hr	4'041	4.48		18'103	
2.1.05	General services, skilled	---	hr	1'616	4.48		7'241	
2.1.06	General services, semiskilled	---	hr	1'616	2.26		3'653	
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	478	50.23	43.99	24'029	21'044
		R	hr	96	15.84	25.15	1'516	2'406
2.2.02	Rear duper, 37.3 ton pay load	O	hr	2'889	65.37	53.83	188'854	155'515
		R	hr	578	20.21	32.45	11'677	18'750
3	**PLACING**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	2'077	11.81		24'524	
2.1.02	Equipment operator	---	hr	5'191	8.14		42'258	
2.1.03	Operator's helper	---	hr	5'191	4.48		23'257	
2.1.04	General services, skilled	---	hr	2'077	4.48		9'303	
2.1.05	General services, semiskilled	---	hr	4'153	2.26		9'386	
3.2	**Equipment**							
3.2.01	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	944	71.29	40.56	67'298	38'289
		R	hr	189	16.70	27.61	3'153	5'213
3.2.02	Crawler crane 100 t capacity	O	hr	787	193.47		152'196	
		R	hr	157	134.76		21'202	
3.2.03	Orange peel bucket, 2.50 m3 capacity	O	hr	787	9.09		7'151	
		R	hr	157	8.28		1'303	
3.2.04	S. drum tandem vibrating roller 3.2 t	O	hr	1'903	19.12		36'390	
		R	hr	381	13.50		5'139	
3.2.05	Mobile winch for rollers work. on slopes	O	hr	1'903	41.76		79'479	
		R	hr	381	30.68		11'678	
3.2.06	Portable diesel pow. floodlight, 10 k W	O	hr	692	9.72		6'729	
		R	hr	138	6.20		858	
Sub-total							1'965'677	296'971
Construction Contingencies			%	2.50%	------------------------->>		49'142	7'424
Total Direct Costs							2'014'818	304'396
Overheads and Profit			%	48.00%	------------------------>>		1'113'223	
Unit Price in Currency Portions			**m3**	**177'000**	------------------------>>		**17.67**	**1.46**
AGGREGATE UNIT PRICE			**m3**	--->>				**19.13**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 4-04*

CIVIL WORKS COST ESTIMATE

PROTECTION OF RIVER BED IN COMMON EXCAVATION - COMPACTED TRANSITION

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.1	**Processed granular material at the pl**	---	t	1'510'320	3.12	0.15	4'712'198	226'548
2	**LOADING AND TRANSPORT**							
2.1	**Labour**							
2.1.02	Foreman	---	hr	3'290	11.81		38'855	
2.1.03	Equipment operator	---	hr	9'400	8.14		76'516	
2.1.04	Operator's helper	---	hr	9'400	4.48		42'112	
2.1.05	General services, skilled	---	hr	3'760	4.48		16'845	
2.1.06	General services, semiskilled	---	hr	3'760	2.26		8'498	
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	1'944	50.23	43.99	97'636	85'507
		R	hr	389	15.84	25.15	6'158	9'777
2.2.02	Rear duper, 63.5 ton pay load	O	hr	5'890	100.64	80.60	592'720	474'695
		R	hr	1'178	33.71	50.86	39'707	59'908
3	**PLACING**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	1'654	11.81		19'536	
2.1.02	Equipment operator	---	hr	4'135	8.14		33'662	
2.1.03	Operator's helper	---	hr	4'135	4.48		18'527	
2.1.04	General services, skilled	---	hr	1'654	4.48		7'411	
2.1.05	General services, semiskilled	---	hr	3'308	2.26		7'477	
3.2	**Equipment**							
3.2.01	Bulldozer 231 kW	O	hr	2'248	127.61		286'803	
		R	hr	450	49.71		22'345	
3.2.02	S. drum tandem vibrating roller 10840 kg	O	hr	1'199	34.70		41'594	
		R	hr	240	15.24		3'654	
3.2.03	Portable diesel pow. floodlight, 10 k W	O	hr	899	9.72		8'738	
		R	hr	180	6.20		1'115	
Sub-total							6'082'105	856'435
Construction Contingencies			%	2.00%	------------------------->>		121'642	17'129
Total Direct Costs							6'203'747	873'564
Overheads and Profit			%	48.00%	------------------------>>		3'397'109	
Unit Price in Currency Portions			**m3**	**719'200**	------------------------>>		**13.35**	**1.03**
AGGREGATE UNIT PRICE			**m3**	--->>				**14.38**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 4-05*

CIVIL WORKS COST ESTIMATE

SUPPORT AND/OR PROTECTION OF ROCK SURFACES - EXPANSION TYPE ROCK BOLTS, 26.5 MM DIAMETER

N°	DESCRIPTION	AUX,	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**BOREHOLE**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	530	11.81		6'256	
1.1.02	Wagondrill operator	---	hr	1'130	8.14		9'198	
1.1.03	Operator's, helper	---	hr	2'260	4.48		10'125	
1.1.04	General services, skilled	---	hr	339	4.48		1'519	
1.1.05	General services, semiskilled	---	hr	509	2.26		1'149	
1.2	**Equipment**							
1.2.01	Wagon drill, 48 kW	O	hr	942	23.81	32.02	22'421	30'152
		R	hr	188	13.65	26.67	2'571	5'023
1.2.02	Button bit grinder grinder	O	hr	11	2.74	1.37	31	15
		R	hr	2	0.81	1.28	2	3
1.3	**Materials**							
1.3.01	Wagon drill sank adaptor	---	ea	7		396.12	-	2'798
1.3.02	Wagon drill 4,915 mm long rod	---	ea	7		612.81	-	4'328
1.3.03	Wagon drill 51 mm button type bit	---	ea	23		162.86	-	3'681
2	**BOLT PLACING**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	1'130	11.81		13'345	-
2.1.02	Skilled	---	hr	2'260	4.48			
2.1.03	Semiskilled	---	hr	6'780	2.26		15'323	-
2.2	**Materials**							
2.2.01	Rock bolt with plate and nut		m	11'300	15.19		171'647	-
Sub-total ---------->>							253'586	46'000
Construction Contingencies			%	3.00%	---------->>		7'608	1'380
Total Direct Costs ---------->>							261'194	47'380
Overhead and Profit			%	48.00%	---------->>		148'115	
Unit price in Currency Portions			**m**	**11'300**	**---------->>**		**36.22**	**4.19**
AGGREGATE UNIT PRICE			**m**	**---------->>**				**40.41**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 4-06*

CIVIL WORKS COST ESTIMATE

SUPPORT AND/OR PROTECTION OF ROCK SURFACES - SHOTCRETE - WET TYPE (EXCLUDING CEMENT)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**CONCRETE**							
1.01	Concrete at mixing plant	---	m3	3'450	32.04		110'538	
1.02	Portland cement	---	t	1'898				
1.03	Quick set admixture	---	kg	94'875	1.19		112'901	
2	**TRANSPORT**							
2.01	Truckmixer, 10 m3 capacity	O	hr	863	71.76		61'893	-
		R	hr	216	20.45		4'410	-
2.02	Foreman	---	hr	259	11.81		3'056	-
2.03	Truckmixer, operator	---	hr	1'035	8.14		8'425	-
2.04	Truckmixer, helper	---	hr	1'035	4.48		4'637	-
3	**PLACING**							
3.01	Diesel powered shotcrete pump, 37 kw	O	hr	863	17.88	19.34	15'422	16'681
		R	hr	216	12.38	13.13	2'669	2'831
3.01	Foreman		hr	776	11.81		9'168	-
3.02	Pump operator	---	hr	1'035	8.14		8'425	-
3.03	Operator's, helper	---	hr	2'070	4.48		9'274	-
3.04	Skilled	---	hr	1'035	4.48		4'637	-
3.05	Semiskilled	---	hr	2'070	2.26		4'678	-
4	**OVERBREAK AND WASTE**							
4.01	Overtickness	---	%	6.00%	360'131	19'512	21'608	1'171
4.02	Losses (rebound etc.)	---	%	25.00%	360'131	19'512	90'033	4'878
Sub-total per m³ ------>>							471'772	25'561
Sub-total per m² ------>>							20.33	1.10
Construction Contingencies			%	3.00%	------>>		0.61	0.03
Total Direct Costs ------>>							20.95	1.13
Overhead and Profit			%	48.00%	------>>		10.60	-
Unit price in Currency Portions			**m²**	**23'200**	**------>>**		**31.54**	**1.13**
AGGREGATE UNIT PRICE (15 CM THICKNESS)			**m²**	**------>>**				**32.68**

RIO MADEIRA H.P.D. - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 4-07*

CIVIL WORKS COST ESTIMATE

SUPPORT AND/OR PROTECTION OF ROCK SURFACES - WELDED WIRE FABRIC

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.01	Welded wire fabric	----	kg	76'560	2.77		212'071	
1.02	Black wire	----	kg	1'531	2.21		3'384	
							-	
2	**TRANSPORT**						-	
							-	
2.01	Flat bed truck with hydraulic crane, 15 t c	O	hr	26	39.20		1'000	
		R	hr	5	14.72		75	
2.02	Foreman	----	hr	7	11.81		83	
2.03	Truck operator	----	hr	28	8.14		229	
2.04	Operator's, helper	----	hr	28	4.48		126	
3	**PLACING**							
3.01	Foreman	----	hr	3'480	11.81		41'099	
3.02	Skilled	----	hr	6'960	4.48		31'181	
3.03	Semiskilled	----	hr	20'880	2.26		47'189	
Sub-total ------>>							336'436	
Construction Contingencies			%	1.50%	------>>		5'047	
Total Direct Costs ------>>							341'483	
Overhead and Profit			%	48.00%	------>>		163'912	
Unit Price in Currency Portions			**m²**	**23'200**	**------>>**		**21.78**	
AGGREGATE UNIT PRICE			**m²**	**------>>**				**21.78**

Part 5 - Auxiliary Cofferdams Removal

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 5-1*
CIVIL WORKS COST ESTIMATE
COFFERDAM REMOVAL - AUXILIARY 1, 2, 3, & 4 (TRANSPORT TO RIGHT BANK DISPOSAL AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	9'434	11.81		111'419	
1.02	Operator, bulldozer in loading area	----	hr	1'157	8.14		9'421	
1.03	Helper for ditto	----	hr	1'157	4.48		5'185	
1.06	Operator, wheel loader	----	hr	967	8.14		7'868	
1.07	Helper for ditto	----	hr	967	4.48		4'330	
1.08	Operator, hydraulic excavator	----	hr	2'732	8.14		22'240	
1.09	Helper for ditto	----	hr	2'732	4.48		12'240	
1.10	Operator, rear dumper	----	hr	28'454	8.14		231'617	
1.11	Helper for ditto	----	hr	28'454	4.48		127'475	
1.12	Operator, bulldozer in disposal area	----	hr	1'794	8.14		14'603	
1.13	Helper for ditto	----	hr	1'794	4.48		8'037	
1.14	General services, skilled	----	hr	1'755	4.48		7'863	
1.15	General services, semiskilled	----	hr	3'510	2.26		7'934	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, in loading area	O	hr	1'052	127.61		134'268	-
		R	hr	210	49.71		10'461	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	421	50.23	43.99	21'140	18'514
		R	hr	84	15.84	25.15	1'333	2'117
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	458	116.86	112.58	53'497	51'538
		R	hr	92	40.63	64.82	3'720	5'935
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	1'125	71.29	40.56	80'183	45'620
		R	hr	225	16.70	27.61	3'757	6'211
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	1'359	106.81	80.15	145'161	108'929
		R	hr	272	34.34	56.99	9'334	15'491
2.07	Dumper, 37.3 ton pay load	O	hr	4'951	65.37	53.83	323'674	266'534
		R	hr	990	20.21	32.45	20'014	32'135
2.08	Dumper, 63.5 ton pay load	O	hr	8'725	100.64	80.60	878'124	703'267
		R	hr	1'745	33.71	50.86	58'827	88'755
2.09	Dumper, 90.9 ton pay load	O	hr	12'191	119.00	94.66	1'450'681	1'153'962
		R	hr	2'438	40.59	56.50	98'963	137'754
2.10	Bulldozer 149 kW in disposal area	O	hr	1'631	89.80		146'453	-
		R	hr	326	37.34		12'179	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	237	9.72		2'301	-
		R	hr	47	6.20		294	-
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			4'024'594	2'636'760
Construction Contingencies			%	2.00%	------------------------>>		80'492	52'735
Total Direct Costs				--->>			4'105'086	2'689'495
Overhead and Profit			%	48.00%	------------------------>>		3'261'399	
Unit price in Currency Portions			**m^3**	**1'304'700**	------------------------>>		**5.65**	**2.06**
AGGREGATE UNIT PRICE			**m^3**	--->>				**7.71**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 5-2*
CIVIL WORKS COST ESTIMATE
COFFERDAM REMOVAL - AUXILIARY 5, 6,& 7 (TRANSPORT TO LEFT BANK DISPOSAL AREA 1)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	4'395	11.81		51'907	
1.02	Operator, bulldozer in loading area	----	hr	750	8.14		6'106	
1.03	Helper for ditto	----	hr	750	4.48		3'361	
1.06	Operator, wheel loader	----	hr	626	8.14		5'099	
1.07	Helper for ditto	----	hr	626	4.48		2'806	
1.08	Operator, hydraulic excavator	----	hr	1'771	8.14		14'415	
1.09	Helper for ditto	----	hr	1'771	4.48		7'933	
1.10	Operator, rear dumper	----	hr	12'044	8.14		98'038	
1.11	Helper for ditto	----	hr	12'044	4.48		53'957	
1.12	Operator, bulldozer in disposal area	----	hr	1'163	8.14		9'465	
1.13	Helper for ditto	----	hr	1'163	4.48		5'209	
1.14	General services, skilled	----	hr	818	4.48		3'663	
1.15	General services, semiskilled	----	hr	1'635	2.26		3'696	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, in loading area	O	hr	682	127.61		87'025	-
		R	hr	136	49.71		6'780	-
2.03	Wheel loader, 229 kW , 4.20 m^3 heaped capacity	O	hr	273	50.23	43.99	13'702	12'000
		R	hr	55	15.84	25.15	864	1'372
2.04	Wheel loader, 468 kW , 8.90 m^3 heaped capacity	O	hr	297	116.86	112.58	34'674	33'404
		R	hr	59	40.63	64.82	2'411	3'847
2.05	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	729	71.29	40.56	51'970	29'568
		R	hr	146	16.70	27.61	2'435	4'025
2.06	Hydraulic front shovel, 390 kW, 5.70 m^3 heaped c.	O	hr	881	106.81	80.15	94'085	70'601
		R	hr	176	34.34	56.99	6'050	10'040
2.07	Dumper, 37.3 ton pay load	O	hr	2'096	65.37	53.83	137'003	112'818
		R	hr	419	20.21	32.45	8'471	13'602
2.08	Dumper, 63.5 ton pay load	O	hr	3'693	100.64	80.60	371'689	297'676
		R	hr	739	33.71	50.86	24'900	37'568
2.09	Dumper, 90.9 ton pay load	O	hr	5'160	119.00	94.66	614'038	488'444
		R	hr	1'032	40.59	56.50	41'889	58'308
2.10	Bulldozer 149 kW in disposal area	O	hr	1'057	89.80		94'922	-
		R	hr	211	37.34		7'894	-
2.11	Mobile diesel powered floodlight, 10,000 W	O	hr	153	9.72		1'491	-
		R	hr	31	6.20		190	-
	O=Oprating units							
	R=Reserve units							
Sub-total				--->>			1'868'139	1'173'272
Construction Contingencies			%	2.00%	------------------------->>		37'363	23'465
Total Direct Costs				--->>			1'905'502	1'196'738
Overhead and Profit			%	48.00%	------------------------->>		1'489'075	
Unit price in Currency Portions			m^3	845'630	------------------------->>		**4.01**	**1.42**
AGGREGATE UNIT PRICE			m^3	-->>				**5.43**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 5-3*

CIVIL WORKS COST ESTIMATE

COFFERDAM REMOVAL - AUXILIARY 8, 9, 10 & 11 IN DRY CONDITIONS (TRANSPORT TO R. BANK DISP. AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**LABOUR**							
1.01	Foreman	----	hr	8'536	11.81		100'813	
1.02	Operator, bulldozer in loading area	----	hr	750	8.14		6'106	
1.03	Helper for ditto	----	hr	750	4.48		3'361	
1.04	Operator, hydraulic excavator	----	hr	1'773	8.14		14'429	
1.05	Helper for ditto	----	hr	1'773	4.48		7'941	
1.06	Operator, rear dumper	----	hr	28'077	8.14		228'549	
1.07	Helper for ditto	----	hr	28'077	4.48		125'786	
1.08	Operator, bulldozer in disposal area	----	hr	1'163	8.14		9'465	
1.09	Helper for ditto	----	hr	1'163	4.48		5'209	
1.10	General services, skilled	----	hr	1'588	4.48		7'115	
1.11	General services, semiskilled	----	hr	3'176	2.26		7'178	
2	**EQUIPMENT**							
2.01	Bulldozer 231 kW, in loading area	O	hr	682	127.61		87'025	-
		R	hr	136	49.71		6'780	-
2.02	Hydraulic backhoe, 257 kW , 3.20 m^3 heaped cap.	O	hr	650	71.29	40.56	46'373	26'384
		R	hr	130	16.70	27.61	2'173	3'592
2.03	Hydraulic backhoe, 382 kW, 5.80 m^3 heaped c.	O	hr	961	106.81	80.15	102'638	77'020
		R	hr	192	34.34	56.99	6'600	10'953
2.04	Dumper, 37.3 ton pay load	O	hr	13'569	65.37	53.83	887'008	730'421
		R	hr	2'714	20.21	32.45	54'846	88'063
2.05	Dumper, 63.5 ton pay load	O	hr	11'956	100.64	80.60	1'203'223	963'631
		R	hr	2'391	33.71	50.86	80'605	121'614
2.06	Dumper, 90.9 ton pay load	O	hr	-	119.00	94.66	-	-
		R	hr	-	40.59	56.50	-	-
2.07	Bulldozer 149 kW in disposal area	O	hr	1'057	89.80		94'922	-
		R	hr	211	37.34		7'894	-
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	153	9.72		1'491	-
		R	hr	31	6.20		190	-
	O=Oprating units							
	R=Reserve units							
Sub-total				-->>			3'097'720	2'021'677
Construction Contingencies			%	2.00%	--------------------------->>		61'954	40'434
Total Direct Costs				-->>			3'159'675	2'062'110
Overhead and Profit			%	48.00%	--------------------------->>		2'506'457	
Unit price in Currency Portions			**m^3**	**845'630**	--------------------------->>		**6.70**	**2.44**
AGGREGATE UNIT PRICE			**m^3**	--->>				**9.14**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 5-4*

CIVIL WORKS COST ESTIMATE

COFFERDAM REMOVAL - AUXILIARY 8, 9, 10 & 11 IN WATER (TRANSPORT TO R. BANK DISPOSAL AREA 2)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	LABOUR							
1.01	Foreman	----	hr	1'849	11.81		21'833	
1.02	Operator, bulldozer in loading area	----	hr	117	8.14		954	
1.03	Helper for ditto	----	hr	117	4.48		525	
1.04	Operator, hydraulic excavator	----	hr	1'049	8.14		8'542	
1.05	Helper for ditto	----	hr	1'049	4.48		4'701	
1.06	Operator, rear dumper	----	hr	5'485	8.14		44'649	
1.07	Helper for ditto	----	hr	5'485	4.48		24'573	
1.08	Operator, bulldozer in disposal area	----	hr	227	8.14		1'849	
1.09	Helper for ditto	----	hr	227	4.48		1'018	
1.10	General services, skilled	----	hr	344	4.48		1'541	
1.11	General services, semiskilled	----	hr	688	2.26		1'555	
2	EQUIPMENT							
2.01	Bulldozer 231 kW, in loading area	O	hr	107	127.61		13'601	-
		R	hr	21	49.71		1'060	-
2.02	Hydraulic backhoe, 257 kW , 3.20 m³ heaped cap.	O	hr	385	71.29	40.56	27'452	15'619
		R	hr	77	16.70	27.61	1'286	2'126
2.03	Hydraulic backhoe, 382 kW, 5.80 m³ heaped c.	O	hr	569	106.81	80.15	60'761	45'595
		R	hr	114	34.34	56.99	3'907	6'484
2.04	Dumper, 37.3 ton pay load	O	hr	2'651	65.37	53.83	173'284	142'693
		R	hr	530	20.21	32.45	10'715	17'204
2.05	Dumper, 63.5 ton pay load	O	hr	2'336	100.64	80.60	235'058	188'252
		R	hr	467	33.71	50.86	15'747	23'758
2.06	Dumper, 90.9 ton pay load	O	hr	-	119.00	94.66	-	-
		R	hr	-	40.59	56.50	-	-
2.07	Bulldozer 149 kW in disposal area	O	hr	207	89.80		18'544	-
		R	hr	41	37.34		1'542	-
2.08	Mobile diesel powered floodlight, 10,000 W	O	hr	24	9.72		233	-
		R	hr	5	6.20		30	-
	O=Oprating units							
	R=Reserve units							
Sub-total				---->>			674'958	441'732
Construction Contingencies			%	5.00%	---->>		33'748	22'087
Total Direct Costs				---->>			708'706	463'818
Overhead and Profit			%	48.00%	---->>		562'812	
Unit price in Currency Portions			m³	**165'200**	---->>		**7.70**	**2.81**
AGGREGATE UNIT PRICE			m³	---->>				**10.50**

Part 6 - Fills and Backfills

RIO MADEIRA HYDROPOWER DEVELOP. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-1*
CIVIL WORKS COST ESTIMATE
ROCKFILL PLACED IN WATER - AUXILIARY COFFERDAMS 2, 3 & 5 (ROCK FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.02	Foreman	---	hr	242	11.81		2'860	
1.1.03	Equipment operator	---	hr	570	8.14		4'638	
1.1.04	Operator's helper	---	hr	570	4.48		2'553	
1.1.05	General services, skilled	---	hr	342	4.48		1'532	
1.1.06	General services, semiskilled	---	hr	456	2.26		1'030	
1.2	**Equipment**							
1.2.01	Bulldozer, 231 kW	O	hr	475	154.40		73'317	
		R	hr	95	60.10		5'708	
1.2.02	Portable diesel pow. floodlight, 10 k W	O	hr	190	9.72		1'846	
		R	hr	38	6.20		236	
Sub-total							93'719	
Construction Contingencies			%	2.50%	------------------------->>		2'343	
Total Direct Costs							96'062	
Overheads and Profit			%	48.00%	------------------------->>		46'110	
Unit Price in Currency Portions			**m3**	**94'970**	------------------------->>		**1.50**	
AGGREGATE UNIT PRICE			**m3**	--->>				**1.50**

RIO MADEIRA HYDROPOWER DEVELOP. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-2*

CIVIL WORKS COST ESTIMATE

ROCKFILL DUMPED INTO WATER - DAM COFFERDAMS (ROCK FROM STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.02	Foreman	---	hr	10'857	11.81		128'224	
1.1.03	Equipment operator	---	hr	31'021	8.14		252'507	
1.1.04	Operator's helper	---	hr	31'021	4.48		138'972	
1.1.05	General services, skilled	---	hr	12'408	4.48		55'589	
1.1.06	General services, semiskilled	---	hr	12'408	2.26		28'043	
1.2	**Equipment**							
1.2.01	Front shovel 390 kW, 5.7 m3 h. buchet	O	hr	6'801	87.17	82.58	592'832	561'616
		R	hr	1'360	30.38	48.38	41'322	65'805
1.2.02	Bulldozer 231 kW	O	hr	1'020	154.40		157'508	
		R	hr	204	60.10		12'262	
1.2.03	Rear duper, 63.5 ton pay load	O	hr	19'050	110.78	88.66	2'110'315	1'688'938
		R	hr	3'810	33.71	50.86	128'432	193'773
1.2.04	Rear duper, 90.9 ton pay load	O	hr	19'993	130.90	104.13	2'617'038	2'081'835
		R	hr	3'999	44.65	62.15	178'534	248'509
2	**PLACING**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	3'989	11.81		47'107	
2.1.02	Equipment operator	---	hr	9'385	8.14		76'396	
2.1.03	Operator's helper	---	hr	9'385	4.48		42'046	
2.1.04	General services, skilled	---	hr	5'631	4.48		25'227	
2.1.05	General services, semiskilled	---	hr	7'508	2.26		16'968	
2.2	**Equipment**							
2.2.01	Bulldozer, 231 kW	O	hr	7'821	154.40		1'207'562	
		R	hr	1'564	60.10		94'008	
2.2.02	Portable diesel pow. floodlight, 10 k W	O	hr	3'128	9.72		30'408	-
		R	hr	626	6.20		3'879	-
Sub-total							7'985'181	4'840'475
Construction Contingencies			%	3.00%	------------------------->>		239'555	145'214
Total Direct Costs							8'224'736	4'985'690
Overheads and Profit			%	48.00%	------------------------->>		6'341'004	
Unit Price in Currency Portions			**m3**	**3'128'400**	------------------------->>		**4.66**	**1.35**
AGGREGATE UNIT PRICE			**m3**	--->>				**6.01**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-3*
CIVIL WORKS COST ESTIMATE
COMPACTED ROCKFILL - DAM AND RELATED COFFERDAMS (MATERIAL FROM STOCKPILE)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	11'928	11.81		140'874	-
1.1.02	Equipment operator	---	hr	31'809	8.14		258'925	-
1.1.03	Operator's helper	---	hr	31'809	4.48		142'504	-
1.1.04	General services, skilled	---	hr	12'724	4.48		57'002	-
1.1.05	General services, semiskilled	---	hr	19'085	2.28		43'515	-
1.2	**Equipment**							
1.2.01	Front shovel 390 kW, 5.7 m3 h. buchet	O	hr	4'197	87.17	82.58	365'811	346'549
		R	hr	839	30.38	48.38	25'498	40'606
1.2.02	Bulldozer 231 kW	O	hr	629	154.40		97'191	-
		R	hr	126	60.10		7'566	-
1.2.03	Rear duper, 63.5 ton pay load	O	hr	11'755	110.78	88.66	1'302'184	1'042'170
		R	hr	2'351	33.71	50.86	79'250	119'569
1.2.04	Rear duper, 90.9 ton pay load	O	hr	12'337	130.90	104.13	1'614'861	1'284'610
		R	hr	2'467	44.65	62.15	110'166	153'344
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	1'679	9.72		16'316	-
		R	hr	336	6.20		2'081	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	7'007	11.81		82'757	
2.1.02	Equipment operator	---	hr	17'518	8.14		142'600	
2.1.03	Operator's helper	---	hr	17'518	4.48		78'482	
2.1.04	General services, skilled	---	hr	7'007	4.48		31'393	
2.1.05	General services, semiskilled	---	hr	14'015	2.26		31'673	
2.2	**Equipment**							
2.2.01	Bulldozer, 231 kW	O	hr	12'065	154.40		1'862'836	
		R	hr	3'016	60.10		181'277	
2.2.02	Smooth drum vibrating roller, 18600 kg	O	hr	3'861	56.71		218'946	
		R	hr	965	22.62		21'833	
2.2.03	Portable diesel pow. floodlight, 10 k W	O	hr	4'826	9.72		46'909	
		R	hr	1'207	6.20		7'480	
Sub-total -->>							6'969'931	2'986'847
Construction Contingencies			%	2.00%	----------------------->>		139'399	59'737
Total Direct Costs -->>							7'109'329	3'046'584
Overhead and Profit			%	48.00%	----------------------->>		4'874'839	
Unit Price in Currency Portions			**m^3**	**1'930'400**	**----------------------->>**		**6.21**	**1.58**
AGGREGATE UNIT PRICE			**m^3**	**--->>**				**7.79**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-4*

CIVIL WORKS COST ESTIMATE

COMPACTED CLAYFILL - COFFERDAMS AUXILIARY 1, 2, 3 & 4 (MATERIAL FROM RIGHT BANK BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	6'738	11.81		79'581	-
1.1.02	Equipment operator	---	hr	25'073	8.14		204'096	-
1.1.03	Operator's helper	---	hr	25'073	4.48		112'328	-
1.1.04	General services, skilled	---	hr	1'254	4.48		5'616	-
1.1.05	General services, semiskilled	---	hr	2'507	2.28		5'717	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	2'548	87.17	82.58	222'132	210'435
		R	hr	510	30.38	48.38	15'483	24'657
1.2.02	Bulldozer 231 kW	O	hr	3'781	127.61		482'530	-
		R	hr	756	49.71		37'594	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	6'945	65.37	53.83	454'008	373'860
		R	hr	1'389	20.21	32.45	28'073	45'074
1.2.04	Rear duper, 63.5 ton capacity	O	hr	9'519	100.64	80.60	958'005	767'242
		R	hr	1'904	33.71	50.86	64'178	96'829
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	1'513	9.72		14'702	-
		R	hr	303	6.20		1'876	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	5'667	11.81		66'926	
2.1.02	Equipment operator	---	hr	14'167	8.14		115'321	
2.1.03	Operator's helper	---	hr	14'167	4.48		63'469	
2.1.04	General services, skilled	---	hr	5'667	4.48		25'388	
2.1.05	General services, semiskilled	---	hr	11'334	2.26		25'614	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	5'582	89.80		501'255	
		R	hr	1'395	37.34		52'107	
2.2.02	Motorgrader, 138 kW	O	hr	2'494	66.09		164'831	
		R	hr	624	31.88		19'878	
2.2.03	Pad-foot drum vibrating roller, 11530 kg	O	hr	2'571	35.99		92'516	
		R	hr	643	16.21		10'417	
2.2.04	Truck mounted water tank, 20 m3 capaci	O	hr	3'868	58.51		226'332	
		R	hr	967	24.71		23'896	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	2'233	9.72		21'702	
		R	hr	558	6.20		3'461	
Sub-total ---------->>							4'099'034	1'518'097
Construction Contingencies			%	1.50%	---------->>		61'486	22'771
Total Direct Costs ---------->>							4'160'519	1'540'869
Overhead and Profit			%	48.00%	---------->>		2'736'666	
Unit Price in Currency Portions			**m^3**	**1'172'200**	**---------->>**		**5.88**	**1.31**
AGGREGATE UNIT PRICE			**m^3**	**---------->>**				**7.20**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-5*
CIVIL WORKS COST ESTIMATE
COMPACTED CLAYFILL - COFFERDAMS AUXILIARY 5, 6 & 7 (MATERIAL FROM LEFT BANK BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	4'568	11.81		53'947	-
1.1.02	Equipment operator	---	hr	16'997	8.14		138'354	-
1.1.03	Operator's helper	---	hr	16'997	4.48		76'146	-
1.1.04	General services, skilled	---	hr	850	4.48		3'807	-
1.1.05	General services, semiskilled	---	hr	1'700	2.28		3'875	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	1'657	87.17	82.58	144'443	136'837
		R	hr	331	30.38	48.38	10'068	16'033
1.2.02	Bulldozer 231 kW	O	hr	2'459	127.61		313'768	-
		R	hr	492	49.71		24'445	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	4'782	65.37	53.83	312'587	257'405
		R	hr	956	20.21	32.45	19'328	31'034
1.2.04	Rear duper, 63.5 ton capacity	O	hr	6'554	100.64	80.60	659'592	528'251
		R	hr	1'311	33.71	50.86	44'187	66'667
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	984	9.72		9'560	-
		R	hr	197	6.20		1'220	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	3'685	11.81		43'519	
2.1.02	Equipment operator	---	hr	9'212	8.14		74'988	
2.1.03	Operator's helper	---	hr	9'212	4.48		41'271	
2.1.04	General services, skilled	---	hr	3'685	4.48		16'509	
2.1.05	General services, semiskilled	---	hr	7'370	2.26		16'656	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	3'630	89.80		325'944	
		R	hr	907	37.34		33'883	
2.2.02	Motorgrader, 138 kW	O	hr	1'622	66.09		107'183	
		R	hr	405	31.88		12'925	
2.2.03	Pad-foot drum vibrating roller, 11530 kg	O	hr	1'672	35.99		60'159	
		R	hr	418	16.21		6'774	
2.2.04	Truck mounted water tank, 20 m3 capaci	O	hr	2'515	58.51		147'174	
		R	hr	629	24.71		15'539	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'452	9.72		14'112	
		R	hr	363	6.20		2'250	
Sub-total ---->>							2'734'213	1'036'227
Construction Contingencies			%	1.50%	---->>		41'013	15'543
Total Direct Costs ---->>							2'775'227	1'051'771
Overhead and Profit			%	48.00%	---->>		1'836'959	
Unit Price in Currency Portions			m^3	**762'230**	---->>		**6.05**	**1.38**
AGGREGATE UNIT PRICE			m^3	---->>				**7.43**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-6*

CIVIL WORKS COST ESTIMATE

COMPACTED CLAYFILL - COFFERDAMS AUXILIARY 8, 9, 10 & 11 (MATERIAL FROM LEFT BANK BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	6'174	11.81		72'914	-
1.1.02	Equipment operator	---	hr	22'973	8.14		186'999	-
1.1.03	Operator's helper	---	hr	22'973	4.48		102'918	-
1.1.04	General services, skilled	---	hr	1'149	4.48		5'146	-
1.1.05	General services, semiskilled	---	hr	2'297	2.28		5'238	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	2'097	87.17	82.58	182'811	173'185
		R	hr	419	30.38	48.38	12'742	20'292
1.2.02	Bulldozer 231 kW	O	hr	3'112	127.61		397'114	-
		R	hr	622	49.71		30'939	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	6'612	65.37	53.83	432'251	355'944
		R	hr	1'322	20.21	32.45	26'727	42'914
1.2.04	Rear duper, 63.5 ton capacity	O	hr	9'063	100.64	80.60	912'095	730'474
		R	hr	1'813	33.71	50.86	61'102	92'188
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	1'245	9.72		12'099	-
		R	hr	249	6.20		1'544	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	4'664	11.81		55'079	
2.1.02	Equipment operator	---	hr	11'659	8.14		94'908	
2.1.03	Operator's helper	---	hr	11'659	4.48		52'234	
2.1.04	General services, skilled	---	hr	4'664	4.48		20'894	
2.1.05	General services, semiskilled	---	hr	9'328	2.26		21'080	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	4'594	89.80		412'524	
		R	hr	1'148	37.34		42'883	
2.2.02	Motorgrader, 138 kW	O	hr	2'053	66.09		135'653	
		R	hr	513	31.88		16'359	
2.2.03	Pad-foot drum vibrating roller, 11530 kg	O	hr	2'116	35.99		76'139	
		R	hr	529	16.21		8'573	
2.2.04	Truck mounted water tank, 20 m3 capaci	O	hr	3'184	58.51		186'267	
		R	hr	796	24.71		19'666	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'838	9.72		17'861	
		R	hr	459	6.20		2'848	
Sub-total ----->>							3'605'609	1'414'997
Construction Contingencies			%	1.50%	------>>		54'084	21'225
Total Direct Costs ----->>							3'659'693	1'436'222
Overhead and Profit			%	48.00%	------>>		2'446'039	
Unit Price in Currency Portions			m^3	**964'700**	------>>		**6.33**	**1.49**
AGGREGATE UNIT PRICE			m^3	------>>				**7.82**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-7*
CIVIL WORKS COST ESTIMATE
CLAYFILL PLACED IN WATER - COFFERDAMS AUXILIARY 2, 3 & 5 (MAT. FROM RIGHT & LEFT BORROW AREAS)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	2'736	11.81		32'316	-
1.1.02	Equipment operator	---	hr	10'182	8.14		82'880	-
1.1.03	Operator's helper	---	hr	10'182	4.48		45'614	-
1.1.04	General services, skilled	---	hr	509	4.48		2'281	-
1.1.05	General services, semiskilled	---	hr	1'018	2.28		2'321	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	776	87.17	82.58	67'661	64'098
		R	hr	155	30.38	48.38	4'716	7'510
1.2.02	Bulldozer 231 kW	O	hr	1'152	127.61		146'978	-
		R	hr	230	49.71		11'451	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	7'328	65.37	53.83	479'044	394'477
		R	hr	1'466	20.21	32.45	29'621	47'560
1.2.04	Rear duper, 63.5 ton capacity	O	hr		100.64	80.60	-	-
		R	hr		33.71	50.86	-	-
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	461	9.72		4'478	-
		R	hr	92	6.20		571	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	1'657	11.81		19'565	
2.1.02	Equipment operator	---	hr	4'142	8.14		33'712	
2.1.03	Operator's helper	---	hr	4'142	4.48		18'554	
2.1.04	General services, skilled	---	hr	1'657	4.48		7'422	
2.1.05	General services, semiskilled	---	hr	3'313	2.26		7'488	
2.2	**Equipment**							
2.2.01	Bulldozer 149 kW	O	hr	952	89.80		85'502	
		R	hr	190	37.34		7'111	
2.2.02	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	1'242	71.29		88'536	
		R	hr	248	16.70		4'148	
2.2.03	Crawler crane 100 t capacity	O	hr	1'190	193.47		230'262	
		R	hr	238	134.76		32'077	
2.2.04	Orange peel bucket, 2.50 m3 capacity	O	hr	1'190	9.09		10'819	
		R	hr	238	8.28		1'971	
2.2.05	Portable diesel p. floodlight, 10000 W	O	hr	381	9.72		3'702	-
		R	hr	76	6.20		472	
								-
Sub-total ------------------------------>>							1'461'272	513'645
Construction Contingencies			%	1.50%	---------------->>		21'919	7'705
Total Direct Costs ------------------------------>>							1'483'191	521'350
Overhead and Profit			%	48.00%	---------------->>		962'180	
Unit Price in Currency Portions			**m^3**	**357'050**	**---------------->>**		**6.85**	**1.46**
AGGREGATE UNIT PRICE			**m^3**	**---------------------------->>**				**8.31**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-8*
CIVIL WORKS COST ESTIMATE
COMPACTED CLAYFILL - DAM AND RELATED COFFERDAMS (MATERIAL FROM RIGHT BANK BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	4'001	11.81		47'253	-
1.1.02	Equipment operator	---	hr	14'888	8.14		121'186	-
1.1.03	Operator's helper	---	hr	14'888	4.48		66'697	-
1.1.04	General services, skilled	---	hr	744	4.48		3'335	-
1.1.05	General services, semiskilled	---	hr	1'489	2.28		3'394	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	1'291	87.17	82.58	112'544	106'618
		R	hr	258	30.38	48.38	7'845	12'493
1.2.02	Bulldozer 231 kW	O	hr	1'916	127.61		244'476	-
		R	hr	383	49.71		19'047	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	3'083	65.37	53.83	201'546	165'966
		R	hr	617	20.21	32.45	12'462	20'010
1.2.04	Rear duper, 63.5 ton capacity	O	hr	7'244	100.64	80.60	729'056	583'882
		R	hr	1'449	33.71	50.86	48'840	73'688
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	766	9.72		7'449	-
		R	hr	153	6.20		950	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	2'871	11.81		33'908	
2.1.02	Equipment operator	---	hr	7'178	8.14		58'428	
2.1.03	Operator's helper	---	hr	7'178	4.48		32'157	
2.1.04	General services, skilled	---	hr	2'871	4.48		12'863	
2.1.05	General services, semiskilled	---	hr	5'742	2.26		12'978	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	2'828	89.80		253'963	
		R	hr	707	37.34		26'400	
2.2.02	Motorgrader, 138 kW	O	hr	1'264	66.09		83'512	
		R	hr	316	31.88		10'071	
2.2.03	Pad-foot drum vibrating roller, 11530 kg	O	hr	1'302	35.99		46'874	
		R	hr	326	16.21		5'278	
2.2.04	Truck mounted water tank, 20 m3 capac.	O	hr	1'960	58.51		114'672	
		R	hr	490	24.71		12'107	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'131	9.72		10'996	
		R	hr	283	6.20		1'753	
Sub-total --->>							2'342'040	962'657
Construction Contingencies			%	2.00%	--->>		46'841	19'253
Total Direct Costs --->>							2'388'880	981'910
Overhead and Profit			%	48.00%	--->>		1'617'979	
Unit Price in Currency Portions			**m^3**	**593'900**	**--->>**		**6.75**	**1.65**
AGGREGATE UNIT PRICE			**m^3**	**--->>**				**8.40**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-9*
CIVIL WORKS COST ESTIMATE
CLAYFILL PLACED IN WATER - DAM AND RELATED COFFERDAMS (MAT. FROM RIGHT BANK BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	13'787	11.81		162'826	-
1.1.02	Equipment operator	---	hr	51'301	8.14		417'589	-
1.1.03	Operator's helper	---	hr	51'301	4.48		229'828	-
1.1.04	General services, skilled	---	hr	2'565	4.48		11'491	-
1.1.05	General services, semiskilled	---	hr	5'130	2.28		11'697	-
1.2	**Equipment**							
1.2.01	Wheel loader 354 kW, 6.60 m3 h. buchet	O	hr	5'005	87.17	82.58	436'305	413'331
		R	hr	1'001	30.38	48.38	30'412	48'430
1.2.02	Bulldozer 231 kW	O	hr	7'427	127.61		947'772	-
		R	hr	1'485	49.71		73'840	-
1.2.03	Rear duper, 63.5 ton capacity	O	hr	6'841	100.64	80.60	688'474	551'381
		R	hr	1'368	33.71	50.86	46'122	69'586
1.2.04	Rear duper, 90.9 ton capacity	O	hr	27'364	119.00	94.66	3'256'295	2'590'260
		R	hr	5'473	40.59	56.50	222'140	309'211
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	2'971	9.72		28'877	-
		R	hr	594	6.20		3'684	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	4'234	11.81		50'004	
2.1.02	Equipment operator	---	hr	10'585	8.14		86'163	
2.1.03	Operator's helper	---	hr	10'585	4.48		47'421	
2.1.04	General services, skilled	---	hr	4'234	4.48		18'969	
2.1.05	General services, semiskilled	---	hr	8'468	2.26		19'138	
2.2	**Equipment**							
2.2.01	Bulldozer 149 kW	O	hr	767	89.80		68'919	
		R	hr	153	37.34		5'731	
2.2.02	Hydraulic backhoe 382 kW , 5.8 m3 b.	O	hr	2'214	128.92	65.55	285'409	145'118
		R	hr	31	31.06	44.69	965	1'388
2.2.03	Crawler crane 100 t capacity with bucket	O	hr	5'756	193.47		1'113'613	
		R	hr	1'151	134.76		155'136	
2.2.04	Orange peel bucket, 2.50 m3 capacity	O	hr	5'756	9.09		52'322	
		R	hr	1'151	8.28		9'532	
2.2.05	Portable diesel p. floodlight, 10000 W	O	hr	886	9.72		8'607	
		R	hr	177	6.20		1'098	
Sub-total -->>							8'490'376	4'128'705
Construction Contingencies			%	5.00%	------------------------>>		424'519	206'435
Total Direct Costs -->>							8'914'895	4'335'141
Overhead and Profit			%	48.00%	------------------------>>		6'360'017	
Unit Price in Currency Portions			m^3	**2'302'400**	**------------------------>>**		**6.63**	**1.88**
AGGREGATE UNIT PRICE			m^3	-->>				**8.52**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-10*
CIVIL WORKS COST ESTIMATE
PROCESSING OF ROCK FOR COARSE TRANSITIONS - ROCK FROM REQUIRED EXCAVATION

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**CRUSHING WITH MOBILE ROCK PLANT (SIZE 5 - 50 MM MATERIAL)**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	15'698	11.81		185'390	
1.1.02	Equipment operator	---	hr	29'900	8.14		243'389	
1.1.03	Operator's helper	---	hr	59'801	4.48		267'907	
1.1.04	General services, skilled	---	hr	17'940	4.48		80'372	
1.1.05	General services, semiskilled	---	hr	17'940	2.26		40'545	
1.2	**Equipment**							
1.2.01	Hydraulic front shovel 260 kW, 4.3 m3 h.b	O	hr	11'074	92.97	71.61	1'029'568	793'023
		R	hr	2'215	26.96	49.75	59'712	110'188
1.2.02	Crawled mobile crusher, 320 kW, 120 t/h	O	hr	13'843	78.48	46.37	1'086'379	641'888
		R	hr	2'769	21.91	36.79	60'659	101'855
Sub-total ---------->>							3'053'921	1'646'955
Miscellaneous works ---------->>			%	3.00%	---------->>		91'618	49'409
Processing waste: ---------->>			%	10.00%	---------->>		314'554	169'636
Unit Direct Cost in Currency Portions			**t**	**1'107'420**	**---------->>**		**3.12**	**0.15**
UNIT DIRECT COST OF CONCRETE AGGREGATE			**US$/t**	**---------->>**				**3.28**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-11*
CIVIL WORKS COST ESTIMATE
COMPACTED TRANSITION - AUXILIARY COFFERDAMS FRROM 1 TO 11 (MAT. FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.01	Processed granular material at the plant	---	t	943'614	3.12	0.15	2'944'076	141'542
2	**LOADING AND TRANSPORT**							
2.1	**Labour**							
2.1.02	Foreman	---	hr	3'590	11.81		42'403	
2.1.03	Equipment operator	---	hr	10'258	8.14		83'503	
2.1.04	Operator's helper	---	hr	10'258	4.48		45'957	
2.1.05	General services, skilled	---	hr	4'103	4.48		18'383	
2.1.06	General services, semiskilled	---	hr	4'103	2.26		9'274	
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	1'214	50.23	43.99	61'001	53'423
		R	hr	243	15.84	25.15	3'847	6'109
2.2.02	Rear duper, 37.3 ton pay load	O	hr	7'334	65.37	53.83	479'434	394'797
		R	hr	1'467	20.21	32.45	29'645	47'599
3	**PLACING**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	1'483	11.81		17'512	
2.1.02	Equipment operator	---	hr	3'707	8.14		30'175	
2.1.03	Operator's helper	---	hr	3'707	4.48		16'608	
2.1.04	General services, skilled	---	hr	1'483	4.48		6'643	
2.1.05	General services, semiskilled	---	hr	2'966	2.26		6'702	
3.2	**Equipment**							
3.2.01	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	2'247	71.29	40.56	160'167	91'126
		R	hr	449	16.70	27.61	7'504	12'406
3.2.02	S.th drum tandem vib. roller 10840 kg	O	hr	1'123	34.70		38'980	
		R	hr	225	15.24		3'424	
3.2.03	Portable diesel pow. floodlight, 10 k W	O	hr	899	9.72		8'735	
		R	hr	180	6.20		1'114	
Sub-total							4'015'087	747'002
Construction Contingencies			%	2.50%	------------------------>>		100'377	18'675
Total Direct Costs							4'115'464	765'677
Overheads and Profit			%	48.00%	------------------------>>		2'342'948	
Unit Price in Currency Portions			**m3**	**449'340**	**------------------------>>**		**14.37**	**1.45**
AGGREGATE UNIT PRICE			**m3**	**-->>**				**15.82**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-12*

CIVIL WORKS COST ESTIMATE

TRANSITION PLACED IN WATER - AUXILIARY COFFERDAMS 1 TO 11 (MAT. FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.01	Processed granular material at the plant	---	t	392'680	3.12	0.15	1'225'162	58'902
							-	-
2	**LOADING AND TRANSPORT**						-	-
							-	-
2.1	**Labour**						-	-
							-	-
2.1.02	Foreman	---	hr	1'569	11.81		18'528	-
2.1.03	Equipment operator	---	hr	4'482	8.14		36'487	-
2.1.04	Operator's helper	---	hr	4'482	4.48		20'081	-
2.1.05	General services, skilled	---	hr	1'793	4.48		8'032	-
2.1.06	General services, semiskilled	---	hr	1'793	2.26		4'052	-
							-	-
2.2	**Equipment**						-	-
							-	-
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	531	50.23	43.99	26'654	23'343
		R	hr	106	15.84	25.15	1'681	2'669
2.2.02	Rear duper, 37.3 ton pay load	O	hr	3'205	65.37	53.83	209'489	172'508
		R	hr	641	20.21	32.45	12'953	20'798
3	**PLACING**						-	-
							-	-
3.1	**Labour**						-	-
							-	-
3.1.01	Foreman	---	hr	605	11.81		7'142	-
2.1.02	Equipment operator	---	hr	1'512	8.14		12'306	-
2.1.03	Operator's helper	---	hr	1'512	4.48		6'773	-
2.1.04	General services, skilled	---	hr	605	4.48		2'709	-
2.1.05	General services, semiskilled	---	hr	1'209	2.26		2'733	-
							-	-
3.2	**Equipment**						-	-
							-	-
3.2.01	Bulldozer 149 kW	O	hr	131	89.80		11'754	-
		R	hr	26	37.34		978	-
3.2.02	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	589	71.29	40.56	41'991	23'891
		R	hr	118	16.70	27.61	1'967	3'253
3.2.03	Crawler crane 100 t capacity	O	hr	654	193.47		126'620	-
		R	hr	131	134.76		17'639	-
3.2.04	Orange peel bucket, 2.50 m3 capacity	O	hr	654	9.09		5'949	-
		R	hr	131	8.28		1'084	-
3.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	236	9.72		2'290	-
		R	hr	47	6.20		292	-
							-	-
							-	-
Sub-total							1'805'348	305'363
Construction Contingencies			%	2.50%	------------------------>>		45'134	7'634
Total Direct Costs							1'850'482	312'998
Overheads and Profit			%	48.00%	------------------------>>		1'038'470	-
Unit Price in Currency Portions			**m3**	**196'340**	**------------------------>>**		**14.71**	**1.36**
AGGREGATE UNIT PRICE			**m3**	**-->>**				**16.07**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-13*
CIVIL WORKS COST ESTIMATE
COMPACTED COARSE TRANSITION - DAM AND RELATED COFFERDAMS (MAT. FROM RIGHT BANK STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.01	Processed granular material at the plant	---	t	379'260	3.12	0.15	1'183'291	56'889
2	**LOADING AND TRANSPORT**							
2.1	**Labour**							
2.1.02	Foreman	---	hr	2'023	11.81		23'893	
2.1.03	Equipment operator	---	hr	5'780	8.14		47'053	
2.1.04	Operator's helper	---	hr	5'780	4.48		25'896	
2.1.05	General services, skilled	---	hr	2'312	4.48		10'359	
2.1.06	General services, semiskilled	---	hr	2'312	2.26		5'226	
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	488	50.23	43.99	24'518	21'472
		R	hr	98	15.84	25.15	1'546	2'455
2.2.02	Rear duper, 37.3 ton pay load	O	hr	4'329	65.37	53.83	282'982	233'026
		R	hr	866	20.21	32.45	17'498	28'095
3	**PLACING**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	511	11.81		6'039	
2.1.02	Equipment operator	---	hr	1'278	8.14		10'407	
2.1.03	Operator's helper	---	hr	1'278	4.48		5'727	
2.1.04	General services, skilled	---	hr	511	4.48		2'291	
2.1.05	General services, semiskilled	---	hr	1'023	2.26		2'311	
3.2	**Equipment**							
3.2.01	Hydraulic backhoe 257 kW , 3.2 m3 b.	O	hr	547	71.29	40.56	39'015	22'197
		R	hr	109	16.70	27.61	1'828	3'022
3.2.02	Smooth drum vibrating roller, 10 840 kg	O	hr	396	34.70		13'743	
		R	hr	99	15.24		1'509	
3.2.03	Portable diesel pow. floodlight, 10 k W	O	hr	219	9.72		2'128	
		R	hr	44	6.20		271	
Sub-total							1'707'532	367'156
Construction Contingencies			%	1.50%	------------------------>>		25'613	5'507
Total Direct Costs							1'733'145	372'664
Overheads and Profit			%	48.00%	------------------------>>		1'010'788	
Unit Price in Currency Portions			**m3**	**180'600**	**------------------------>>**		**15.19**	**1.75**
AGGREGATE UNIT PRICE			**m3**	**-->>**				**16.95**

RIO MADEIRA HYDROPOWER DEV. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-14*
CIVIL WORKS COST ESTIMATE
COARSE TRANSITION PLACED IN WATER- DAM COFFERDAMS (MATERIAL FROM RIGHT BANK STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**MATERIAL**							
1.01	Processed granular material at the plant	---	t	495'800	3.12	0.15	1'546'896	74'370
2	**LOADING AND TRANSPORT**							
2.1	**Labour**							
2.1.02	Foreman	---	hr		11.81			
2.1.03	Equipment operator	---	hr		8.14			
2.1.04	Operator's helper	---	hr		4.48			
2.1.05	General services, skilled	---	hr		4.48			
2.1.06	General services, semiskilled	---	hr		2.26			
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr		50.23	43.99		
		R	hr		15.84	25.15		
2.2.02	Rear duper, 37.3 ton pay load	O	hr		65.37	53.83		
		R	hr		20.21	32.45		
3	**PLACING**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	690	11.81		8'149	
2.1.02	Equipment operator	---	hr	1'725	8.14		14'042	
2.1.03	Operator's helper	---	hr	1'725	4.48		7'728	
2.1.04	General services, skilled	---	hr	690	4.48		3'091	
2.1.05	General services, semiskilled	---	hr	1'380	2.26		3'119	
3.2	**Equipment**							
3.2.01	Bulldozer 149 kW	O	hr	99	89.80		8'905	
		R	hr	20	37.34		741	
3.2.02	Hydraulic backhoe 382 kW , 5.8 m3 b.	O	hr	643	128.92	65.55	82'857	42'129
		R	hr	31	31.06	44.69	965	1'388
3.2.03	Crawler crane 100 t capacity	O	hr	826	193.47		159'871	
		R	hr	165	134.76		22'271	
3.2.04	Orange peel bucket, 2.50 m3 capacity	O	hr	826	9.09		7'511	
		R	hr	165	8.28		1'368	
3.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	331	9.72		3'213	
		R	hr	66	6.20		410	
Sub-total							1'871'136	117'887
Construction Contingencies			%	3.50%	------------------------>>		65'490	4'126
Total Direct Costs							1'936'626	122'013
Overheads and Profit			%	48.00%	------------------------>>		988'147	
Unit Price in Currency Portions			**m3**	**247'900**	**------------------------>>**		**11.80**	**0.42**
AGGREGATE UNIT PRICE			**m3**	**-->>**				**12.22**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-15*
CIVIL WORKS COST ESTIMATE
COMPACTED FINE TRANSITION - DAM (STOCKPILED MATERIAL FROM BORROW AREA)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING & TRANSPORT TO STOCK**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	644	11.81		7'605	-
1.1.02	Equipment operator	---	hr	1'717	8.14		13'977	-
1.1.03	Operator's helper	---	hr	1'717	4.48		7'693	-
1.1.04	General services, skilled	---	hr	687	4.48		3'077	-
1.1.05	General services, semiskilled	---	hr	1'030	2.28		2'349	-
1.2	**Equipment**							
1.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	214	50.23	43.99	10'764	9'426
		R	hr	43	15.84	25.15	679	1'078
1.2.02	Rear duper, 37.3 ton capacity	O	hr	1'347	65.37	53.83	88'034	72'493
		R	hr	269	20.21	32.45	5'443	8'740
1.2.03	Portable diesel p. floodlight, 10000 W	O	hr	86	9.72		833	-
		R	hr	17	6.20		106	-
2	**LOADING & TRANSPORT TO DAM**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	692	11.81		8'175	-
2.1.02	Equipment operator	---	hr	1'846	8.14		15'026	-
2.1.03	Operator's helper	---	hr	1'846	4.48		8'270	-
2.1.04	General services, skilled	---	hr	738	4.48		3'308	-
2.1.05	General services, semiskilled	---	hr	1'108	2.28		2'525	-
2.2	**Equipment**							
2.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	214	50.23	43.99	10'764	9'426
		R	hr	43	15.84	25.15	679	1'078
2.2.02	Rear duper, 37.3 ton capacity	O	hr	1'464	65.37	53.83	95'689	78'797
		R	hr	293	20.21	32.45	5'917	9'500
2.2.03	Portable diesel p. floodlight, 10000 W	O	hr	86	9.72		833	-
		R	hr	17	6.20		106	-
3	**PLACING AND COMPACTION**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	275	11.81		3'253	
3.1.02	Equipment operator	---	hr	689	8.14		5'606	
3.1.03	Operator's helper	---	hr	689	4.48		3'085	
3.1.04	General services, skilled	---	hr	275	4.48		1'234	
3.1.05	General services, semiskilled	---	hr	551	2.26		1'245	
3.2	**Equipment**							
3.2.01	Bulldozer, 149 kW	O	hr	315	89.80		28'287	
		R	hr	79	37.34		2'941	
3.2.02	Motorgrader, 138 kW	O	hr	153	66.09		10'124	
		R	hr	38	31.88		1'221	
3.2.03	Smooth drum vibrating roller, 10 840 kg	O	hr	158	34.70		5'479	
		R	hr	39	15.24		602	
3.2.04	Portable diesel pow. floodlight, 10 k W	O	hr	126	9.72		1'225	
		R	hr	32	6.20		195	
Sub-total ---------->>							356'348	190'538
Construction Contingencies			%	1.50%	---------->>		5'345	2'858
Total Direct Costs ---------->>							361'693	193'397
Overhead and Profit			%	48.00%	---------->>		266'443	
Unit Price in Currency Portions			**m³**	**72'000**	**---------->>**		**8.72**	**2.69**
AGGREGATE UNIT PRICE			**m³**	**---------->>**				**11.41**

RIO MADEIRA HYDROPOWER DEVELOP. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-16*
CIVIL WORKS COST ESTIMATE
RIP-RAP - AUXILIARY COFFERDAMS FROM 1 TO 11 (ROCK FROM STOCKPILE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.02	Foreman	---	hr	3'818	11.81		45'087	
1.1.03	Equipment operator	---	hr	10'908	8.14		88'788	
1.1.04	Operator's helper	---	hr	10'908	4.48		48'866	
1.1.05	General services, skilled	---	hr	4'363	4.48		19'546	
1.1.06	General services, semiskilled	---	hr	4'363	2.26		9'861	
1.2	**Equipment**							
1.2.01	Wheel loader, 161 kW with rock grapple	O	hr	5'973	66.49		397'167	
		R	hr	1'195	32.52		38'851	
1.2.02	Rear duper, 37.3 ton pay load	O	hr	3'116	71.90	59.21	224'067	184'520
		R	hr	623	22.73	35.69	14'167	22'245
1.2.03	Rear duper, 63.5 ton pay load	O	hr	4'785	110.78	88.66	530'073	424'230
		R	hr	957	37.08	35.95	35'485	34'404
2	**PLACING**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	1'357	11.81		16'028	
2.1.02	Equipment operator	---	hr	3'193	8.14		25'994	
2.1.03	Operator's helper	---	hr	3'193	4.48		14'306	
2.1.04	General services, skilled	---	hr	1'916	4.48		8'584	
2.1.05	General services, semiskilled	---	hr	2'555	2.26		5'774	
2.2	**Equipment**							
2.2.01	Hydraulic backhoe 200 kW , 2.55 m3 h.	O	hr	2'688	91.71		246'516	
		R	hr	538	38.51		20'703	
2.2.02	Crawler crane 100 t capacity	O	hr	215	193.47		41'604	
		R	hr	43	134.76		5'796	
2.2.03	Rock grapple, 1.70 m opening	O	hr	215	3.32		714	
		R	hr	43	2.82		121	
2.2.04	Portable diesel pow. floodlight, 10 k W	O	hr	1'161	9.72		11'287	
		R	hr	232	6.20		1'440	
Sub-total							1'850'823	665'398
Construction Contingencies			%	2.50%	------------------------->>		46'271	16'635
Total Direct Costs							1'897'094	682'033
Overheads and Profit			%	48.00%	------------------------->>		1'176'082	61'899
Unit Price in Currency Portions			**m3**	**215'040**	------------------------->>		**14.29**	**2.94**
AGGREGATE UNIT PRICE			**m3**	--->>				**17.23**

RIO MADEIRA HYDROPOWER DEVELOP. - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-17*
CIVIL WORKS COST ESTIMATE
RIP-RAP - AUXILIARY COFFERDAMS FROM 1 TO 11 (ROCK FROM REQUIRED EXCAVATION)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**SELECTION OF ROCK FRAGMENTS**							
	LOADING AND TRANSPORT							
1.1	**Labour**							
1.1.02	Foreman	---	hr	3'549	11.81		41'914	
1.1.03	Equipment operator	---	hr	10'140	8.14		82'541	
1.1.04	Operator's helper	---	hr	10'140	4.48		45'428	
1.1.05	General services, skilled	---	hr	4'056	4.48		18'171	
1.1.06	General services, semiskilled	---	hr	4'056	2.26		9'167	
1.2	**Equipment**							
1.2.01	Wheel loader, 161 kW with rock grapple	O	hr	5'973	66.49		397'167	
		R	hr	1'195	32.52		38'851	
1.2.02	Rear duper, 37.3 ton pay load	O	hr	2'477	71.90	59.21	178'083	146'652
		R	hr	495	22.73	35.69	11'260	17'680
1.2.03	Rear duper, 63.5 ton pay load	O	hr	3'908	110.78	88.66	432'967	346'514
		R	hr	782	37.08	35.95	28'984	28'101
2	**PLACING**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	1'564	11.81		18'469	
2.1.02	Equipment operator	---	hr	3'680	8.14		29'952	
2.1.03	Operator's helper	---	hr	3'680	4.48		16'484	
2.1.04	General services, skilled	---	hr	2'208	4.48		9'891	
2.1.05	General services, semiskilled	---	hr	2'944	2.26		6'653	
2.2	**Equipment**							
2.2.01	Hydraulic backhoe 200 kW , 2.55 m3 h.	O	hr	2'389	91.71		219'126	
		R	hr	478	38.51		18'403	
2.2.02	Crawler crane 100 t capacity	O	hr	956	193.47		184'906	
		R	hr	191	134.76		25'759	
2.2.03	Rock grapple, 1.70 m opening	O	hr	956	3.32		3'173	
		R	hr	191	2.82		539	
2.2.04	Portable diesel pow. floodlight, 10 k W	O	hr	1'338	9.72		13'006	
		R	hr	268	6.20		1'659	
Sub-total							1'832'551	538'947
Construction Contingencies			%	2.50%	------------------------->>		45'814	13'474
Total Direct Costs							1'878'365	552'421
Overheads and Profit			%	48.00%	------------------------->>		1'166'777	
Unit Price in Currency Portions			**m3**	**215'040**	------------------------->>		**14.16**	**2.18**
AGGREGATE UNIT PRICE			**m3**	-->>				**16.34**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-18*
CIVIL WORKS COST ESTIMATE
COMPACTED RANDOM FILL & BACKFILL - POWERHOUSE TAILRACE CHANNEL (MATERIAL FROM EXCAVATION)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**PLACING AND COMPACTION**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	4'198	11.81		49'578	
1.1.02	Equipment operator	---	hr	10'495	8.14		85'429	
1.1.03	Operator's helper	---	hr	10'495	4.48		47'017	
1.1.04	General services, skilled	---	hr	4'198	4.48		18'807	
1.1.05	General services, semiskilled	---	hr	8'396	2.26		18'975	
1.2	**Equipment**							
1.2.01	Bulldozer, 149 kW	O	hr	4'460	89.80		400'473	
		R	hr	1'115	37.34		41'630	
1.2.02	Motorgrader, 138 kW	O	hr	2'169	66.09		143'337	
		R	hr	542	31.88		17'285	
1.2.03	Smooth drum vibrating roller, 10 840 kg	O	hr	2'912	34.70		101'060	
		R	hr	728	15.24		11'096	
1.2.04	Truck mounted water tank, 20 m3 capac.	O	hr	3'364	58.51		114'672	
		R	hr	673	24.71		12'107	
1.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'784	9.72		17'339	
		R	hr	357	6.20		2'212	
Sub-total ----->>							1'081'017	
Construction Contingencies			%	1.50%	----->>		16'215	
Total Direct Costs ----->>							1'097'233	
Overhead and Profit			%	48.00%	----->>		526'672	
Unit Price in Currency Portions			**m^3**	**1'019'340**	**----->>**		**1.59**	
AGGREGATE UNIT PRICE			**m^3**	**----->>**				**1.59**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-19*

CIVIL WORKS COST ESTIMATE

COMPACTED RANDOM BACKFILL - POWERHOUSE ERECTION-UNLOADING AREAS (MATERIAL FROM STOCK.)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	7'166	11.81		84'635	-
1.1.02	Equipment operator	---	hr	19'110	8.14		155'557	-
1.1.03	Operator's helper	---	hr	19'110	4.48		85'614	-
1.1.04	General services, skilled	---	hr	7'644	4.48		34'246	-
1.1.05	General services, semiskilled	---	hr	11'466	2.28		26'143	-
1.2	**Equipment**							
1.2.01	Front shovel 390 kW, 5.7 m3 h. buchet	O	hr	2'283	87.17	82.58	198'975	188'498
		R	hr	457	30.38	48.38	13'869	22'087
1.2.02	Bulldozer 231 kW	O	hr	342	127.61		43'693	-
		R	hr	68	49.71		3'404	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	6'221	65.37	53.83	406'679	334'886
		R	hr	1'244	20.21	32.45	25'146	40'375
1.2.04	Rear duper, 63.5 ton capacity	O	hr	8'527	100.64	80.60	858'134	687'258
		R	hr	1'705	33.71	50.86	57'487	86'734
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	913	9.72		8'875	-
		R	hr	183	6.20		1'132	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	4'324	11.81		51'069	
2.1.02	Equipment operator	---	hr	10'811	8.14		87'998	
2.1.03	Operator's helper	---	hr	10'811	4.48		48'431	
2.1.04	General services, skilled	---	hr	4'324	4.48		19'373	
2.1.05	General services, semiskilled	---	hr	8'648	2.26		19'546	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	4'594	89.80		412'519	
		R	hr	1'148	37.34		42'883	
2.2.02	Motorgrader, 138 kW	O	hr	2'234	66.09		147'648	
		R	hr	559	31.88		17'805	
2.2.03	Smooth drum vibrating roller, 10 840 kg	O	hr	3'000	34.70		104'100	
		R	hr	750	15.24		11'430	
2.2.04	Truck mounted water tank, 20 m3 capac.	O	hr	3'465	58.51		114'672	
		R	hr	693	24.71		12'107	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'838	9.72		17'861	
		R	hr	459	6.20		2'848	
Sub-total -->>							3'113'877	1'359'838
Construction Contingencies			%	1.50%	------------------------>>		46'708	20'398
Total Direct Costs -->>							3'160'585	1'380'236
Overhead and Profit			%	48.00%	------------------------>>		2'179'594	
Unit Price in Currency Portions			**m^3**	**1'050'000**	**------------------------>>**		**5.09**	**1.31**
AGGREGATE UNIT PRICE			**m^3**	**-->>**				**6.40**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 6-20*

CIVIL WORKS COST ESTIMATE

COMPACTED RANDOM BACKFILL - SPILLWAY RIGHT HAND SIDE LATERAL WALL (MATERIAL FROM STOCK.)

N°	DESCRIPTION		UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	4'670	11.81		55'150	-
1.1.02	Equipment operator	---	hr	12'453	8.14		101'365	-
1.1.03	Operator's helper	---	hr	12'453	4.48		55'788	-
1.1.04	General services, skilled	---	hr	4'981	4.48		22'315	-
1.1.05	General services, semiskilled	---	hr	7'472	2.28		17'035	-
1.2	**Equipment**							
1.2.01	Front shovel 390 kW, 5.7 m3 h. buchet	O	hr	1'313	87.17	82.58	114'420	108'395
		R	hr	263	30.38	48.38	7'975	12'701
1.2.02	Bulldozer 231 kW	O	hr	197	127.61		25'125	-
		R	hr	39	49.71		1'957	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	4'139	65.37	53.83	270'543	222'783
		R	hr	828	20.21	32.45	16'728	26'860
1.2.04	Rear duper, 63.5 ton capacity	O	hr	5'672	100.64	80.60	570'875	457'199
		R	hr	1'134	33.71	50.86	38'244	57'700
1.2.05	Portable diesel p. floodlight, 10000 W	O	hr	525	9.72		5'103	-
		R	hr	105	6.20		651	-
2	**PLACING AND COMPACTION**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	2'487	11.81		29'367	
2.1.02	Equipment operator	---	hr	6'217	8.14		50'603	
2.1.03	Operator's helper	---	hr	6'217	4.48		27'850	
2.1.04	General services, skilled	---	hr	2'487	4.48		11'140	
2.1.05	General services, semiskilled	---	hr	4'973	2.26		11'240	
2.2	**Equipment**							
2.2.01	Bulldozer, 149 kW	O	hr	2'642	89.80		237'218	
		R	hr	660	37.34		24'660	
2.2.02	Motorgrader, 138 kW	O	hr	1'285	66.09		84'905	
		R	hr	321	31.88		10'239	
2.2.03	Smooth drum vibrating roller, 10 840 kg	O	hr	1'725	34.70		59'862	
		R	hr	431	15.24		6'573	
2.2.04	Truck mounted water tank, 20 m3 capac.	O	hr	1'993	58.51		114'672	
		R	hr	399	24.71		12'107	
2.2.05	Portable diesel pow. floodlight, 10 k W	O	hr	1'057	9.72		10'271	
		R	hr	264	6.20		1'638	
Sub-total ---------->>							1'995'620	885'638
Construction Contingencies			%	1.50%	---------->>		29'934	13'285
Total Direct Costs ---------->>							2'025'554	898'923
Overhead and Profit			%	48.00%	---------->>		1'403'749	
Unit Price in Currency Portions			m^3	**603'800**	---------->>		**5.68**	**1.49**
AGGREGATE UNIT PRICE			m^3	---------->>				**7.17**

Part 7 - Concrete Aggregates

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-1*
CIVIL WORKS COST ESTIMATE
SAND FROM RIGHT BANK BORROW AREA TO BE MIXED WITH SAND OF AGGREGATE PROCESSING PLANT

N°	DESCRIPTION	AUX	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	1'841	11.81		21'737	-
1.1.02	Equipment operator	---	hr	4'908	8.14		39'953	-
1.1.03	Operator's helper	---	hr	4'908	4.48		21'989	-
1.1.04	General services, skilled	---	hr	1'963	4.48		8'796	-
1.1.05	General services, semiskilled	---	hr	2'945	2.28		6'714	-
1.2	**Equipment**							
1.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	492	50.23	43.99	24'692	21'625
		R	hr	98	15.84	25.15	1'557	2'473
1.2.02	Rear duper, 37.3 ton capacity	O	hr	3'774	65.37	53.83	246'693	203'143
		R	hr	755	20.21	32.45	15'254	24'492
1.2.03	Portable diesel p. floodlight, 10000 W	O	hr	197	9.72		1'911	-
		R	hr	39	6.20		244	-
Sub-total ---------->>							389'540	251'733
Construction Contingencies			%		---------->>			
Total Direct Costs ---------->>							389'540	251'733
Unit Direct Cost in Currency Portions			**t**	**338'601**	**---------->>**		**1.15**	**0.74**
AGGREGATE UNIT DIRECT COST			**t**	**---------->>**				**1.89**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-2*
CIVIL WORKS COST ESTIMATE
PROCESSING OF AGGREGATES FOR THE CONCRETES OF THE RIGHT BANK

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT (10%)**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	802	11.81		9'474	-
1.1.02	Equipment operator	---	hr	2'139	8.14		17'413	-
1.1.03	Operator's helper	---	hr	2'139	4.48		9'584	-
1.1.04	General services, skilled	---	hr	856	4.48		3'834	-
1.1.05	General services, semiskilled	---	hr	1'284	2.28		2'926	-
1.2	**Equipment**							
1.2.01	Front shovel 260 kW, 4.3 m3 h. buchet	O	hr	893	80.84	62.27	72'160	55'584
		R	hr	179	26.06	43.26	4'652	7'723
1.2.02	Bulldozer 231 kW	O	hr	134	127.61		17'086	-
		R	hr	27	49.71		1'331	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	578	65.37	53.83	37'814	31'138
		R	hr	116	20.21	32.45	2'338	3'754
1.2.04	Rear duper, 63.5 ton capacity	O	hr	340	100.64	80.60	34'196	27'387
		R	hr	68	33.71	50.86	2'291	3'456
1.2.05	Alogen floodlights, 2000 W x No. 2	O	hr	714	0.41		293	-
2	**ROCK PROCESSING**							
2.1	**Labour**							
2.1.01	Foreman	1	hr	10'200	11.81		120'462	
2.1.02	Plant operator	1	hr	10'200	8.14		83'028	
2.1.03	Operator's helper	1	hr	10'200	4.48		45'696	
2.1.04	General services, specialist	1	hr	10'200	8.14		83'028	
2.1.05	General services, skilled	2	hr	20'400	4.48		91'392	
2.1.06	General services, semiskilled	3	hr	30'600	2.26		69'156	
2.2	**Equipment**							
2.2.01	Crushing and processing plant, 300 t/hr	1	month	17	124'127		2'110'159	
		1	hr	5'220	328.82		1'716'474	
2.2.02	Transformer cabin, 1500 kVA	1	month	17	2'535.70		43'107	
2.2.03	Water pump, 53 kW	1	hr	5'220	18.34		95'737	
2.2.04	Steel pipeline, 250 mm diameter, 500 m	1	month	17	915.00		15'555	
2.2.05	Water steel tank, 200 m3 capacity	1	month	17	455.12		7'737	
2.2.06	Alogen floodlights, 1000 W	6	hr	61'200	0.36		22'032	
2.2.07	Alogen floodlights, 2000 W	4	hr	40'800	0.41		16'728	
Sub-total --->>							4'735'682	129'042

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-2*
CIVIL WORKS COST ESTIMATE
PROCESSING OF AGGREGATES FOR CONCRETE (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
							4'735'682	129'042
2.3	**Civil Works for Plant Installation**							
2.3.01	Excavation, common	---	m^3	55'000	3.70		203'500	
2.3.02	Excavation, rock	---	m^3	13'000	7.70		100'100	
2.3.03	Concrete	---	m^3	1'400	130.00		182'000	
2.3.04	Reinforcing steel	---	t	140	2'300.00		322'000	
2.3.05	Fills and backfills	---	m^3	22'000	4.50		99'000	
2.3.06	Concrete demolition	---	m^3	700	55.00		38'500	
2.4	**Plant Installation (Erection & Removal)**							
2.4.01	Plant installation	---	l.s				492'000	
2.4.02	Plant removal	---	l.s				262'000	
	Sub-total No. 1 & 2 ------>>						6'434'782	129'042
3	**LOADING AND TRANSPORT OF NATURAL SAND TO PLANT**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	1'776	11.81		20'971	-
3.1.02	Equipment operator	---	hr	4'735	8.14		38'544	-
3.1.03	Operator's helper	---	hr	4'735	4.48		21'214	-
3.1.04	General services, skilled	---	hr	1'894	4.48		8'485	-
3.1.05	General services, semiskilled	---	hr	2'841	2.28		6'478	-
3.2	**Equipment**							
3.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	492	50.23	43.99	24'692	21'625
		R	hr	98	15.84	25.15	1'557	2'473
3.2.02	Rear duper, 37.3 ton capacity	O	hr	3'774	65.37	53.83	246'693	203'143
		R	hr	755	20.21	32.45	15'254	24'492
3.2.03	Portable diesel p. floodlight, 10000 W	O	hr	39	9.72		382	-
		R	hr	8	6.20		49	-
	Sub-total No. 3 ------>>						384'319	251'733
Quantity of No. 1 & 2 ------>>			%	86.7%	------>>		5'577'026	111'841
Quantity of No. 3 ------>>			%	13.3%	------>>		51'230	33'556
Sub-total ------>>							5'628'256	145'397
Miscellaneous works ------>>			%	5.00%	------>>		281'413	7'270
Processing waste: ------>>			%	12.00%	------>>		709'160	18'320
Unit Direct Cost in Currency Portions			**t**	**1'302'312**	**------>>**		**5.08**	**0.01**
UNIT DIRECT COST OF CONCRETE AGGREGATE US$/t				**------>>**				**5.10**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-3*
CIVIL WORKS COST ESTIMATE
SAND FROM LEFT BANK BORROW AREA TO BE MIXED WITH SAND OF AGGREGATE PROCESSING PLANT

N°	DESCRIPTION	AUX	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**LOADING AND TRANSPORT**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	6'459	11.81		76'281	-
1.1.02	Equipment operator	---	hr	17'224	8.14		140'205	-
1.1.03	Operator's helper	---	hr	17'224	4.48		77'164	-
1.1.04	General services, skilled	---	hr	6'890	4.48		30'866	-
1.1.05	General services, semiskilled	---	hr	10'334	2.28		23'563	-
1.2	**Equipment**							
1.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	988	50.23	43.99	49'645	43'477
		R	hr	198	15.84	25.15	3'131	4'971
1.2.02	Rear duper, 37.3 ton capacity	O	hr	14'275	65.37	53.83	933'132	768'403
		R	hr	2'855	20.21	32.45	57'698	92'642
1.2.03	Portable diesel p. floodlight, 10000 W	O	hr	395	9.72		3'843	-
		R	hr	79	6.20		490	-
Sub-total --->>							1'396'018	909'494
Construction Contingencies			%		------------------->>			
Total Direct Costs --->>							1'396'018	909'494
Unit Direct Cost in Currency Portions			**t**	**680'775**	**------------------->>**		**2.05**	**1.34**
AGGREGATE UNIT DIRECT COST			**t**	**-------------------------------->>**				**3.39**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-4*

CIVIL WORKS COST ESTIMATE

PROCESSING OF AGGREGATES FOR THE CONCRETES OF THE LEFT BANK

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**LOADING AND TRANSPORT (40%)**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	11'293	11.81		133'367	-
1.1.02	Equipment operator	---	hr	30'114	8.14		245'128	-
1.1.03	Operator's helper	---	hr	30'114	4.48		134'911	-
1.1.04	General services, skilled	---	hr	12'046	4.48		53'964	-
1.1.05	General services, semiskilled	---	hr	18'068	2.28		41'196	-
1.2	**Equipment**							
1.2.01	Front shovel 260 kW, 4.3 m3 h. buchet	O	hr	5'356	80.84	62.27	432'958	333'502
		R	hr	1'071	26.06	43.26	27'914	46'338
1.2.02	Bulldozer 231 kW	O	hr	803	127.61		102'517	-
		R	hr	161	49.71		7'987	-
1.2.03	Rear duper, 37.3 ton capacity	O	hr	13'366	65.37	53.83	873'737	719'493
		R	hr	2'673	20.21	32.45	54'025	86'746
1.2.04	Rear duper, 63.5 ton capacity	O	hr	7'851	100.64	80.60	790'147	632'809
		R	hr	1'570	33.71	50.86	52'933	79'863
1.2.05	Alogen floodlights, 2000 W x No. 2	O	hr	4'285	0.41		1'757	-
2	**ROCK PROCESSING**							
2.1	**Labour**							
2.1.01	Foreman	1	hr	31'800	11.81		375'558	
2.1.02	Plant operator	1	hr	31'800	8.14		258'852	
2.1.03	Operator's helper	1	hr	31'800	4.48		142'464	
2.1.04	General services, specialist	1	hr	31'800	8.14		258'852	
2.1.05	General services, skilled	2	hr	63'600	4.48		284'928	
2.1.06	General services, semiskilled	3	hr	95'400	2.26		215'604	
2.2	**Equipment**							
2.2.01	Crushing and processing plant, 340 t/hr	1	month	53	127'449		6'754'785	
		1	hr	21'149	356.43		7'538'144	
2.2.02	Transformer cabin, 1500 kVA	1	month	53	2'535.70		134'392	
2.2.03	Water pump, 53 kW	1	hr	21'149	18.34		387'873	
2.2.04	Steel pipeline, 250 mm diameter, 500 m	1	month	53	915.00		48'495	
2.2.05	Water steel tank, 200 m3 capacity	1	month	53	455.12		24'121	
2.2.06	Alogen floodlights, 1000 W	6	hr	190'800	0.360		68'688	
2.2.07	Alogen floodlights, 2000 W	4	hr	127'200	0.410		52'152	
Sub-total -->>							19'497'451	1'898'750

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 7-4*
CIVIL WORKS COST ESTIMATE
PROCESSING OF AGGREGATES FOR CONCRETE (CONT.D)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
							19'497'451	1'898'750
2.3	**Civil Works for Plant Installation**							
2.3.01	Excavation, common	---	m^3	60'000	3.70		222'000	
2.3.02	Excavation, rock	---	m^3	15'000	7.70		115'500	
2.3.03	Concrete	---	m^3	1'500	130.00		195'000	
2.3.04	Reinforcing steel	---	t	150	2'300.00		345'000	
2.3.05	Fills and backfills	---	m^3	25'000	4.50		112'500	
2.3.06	Concrete demolition	---	m^3	750	55.00		41'250	
2.4	**Plant Installation (Erection & Removal)**							
2.4.01	Plant installation	---	l.s	---	---	---	548'800	
2.4.02	Plant removal	---	l.s	---	---	---	292'700	
	Sub-total No. 1 & 2 ---------->>						21'370'201	1'898'750
3	**LOADING AND TRANSPORT OF NATURAL SAND TO PLANT**							
3.1	**Labour**							
3.1.01	Foreman	---	hr	6'329	11.81		74'741	-
3.1.02	Equipment operator	---	hr	16'876	8.14		137'373	-
3.1.03	Operator's helper	---	hr	16'876	4.48		75'606	-
3.1.04	General services, skilled	---	hr	6'750	4.48		30'242	-
3.1.05	General services, semiskilled	---	hr	10'126	2.28		23'087	-
3.2	**Equipment**							
3.2.01	Wheel loader 229 kW, 4.2 m3 h. buchet	O	hr	988	50.23	43.99	49'645	43'477
		R	hr	198	15.84	25.15	3'131	4'971
3.2.02	Rear duper, 37.3 ton capacity	O	hr	14'275	65.37	53.83	933'132	768'403
		R	hr	2'855	20.21	32.45	57'698	92'642
3.2.03	Portable diesel p. floodlight, 10000 W	O	hr	79	9.72		769	-
		R	hr	16	6.20		98	-
	Sub-total No. 3 ---------->>						1'385'521	909'494
Quantity of No. 1 & 2 ---------->>			%	86.7%	---------->>		18'521'553	1'645'647
Quantity of No. 3 ---------->>			%	13.3%	---------->>		184'690	121'236
Sub-total ---------->>							18'706'243	1'766'882
Miscellaneous works ---------->>			%	5.00%	---------->>		935'312	88'344
Processing waste: ---------->>			%	12.00%	---------->>		2'356'987	222'627
Unit Direct Cost in Currency Portions			**t**	**5'105'808**	**---------->>**		**4.31**	**0.04**
UNIT DIRECT COST OF CONCRETE AGGREGATE US$/t				**---------->>**				**4.35**

Part 8 - Concrete Works

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-1*
CIVIL WORKS COST ESTIMATE
CONCRETE MIXED AT THE BATCHING PLANT - RIGHT BANK (EXCLUDING CEMENT & POZZOLAN)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Concrete Batching and Mixing**							
		x						
1.1	**Labour**	shift						
1.1.01	Foreman	1	hr	10'200	11.81		120'462	-
1.1.02	Equipment operator	1	hr	10'200	8.14		83'028	-
1.1.03	Operators, assistant	1	hr	10'200	5.76		58'752	-
1.1.04	General services, specialist	1	hr	10'200	5.76		58'752	-
1.1.05	General services, skilled	2	hr	20'400	4.48		91'392	-
1.1.06	General services, semiskilled	3	hr	30'600	2.26		69'156	-
1.2	**Equipment**							
1.2.01	Aggregates loading system	1	m.th	17	4'532.35		77'050	-
			hr	4'770	14.85		70'840	-
1.2.02	Batching and mixing plant, 240 m3/hr	1	m.th	17	40'320.47		685'448	-
			hr	4'770	101.01		481'855	-
1.2.03	Chilled water plant, 6 x 810,000 kcal/h cap.	1	m.th	17	107'843.31		1'833'336	-
			hr	4'770	297.52		1'419'281	-
1.2.04	Ice plant, capacity 180 t/day of flakes	1	m.th	17	118'773.53		2'019'150	-
			hr	4'770	169.09		806'622	-
1.2.03	Aggregate cooling plant, 2330 kW ref. capacity	1	m.th	17	85'112.21		1'446'908	-
			hr	4'770	193.57		923'401	-
1.2.04	Cementitious materials bag emtier	1	m.th	17	3'593.75		61'094	
			hr	4'770	4.25		20'274	
1.2.05	Portland cement steel silos, 800 t capacity	6	m.th	17	4'831.95		82'143	-
1.2.06	Pozzolan steel silos, 500 t capacity	2	m.th	17	2'039.95		34'679	-
1.2.07	Transformer cabin, 500 KVA	1	m.th	17	764.33		12'994	-
1.2.08	Transformer cabin, 1500 KVA	2	m.th	17	5'071.40		86'214	-
1.2.09	Steel water tank, 100 m3 capacity	1	m.th	17	255.21		4'339	-
1.2.10	Water supply pipeline, 125 mm dia., 500 m	500	m.th	17	325.00		5'525	-
1.2.11	Alogen floodligth, 1000 W	4	hr	40'800	0.72		29'376	-
1.2.12	Alogen floodligth, 2000 W	2	hr	20'400	0.83		16'932	-
1.2.13	Water pump, 10 l/s, 15 kW	1	hr	4'770	3.72		17'746	-
			hr	954	1.08		1'030	-
1.3	**Materials**							
1.3.01	Processed aggregates	---	t	1'302'311	5.08	0.01	6'615'742	13'023
1.4	**Civil Works for Plant Installation**							
1.4.01	Common excavation	---	m3	50'000	3.70		185'000	-
1.4.02	Rock excavation	---	m3	15'000	7.70		115'500	-
1.4.03	Concrete	---	m3	960	150.00		144'000	-
1.4.04	Reinforcing steel	---	t	90	2'300.00		207'000	-
1.4.05	Fills and backfills	---	m3	20'000	4.50		90'000	-
1.4.06	Concrete demolition	---	m3	600	55.00		33'000	-
1.5	**Plant Installation (Erection & Removal)**							
1.5.01	Plant installation	---	l.s	---	---	---	1'020'000	
1.5.02	Plant removal	---	l.s	---	---	---	410'000	
Sub-total -->>							19'438'020	13'023
Miscellaneous works			%	5.00%	---------------------------->>		971'901	651
Processing waste			%	0.50%	---------------------------->>		102'050	68
Unit Direct Cost in Currency Portions			m^3	667'852	---------------------------->>		**30.71**	**0.00**
UNIT DIRECT COST OF CONCRETE			m^3	-->>				**30.71**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-2*
CIVIL WORKS COST ESTIMATE
RIGHT BANK CONCRETE - SPILLWAY, CHUTE MASS CONCRETE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	223'500	30.71	0.00	6'864'433	23
1.02	Water reducing-retarding admixture	---	kg	201'150	1.58		317'817	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	6'181	71.76		443'530	-
		R	hr	1'236	20.45		25'279	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	6'343	36.20	29.76	229'631	188'779
		R	hr	1'269	10.88	8.91	13'803	11'304
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	12.34	36'853.18	45'852.73	454'657	565'684
		O&R	hr	3'474	57.06	42.98	198'232	149'317
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	3'474	2.37		8'234	-
		R	hr	869	2.19		1'902	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	1'565	62.40	79.52	97'625	124'409
	(including 10 m3 capacity auger-belt feeder)	R	hr	313	45.20	64.94	14'143	20'320
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	5'268	11.81		62'221	-
2.08	Equipment operator	---	hr	19'333	8.14		157'367	-
2.09	Operator's helper	---	hr	22'815	4.48		102'212	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	1'490	22.31	22.49	33'242	33'510
		R	hr	298	9.02	13.16	2'688	3'922
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	26'820	0.51	0.77	13'678	20'651
		R	hr	6'705	0.35	0.69	2'347	4'626
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	13'038	51.69	19.31	673'908	251'754
	with 120 mm dia. hydraulic type framed vibrators	R	hr	2'608	32.00	16.41	83'440	42'789
3.04	Compressed air including distribution pipeline	---	m^3	8'636'040	0.06		518'162	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	60'524	0.41		24'815	-
3.06	Foreman	---	hr	18'914	11.81		223'371	-
3.07	Equipment operator	---	hr	15'980	8.14		130'079	-
3.08	Operator's helper	---	hr	15'980	4.48		71'592	-
3.09	Vibratorman	---	hr	59'004	2.26		133'349	-
3.10	General works, skilled	---	hr	26'820	4.48		120'154	-
3.11	General works, semiskilled	---	hr	33'525	2.26		75'767	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	43'583	20.36	0.29	887'340	12'639
4.02	Formwork for structures, finish F1 & F2	---	m^2	8'717	21.52	2.38	187'579	20'745
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.54	0.82	-	-
5.02	Concrete slab type scaffolding	---	m^3	4'700	5.83	1.05	27'401.00	4'935
6	**Finishing and Curing**							
6.01	Foreman	---	hr	599	11.81		7'077	-
6.02	Skilled	---	hr	4'794	4.48		21'477	-
6.03	Semiskilled	---	hr	9'588	2.28		21'861	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	1.80%			327'458	26'109
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			90'961	7'085
Sub-total				--->>			12'668'831	1'488'602
Construction Contingencies			%	2.00%	-------------------------->>		253'377	29'772
Total Direct Costs				--->>			12'922'207	1'518'374
Overhead and Profit			%	48.00%	-------------------------->>		6'931'479	
Unit price in Currency Portions			m^3	**223'500**	-------------------------->>		**88.83**	**6.79**
AGGREGATE UNIT PRICE			m^3	--->>				**95.62**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-3*

CIVIL WORKS COST ESTIMATE

RIGHT BANK CONCRETE - SPILLWAY, SLAB DOWNSTREAM OF CHUTE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	33'700	30.71	0.00	1'035'040	3
1.02	Water reducing-retarding admixture	---	kg	30'330	1.58		47'921	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	-	71.76		-	-
		R	hr	-	20.45		-	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	1'366	36.20	29.76	49'463	40'664
		R	hr	273	10.88	8.91	2'973	2'435
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	-	36'853.18	45'852.73	-	-
		O&R	hr	-	57.06	42.98	-	-
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	-	2.37		-	-
		R	hr	-	2.19		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	337	62.40	79.52	21'029	26'798
	(including 10 m3 capacity auger-belt feeder)	R	hr	67	45.20	64.94	3'046	4'377
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	561	11.81		6'627	-
2.08	Equipment operator	---	hr	1'874	8.14		15'252	-
2.09	Operator's helper	---	hr	2'615	4.48		11'716	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	449	22.31	22.49	10'025	10'106
		R	hr	90	9.02	13.16	811	1'183
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	1'348	0.51	0.77	687	1'038
		R	hr	337	0.35	0.69	118	233
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	2'528	51.69	19.31	130'646	48'806
	with 120 mm dia. hydraulic type framed vibrators	R	hr	506	32.00	16.41	16'176	8'295
3.04	Compressed air including distribution pipeline	---	m^3	1'108'056	0.06		66'483	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	7'445	0.41		3'053	-
3.06	Foreman	---	hr	2'327	11.81		27'478	-
3.07	Equipment operator	---	hr	3'275	8.14		26'655	-
3.08	Operator's helper	---	hr	3'275	4.48		14'670	-
3.09	Vibratorman	---	hr	2'966	2.26		6'702	-
3.10	General works, skilled	---	hr	4'044	4.48		18'117	-
3.11	General works, semiskilled	---	hr	5'055	2.26		11'424	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	-	20.36	0.29	-	-
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	21.52	2.38	-	-
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.54	0.82	-	-
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	316	11.81		3'731	-
6.02	Skilled	---	hr	2'528	4.48		11'323	-
6.03	Semiskilled	---	hr	5'055	2.28		11'525	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	8.00%			207'667	11'515
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			12'979	720
Sub-total				-->>			1'773'339	156'172
Construction Contingencies			%	2.00%	------------------------->>		35'467	3'123
Total Direct Costs				-->>			1'808'806	159'295
Overhead and Profit			%	48.00%	------------------------->>		944'689	
Unit price in Currency Portions			m^3	33'700	------------------------->>		**81.71**	**4.73**
AGGREGATE UNIT PRICE			m^3	-->>				**86.43**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-4*
CIVIL WORKS COST ESTIMATE
RIGHT BANK CONCRETE - SPILLWAY PIERS

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	145'000	30.71	0.00	4'453'435	15
1.02	Water reducing-retarding admixture	---	kg	130'500	1.58		206'190	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	8'020	71.76		575'497	-
		R	hr	1'604	20.45		32'801	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	2'352	36.20	29.76	85'130	69'985
		R	hr	470	10.88	8.91	5'117	4'191
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	14.70	36'853.18	45'852.73	541'897	674'229
		O&R	hr	4'508	57.06	42.98	257'213	193'744
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	4'508	2.37		10'683	-
		R	hr	1'127	2.19		2'468	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	580	62.40	79.52	36'192	46'122
	(including 10 m3 capacity auger-belt feeder)	R	hr	116	45.20	64.94	5'243	7'533
2.06	Electric powered concrete pump, 63 kW	O	hr	725	35.82		25'970	-
	(including delivery pipeline)	R	hr	145	21.91		3'177	-
2.07	Foreman	---	hr	4'620	11.81		54'565	-
2.08	Equipment operator	---	hr	17'819	8.14		145'045	-
2.09	Operator's helper	---	hr	19'143	4.48		85'762	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	58'000	0.51	0.77	29'580	44'660
		R	hr	14'500	0.35	0.69	5'075	10'005
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	8'526'000	0.06		511'560	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	66'700	0.41		27'347	-
3.06	Foreman	---	hr	20'844	11.81		246'165	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	127'600	2.26		288'376	-
3.10	General works, skilled	---	hr	17'400	4.48		77'952	-
3.11	General works, semiskilled	---	hr	21'750	2.26		49'155	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	75'400	20.36	0.29	1'535'144	21'866
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	21.52	2.38	-	-
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	29'000	29.60	2.70	858'400	78'300
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	53'000	5.54	0.82	293'620	43'460
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	788	11.81		9'311	-
6.02	Skilled	---	hr	6'308	4.48		28'258	-
6.03	Semiskilled	---	hr	12'615	2.28		28'762	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			71'027	5'252
Sub-total				------------------------------------->>			10'586'118	1'199'362
Construction Contingencies			%	2.00%	------------------------>>		211'722	23'987
Total Direct Costs				------------------------------------->>			10'797'841	1'223'349
Overhead and Profit			%	48.00%	------------------------>>		5'770'171	
Unit price in Currency Portions			m^3	**145'000**	------------------------>>		**114.26**	**8.44**
AGGREGATE UNIT PRICE			m^3	--->>				**122.70**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-5*
CIVIL WORKS COST ESTIMATE
RIGHT BANK CONCRETE - PIERS OF DOWNSTREAM BRODGE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	22'600	30.71	0.00	694'122	2
1.02	Water reducing-retarding admixture	---	kg	20'340	1.58		32'137	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	1'458	71.76		104'648	-
		R	hr	292	20.45		5'964	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	275	36.20	29.76	9'951	8'181
		R	hr	55	10.88	8.91	598	490
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	2.29	36'853.18	45'852.73	84'461	105'087
		O&R	hr	703	57.06	42.98	40'090	30'197
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	703	2.37		1'665	-
		R	hr	176	2.19		385	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	68	62.40	79.52	4'231	5'391
	(including 10 m3 capacity auger-belt feeder)	R	hr	14	45.20	64.94	613	881
2.06	Electric powered concrete pump, 63 kW	O	hr	113	35.82		4'048	-
	(including delivery pipeline)	R	hr	23	21.91		495	-
2.07	Foreman	---	hr	740	11.81		8'737	-
2.08	Equipment operator	---	hr	2'881	8.14		23'450	-
2.09	Operator's helper	---	hr	3'037	4.48		13'608	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	9'040	0.51	0.77	4'610	6'961
		R	hr	2'260	0.35	0.69	791	1'559
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	1'328'880	0.06		79'733	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	10'396	0.41		4'262	-
3.06	Foreman	---	hr	3'249	11.81		38'368	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	19'888	2.26		44'947	-
3.10	General works, skilled	---	hr	2'712	4.48		12'150	-
3.11	General works, semiskilled	---	hr	3'390	2.26		7'661	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	9'040	20.36	0.29	184'054	2'622
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	21.52	2.38	-	-
4.03	Formwork for structures, finish F3	---	m^2	5'650	25.84	2.66	145'996	15'029
4.04	Formwork for structures, finish F4	---	m^2	4'520	29.60	2.70	133'792	12'204
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	7'200	5.54	0.82	39'888	5'904
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	141	11.81		1'668	-
6.02	Skilled	---	hr	1'130	4.48		5'062	-
6.03	Semiskilled	---	hr	2'260	2.28		5'153	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			11'130	794
Sub-total				-->>			1'748'469	195'302
Construction Contingencies			%	2.00%	-------------------------->>		34'969	3'906
Total Direct Costs				-->>			1'783'438	199'208
Overhead and Profit			%	48.00%	-------------------------->>		951'670	
Unit price in Currency Portions			**m^3**	**22'600**	-------------------------->>		**121.02**	**8.81**
AGGREGATE UNIT PRICE			**m^3**	-->>				**129.84**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-6*

CIVIL WORKS COST ESTIMATE

RIGHT BANK CONCRETE - SPILLWAY LATERAL WALLS, CONVENTIONAL CONCRETE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	175'300	30.71	0.00	5'384'050	18
1.02	Water reducing-retarding admixture	---	kg	157'770	1.58		249'277	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	4'848	71.76		347'878	-
		R	hr	970	20.45		19'828	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	4'975	36.20	29.76	180'109	148'067
		R	hr	995	10.88	8.91	10'826	8'866
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	-	36'853.18	45'852.73	-	-
		O&R	hr	-	57.06	42.98	-	-
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	-	2.37		-	-
		R	hr	-	2.19		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	1'227	62.40	79.52	76'571	97'579
	(including 10 m3 capacity auger-belt feeder)	R	hr	245	45.20	64.94	11'093	15'938
2.06	Electric powered concrete pump, 63 kW	O	hr	2'630	35.82		94'189	-
	(including delivery pipeline)	R	hr	526	21.91		11'522	-
2.07	Foreman	---	hr	4'099	11.81		48'414	-
2.08	Equipment operator	---	hr	15'048	8.14		122'489	-
2.09	Operator's helper	---	hr	17'747	4.48		79'508	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	1'636	22.31	22.49	36'502	36'797
		R	hr	327	9.02	13.16	2'952	4'306
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	21'036	0.51	0.77	10'728	16'198
		R	hr	5'259	0.35	0.69	1'841	3'629
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	10'226	51.69	19.31	528'573	197'461
	with 120 mm dia. hydraulic type framed vibrators	R	hr	2'045	32.00	16.41	65'445	33'561
3.04	Compressed air including distribution pipeline	---	m^3	6'773'592	0.06		406'416	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	47'883	0.41		19'632	-
3.06	Foreman	---	hr	14'963	11.81		176'717	-
3.07	Equipment operator	---	hr	13'048	8.14		106'212	-
3.08	Operator's helper	---	hr	13'048	4.48		58'456	-
3.09	Vibratorman	---	hr	46'279	2.26		104'591	-
3.10	General works, skilled	---	hr	21'036	4.48		94'241	-
3.11	General works, semiskilled	---	hr	26'295	2.26		59'427	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	56'973	20.36	0.29	1'159'960	16'522
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	21.52	2.38	-	-
4.03	Formwork for structures, finish F3	---	m^2	11'395	25.84	2.66	294'434	30'309
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	45'600	5.54	0.82	252'624	37'392
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	477	11.81		5'629	-
6.02	Skilled	---	hr	3'813	4.48		17'081	-
6.03	Semiskilled	---	hr	7'626	2.28		17'386	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	2.60%			418'541	15'841
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			80'489	2'812
Sub-total				------------------------------------>>			10'553'629	665'295
Construction Contingencies			%	2.00%	------------------------>>		211'073	13'306
Total Direct Costs				------------------------------------>>			10'764'702	678'601
Overhead and Profit			%	48.00%	------------------------>>		5'492'785	
Unit price in Currency Portions			m^3	**175'300**	------------------------>>		**92.74**	**3.87**
AGGREGATE UNIT PRICE			m^3	--->>				**96.61**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-7*
CIVIL WORKS COST ESTIMATE
RIGHT BANK CONCRETE - MATO GROSSO DIVERSION TUNNEL

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	49'400	30.71	0.00	1'517'239	5
1.02	Water reducing-retarding admixture	---	kg	44'460	1.58		70'247	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	4'554	71.76		326'777	-
		R	hr	911	20.45		18'625	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	-	36.20	29.76	-	-
		R	hr	-	10.88	8.91	-	-
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	-	36'853.18	45'852.73	-	-
		O&R	hr	-	57.06	42.98	-	-
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	-	2.37		-	-
		R	hr	-	2.19		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	-	62.40	79.52	-	-
	(including 10 m3 capacity auger-belt feeder)	R	hr	-	45.20	64.94	-	-
2.06	Electric powered concrete pump, 63 kW	O	hr	2'470	35.82		88'475	-
	(including delivery pipeline)	R	hr	494	21.91		10'824	-
2.07	Foreman	---	hr	1'932	11.81		22'811	-
2.08	Equipment operator	---	hr	7'726	8.14		62'891	-
2.09	Operator's helper	---	hr	7'726	4.48		34'613	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	19'760	0.51	0.77	10'078	15'215
		R	hr	4'940	0.35	0.69	1'729	3'409
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	2'904'720	0.06		174'283	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	22'724	0.41		9'317	-
3.06	Foreman	---	hr	7'101	11.81		83'866	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	43'472	2.26		98'247	-
3.10	General works, skilled	---	hr	5'928	4.48		26'557	-
3.11	General works, semiskilled	---	hr	7'410	2.26		16'747	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	14'820	20.36	0.29	301'735	4'298
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	21.52	2.38	-	-
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	16'796	29.60	2.70	497'162	45'349
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	13'900	5.54	0.82	77'006	11'398
5.02	Concrete slab type scaffolding	---	m^3	46'000	5.83	1.05	268'180.00	48'300
6	**Finishing and Curing**							
6.01	Foreman	---	hr	357	11.81		4'215	-
6.02	Skilled	---	hr	2'855	4.48		12'792	-
6.03	Semiskilled	---	hr	5'711	2.28		13'020	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	2.60%			123'985	1'775
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			23'843	93
Sub-total				--->>			3'895'263	129'842
Construction Contingencies			%	2.00%	------------------------->>		77'905	2'597
Total Direct Costs				--->>			3'973'168	132'439
Overhead and Profit			%	48.00%	------------------------->>		1'970'691	
Unit price in Currency Portions			m^3	**49'400**	------------------------->>		**120.32**	**2.68**
AGGREGATE UNIT PRICE			m^3	--->>				**123.00**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-8*

CIVIL WORKS COST ESTIMATE

RIGHT BANK CONCRETE - SPILLWAY DENTAL CONCRETE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	9'600	17.36	0.00	166'693	1
1.02	Water reducing-retarding admixture	---	kg	8'640	1.31		11'318	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	885	71.76		63'503	-
		R	hr	177	20.45		3'619	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	-	36.20	29.76	-	-
		R	hr	-	10.88	8.91	-	-
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	0.32	36'853.18	45'852.73	11'959	14'880
		O&R	hr	91	57.06	42.98	5'217	3'930
2.04	Concrete hydraulic operated bucket, 3.0 m^3	O	hr	91	2.37		217	-
		R	hr	23	2.19		50	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	-	62.40	79.52	-	-
	(including 10 m3 capacity auger-belt feeder)	R	hr	-	45.20	64.94	-	-
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	269	11.81		3'174	-
2.08	Equipment operator	---	hr	1'074	8.14		8'745	-
2.09	Operator's helper	---	hr	1'075	4.48		4'818	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	3'840	0.51	0.77	1'958	2'957
		R	hr	960	0.35	0.69	336	662
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	564'480	0.06		33'869	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	4'416	0.41		1'811	-
3.06	Foreman	---	hr	1'380	11.81		16'298	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	8'448	2.26		19'092	-
3.10	General works, skilled	---	hr	1'152	4.48		5'161	-
3.11	General works, semiskilled	---	hr	1'440	2.26		3'254	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	-	16.78		-	-
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	22.73		-	-
4.03	Formwork for structures, finish F3	---	m^2	-	27.56		-	-
4.04	Formwork for structures, finish F4	---	m^2	-	31.32		-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.26		-	-
5.02	Concrete slab type scaffolding	---	m^3		5.67		-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	-	11.81		-	-
6.02	Skilled	---	hr		4.48		-	-
6.03	Semiskilled	---	hr	-	2.28		-	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			2'832	112
Sub-total				--->>			363'925	22'541
Construction Contingencies			%	2.00%	------------------------->>		7'279	451
Total Direct Costs				--->>			371'204	22'992
Overhead and Profit			%	48.00%	------------------------->>		189'214	
Unit price in Currency Portions			**m^3**	**9'600**	------------------------->>		**58.38**	**2.40**
AGGREGATE UNIT PRICE			m^3	--->>				60.77

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-9*

CIVIL WORKS COST ESTIMATE

CONCRETE MIXED AT THE BATCHING PLANT - LEFT BANK (EXCLUDING CEMENT & POZZOLAN)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Concrete Batching and Mixing**							
		x						
1.1	**Labour**	shift						
1.1.01	Foreman	1	hr	31'800	11.81		375'558	-
1.1.02	Equipment operator	1	hr	31'800	8.14		258'852	-
1.1.03	Operators, assistant	1	hr	31'800	5.76		183'168	-
1.1.04	General services, specialist	1	hr	31'800	5.76		183'168	-
1.1.05	General services, skilled	2	hr	63'600	4.48		284'928	-
1.1.06	General services, semiskilled	3	hr	95'400	2.26		215'604	-
1.2	**Equipment**							
1.2.01	Aggregates loading system	1	m.th	53	6'638.00		351'814	-
			hr	18'703	21.75		406'781	-
1.2.02	Batching and mixing plant, 370 m3/hr	1	m.th	53	77'338.81		4'098'957	-
			hr	18'703	154.61		2'891'608	-
1.2.03	Chilled water plant, 9 x 810,000 kcal/h cap.	1	m.th	53	156'370.00		8'287'610	-
			hr	18'703	540.40		10'106'881	-
1.2.04	Ice plant, capacity 275 t/day of flakes	1	m.th	53	172'227.62		9'128'064	-
			hr	18'703	245.18		4'585'502	-
1.2.03	Aggregate cooling plant, 2330 kW ref. capacity	1	m.th	53	127'278.20		6'745'745	-
			hr	18'703	289.55		5'415'336	-
1.2.04	Cement bag bag emtier, 110 t/h	1	m.th	53	5'007.60		265'403	
			hr	18'703	5.95		111'280	
1.2.05	Portland cement steel silos, 800 t capacity	9	m.th	53	4'831.95		256'093	-
1.2.06	Pozzolan steel silos, 500 t capacity	3	m.th	53	2'039.95		108'117	-
1.2.07	Transformer cabin, 750 KVA	2	m.th	53	2'447.12		129'697	-
1.2.08	Transformer cabin, 1500 KVA	2	m.th	53	5'071.40		268'784	-
1.2.09	Steel water tank, 200 m3 capacity	1	m.th	53	455.12		24'121	-
1.2.10	Water supply pipeline, 200 mm dia., 500 m	500	m.th	53	655.00		34'715	-
1.2.11	Alogen floodligth, 1000 W	4	hr	127'200	0.36		45'792	-
1.2.12	Alogen floodligth, 2000 W	2	hr	63'600	0.41		26'076	-
1.2.13	Water pump, 20 l/s, 15 kW	1	hr	13'092	7.08		92'690	-
			hr	2'618	2.05		5'368	-
1.3	**Materials**							
1.3.01	Processed aggregates	---	t	5'105'808	4.31	0.04	22'006'032	204'232
1.4	**Civil Works for Plant Installation**							
1.4.01	Common excavation	---	m3	75'000	3.70		277'500	-
1.4.02	Rock excavation	---	m3	23'000	7.70		177'100	-
1.4.03	Concrete	---	m3	1'450	150.00		217'500	-
1.4.04	Reinforcing steel	---	t	140	2'300.00		322'000	-
1.4.05	Fills and backfills	---	m3	30'000	4.50		135'000	-
1.4.06	Concrete demolition	---	m3	900	55.00		49'500	-
1.5	**Plant Installation (Erection & Removal)**							
1.5.01	Plant installation	---	l.s	---	---	---	1'020'000	
1.5.02	Plant removal	---	l.s	---	---	---	410'000	
Sub-total ----------------------------------->>							79'502'345	204'232
Miscellaneous works			%	5.00%	---------------------------->>		3'975'117	10'212
Processing waste			%	0.50%	---------------------------->>		417'387	1'072
Unit Direct Cost in Currency Portions			**m^3**	**2'618'363**	---------------------------->>		**32.04**	**0.00**
UNIT DIRECT COST OF CONCRETE			**m^3**	--->>				**32.04**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-10*
CIVIL WORKS COST ESTIMATE
LEFT BANK CONCRETE - POWERHOUSE (POWER INTAKES AND GENERATING UNITS)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	1'600'000	32.04	0.00	51'265'527	655
1.02	Water reducing-retarding admixture	---	kg	1'440'000	1.58		2'275'200	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	132'082	71.76		9'478'226	-
		R	hr	26'416	20.45		540'217	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	10'854	36.20	29.76	392'908	323'009
		R	hr	2'171	10.88	8.91	23'618	19'341
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	138	33'012	51'788.38	4'566'235	7'163'442
		O&R	hr	38'951	58.84	46.98	2'291'895	1'829'933
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	38'951	3.59		139'835	-
		R	hr	9'738	3.33		32'427	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	2'400	62.40	79.52	149'760	190'848
	(including 10 m3 capacity auger-belt feeder)	R	hr	480	45.20	64.94	21'696	31'171
2.06	Electric powered concrete pump, 63 kW	O	hr	16'000	35.82		573'120	-
	(including delivery pipeline)	R	hr	3'200	21.91		70'112	-
2.07	Foreman	---	hr	55'834	11.81		659'401	-
2.08	Equipment operator	---	hr	220'468	8.14		1'794'612	-
2.09	Operator's helper	---	hr	226'205	4.48		1'013'397	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	3'200	22.31	22.49	71'392	71'968
		R	hr	640	9.02	13.16	5'773	8'422
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	544'000	0.51	0.77	277'440	418'880
		R	hr	136'000	0.35	0.69	47'600	93'840
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	20'000	51.69	19.31	1'033'800	386'200
	with 120 mm dia. hydraulic type framed vibrators	R	hr	4'000	32.00	16.41	128'000	65'640
3.04	Compressed air including distribution pipeline	---	m^3	87'168'000	0.06		5'230'080	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	716'736	0.41		293'862	-
3.06	Foreman	---	hr	223'980	11.81		2'645'204	-
3.07	Equipment operator	---	hr	25'520	8.14		207'733	-
3.08	Operator's helper	---	hr	25'520	4.48		114'330	-
3.09	Vibratorman	---	hr	1'196'800	2.26		2'704'768	-
3.10	General works, skilled	---	hr	256'000	4.48		1'146'880	-
3.11	General works, semiskilled	---	hr	288'000	2.26		650'880	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	374'400	20.36	0.29	7'622'784	108'576
4.02	Formwork for structures, finish F1 & F2	---	m^2	62'400	21.52	2.38	1'342'848	148'512
4.03	Formwork for structures, finish F3	---	m^2	395'200	25.84	2.66	10'211'968	1'051'232
4.04	Formwork for structures, finish F4	---	m^2	1'040'000	29.60	2.70	30'784'000	2'808'000
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	1'150'000	5.54	0.82	6'371'000	943'000
5.02	Concrete slab type scaffolding	---	m^3	1'300'000	5.83	1.05	7'579'000	1'365'000
6	**Finishing and Curing**							
6.01	Foreman	---	hr	15'600	11.81		184'236	-
6.02	Skilled	---	hr	124'800	4.48		559'104	-
6.03	Semiskilled	---	hr	249'600	2.28		569'088	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	0.10%			150'792	14'720
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			753'958	53'017
Sub-total				--->>			155'974'704	17'095'406
Construction Contingencies			%	2.00%	-------------------------->>		3'119'494	341'908
Total Direct Costs				--->>			159'094'198	17'437'315
Overhead and Profit			%	48.00%	-------------------------->>		84'735'126	
Unit price in Currency Portions			**m^3**	**1'600'000**	-------------------------->>		**152.39**	**10.90**
AGGREGATE UNIT PRICE			**m^3**	--->>				**163.29**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-11*

CIVIL WORKS COST ESTIMATE

LEFT BANK CONCRETE - POWERHOUSE MAIN ERECTION AND UNLOADING AREAS (EXCLUDING MASS CONCRETE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	40'000	32.04	0.00	1'281'638	16
1.02	Water reducing-retarding admixture	---	kg	36'000	1.58		56'880	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	3'302	71.76		236'956	-
		R	hr	660	20.45		13'505	-
2.02	Truck concrete screw agitator, 10.6 m³ capacity	O	hr	271	36.20	29.76	9'823	8'075
		R	hr	54	10.88	8.91	590	484
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	3	33'011.77	51'788.38	114'156	179'086
		O&R	hr	974	58.84	46.98	57'297	45'748
2.04	Concrete hydraulic operated bucket, 5.0 m³	O	hr	974	3.59		3'496	-
		R	hr	243	3.33		811	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	60	62.40	79.52	3'744	4'771
	(including 10 m3 capacity auger-belt feeder)	R	hr	12	45.20	64.94	542	779
2.06	Electric powered concrete pump, 63 kW	O	hr	400	35.82		14'328	-
	(including delivery pipeline)	R	hr	80	21.91		1'753	-
2.07	Foreman	---	hr	1'396	11.81		16'485	-
2.08	Equipment operator	---	hr	5'512	8.14		44'865	-
2.09	Operator's helper	---	hr	5'655	4.48		25'335	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	13'600	0.51	0.77	6'936	10'472
		R	hr	3'400	0.35	0.69	1'190	2'346
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	500	51.69	19.31	25'845	9'655
	with 120 mm dia. hydraulic type framed vibrators	R	hr	100	32.00	16.41	3'200	1'641
3.04	Compressed air including distribution pipeline	---	m³	2'179'200	0.06		130'752	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	17'848	0.41		7'318	-
3.06	Foreman	---	hr	5'578	11.81		65'870	-
3.07	Equipment operator	---	hr	550	8.14		4'477	-
3.08	Operator's helper	---	hr	550	4.48		2'464	-
3.09	Vibratorman	---	hr	29'920	2.26		67'619	-
3.10	General works, skilled	---	hr	6'400	4.48		28'672	-
3.11	General works, semiskilled	---	hr	7'200	2.26		16'272	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m²	13'000	20.36	0.29	264'680	3'770
4.02	Formwork for structures, finish F1 & F2	---	m²	1'040	21.52	2.38	22'381	2'475
4.03	Formwork for structures, finish F3	---	m²	3'120	25.84	2.66	80'621	8'299
4.04	Formwork for structures, finish F4	---	m²	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m²	18'200	5.54	0.82	100'828	14'924
5.02	Concrete slab type scaffolding	---	m³	27'830	5.83	1.05	162'249	29'222
6	**Finishing and Curing**							
6.01	Foreman	---	hr	274	11.81		3'236	-
6.02	Skilled	---	hr	2'192	4.48		9'819	-
6.03	Semiskilled	---	hr	4'384	2.28		9'995	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			18'832	1'315
Sub-total				--->>			2'915'460	323'079
Construction Contingencies			%	2.00%	-------------------------->>		58'309	6'462
Total Direct Costs				--->>			2'973'769	329'541
Overhead and Profit			%	48.00%	-------------------------->>		1'585'589	
Unit price in Currency Portions			m³	**40'000**	-------------------------->>		**113.98**	**8.24**
AGGREGATE UNIT PRICE			m³	--->>				**122.22**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-12*

CIVIL WORKS COST ESTIMATE

LEFT BANK CONCRETE - POWERHOUSE AUXILIARY ERECTION AREA (EXCLUDING MASS CONCRETE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	36'000	32.04	0.00	1'153'474	15
1.02	Water reducing-retarding admixture	---	kg	32'400	1.58		51'192	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	2'972	71.76		213'260	-
		R	hr	594	20.45		12'155	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	244	36.20	29.76	8'840	7'268
		R	hr	49	10.88	8.91	531	435
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	3	33'011.77	51'788.38	102'740	161'177
		O&R	hr	876	58.84	46.98	51'568	41'173
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	876	3.59		3'146	-
		R	hr	219	3.33		730	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	54	62.40	79.52	3'370	4'294
	(including 10 m3 capacity auger-belt feeder)	R	hr	11	45.20	64.94	488	701
2.06	Electric powered concrete pump, 63 kW	O	hr	360	35.82		12'895	-
	(including delivery pipeline)	R	hr	72	21.91		1'578	-
2.07	Foreman	---	hr	1'256	11.81		14'837	-
2.08	Equipment operator	---	hr	4'961	8.14		40'379	-
2.09	Operator's helper	---	hr	5'090	4.48		22'801	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	11'520	0.51	0.77	5'875	8'870
		R	hr	2'880	0.35	0.69	1'008	1'987
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	300	51.69	19.31	15'507	5'793
	with 120 mm dia. hydraulic type framed vibrators	R	hr	60	32.00	16.41	1'920	985
3.04	Compressed air including distribution pipeline	---	m^3	1'909'440	0.06		114'566	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	15'298	0.41		6'272	-
3.06	Foreman	---	hr	4'781	11.81		56'458	-
3.07	Equipment operator	---	hr	330	8.14		2'686	-
3.08	Operator's helper	---	hr	330	4.48		1'478	-
3.09	Vibratorman	---	hr	25'344	2.26		57'277	-
3.10	General works, skilled	---	hr	5'760	4.48		25'805	-
3.11	General works, semiskilled	---	hr	6'480	2.26		14'645	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	9'360	20.36	0.29	190'570	2'714
4.02	Formwork for structures, finish F1 & F2	---	m^2	936	21.52	2.38	20'143	2'228
4.03	Formwork for structures, finish F3	---	m^2	2'808	25.84	2.66	72'559	7'469
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	11'000	5.54	0.82	60'940	9'020
5.02	Concrete slab type scaffolding	---	m^3	27'830	5.83	1.05	162'249	29'222
6	**Finishing and Curing**							
6.01	Foreman	---	hr	152	11.81		1'796	-
6.02	Skilled	---	hr	1'217	4.48		5'451	-
6.03	Semiskilled	---	hr	2'434	2.28		5'549	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			16'844	1'163
Sub-total				-->>			2'533'582	284'516
Construction Contingencies			%	2.00%	--------------------------->>		50'672	5'690
Total Direct Costs				-->>			2'584'254	290'206
Overhead and Profit			%	48.00%	--------------------------->>		1'379'741	
Unit price in Currency Portions			**m^3**	**36'000**	--------------------------->>		**110.11**	**8.06**
AGGREGATE UNIT PRICE			m^3	-->>				**118.17**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-13*
CIVIL WORKS COST ESTIMATE
LEFT BANK CONCRETE - P.H. MAIN & AUXILIARY ERECTION & UNLOADING AREAS (MASS CONCRE.)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	380'200	32.04	0.00	12'181'971	156
1.02	Water reducing-retarding admixture	---	kg	342'180	1.58		540'644	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	3'692	71.76		264'972	-
		R	hr	738	20.45		15'102	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	15'475	36.20	29.76	560'188	460'530
		R	hr	3'095	10.88	8.91	33'673	27'576
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	5	33'011.77	51'788.38	166'931	261'879
		O&R	hr	1'424	58.84	46.98	83'786	66'898
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	1'424	3.59		5'112	-
		R	hr	356	3.33		1'185	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	3'422	62.40	79.52	213'520	272'102
	(including 10 m3 capacity auger-belt feeder)	R	hr	684	45.20	64.94	30'933	44'442
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	7'548	11.81		89'143	-
2.08	Equipment operator	---	hr	26'420	8.14		215'058	-
2.09	Operator's helper	---	hr	33'965	4.48		152'161	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	5'069	22.31	22.49	113'097	114'009
		R	hr	1'014	9.02	13.16	9'145	13'342
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	15'208	0.51	0.77	7'756	11'710
		R	hr	3'802	0.35	0.69	1'331	2'623
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	28'515	51.69	19.31	1'473'940	550'625
	with 120 mm dia. hydraulic type framed vibrators	R	hr	5'703	32.00	16.41	182'496	93'586
3.04	Compressed air including distribution pipeline	---	m^3	12'500'976	0.06		750'059	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	94'644	0.41		38'804	-
3.06	Foreman	---	hr	29'576	11.81		349'297	-
3.07	Equipment operator	---	hr	36'943	8.14		300'714	-
3.08	Operator's helper	---	hr	36'943	4.48		165'504	-
3.09	Vibratorman	---	hr	33'458	2.26		75'614	-
3.10	General works, skilled	---	hr	60'832	4.48		272'527	-
3.11	General works, semiskilled	---	hr	68'436	2.26		154'665	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	88'967	20.36	0.29	1'811'364	25'800
4.02	Formwork for structures, finish F1 & F2	---	m^2	11'406	21.52	2.38	245'457	27'146
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	10'000	5.54	0.82	55'400	8'200
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	627	11.81		7'409	-
6.02	Skilled	---	hr	5'019	4.48		22'484	-
6.03	Semiskilled	---	hr	10'037	2.28		22'885	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	0.02%			5'621	394
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			140'521	9'597
Sub-total				-->>			20'760'471	1'990'618
Construction Contingencies			%	2.00%	-------------------------->>		415'209	39'812
Total Direct Costs				-->>			21'175'680	2'030'430
Overhead and Profit			%	48.00%	-------------------------->>		11'138'933	
Unit price in Currency Portions			m^3	**380'200**	-------------------------->>		**84.99**	**5.34**
AGGREGATE UNIT PRICE			m^3	--->>				**90.33**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-14*
CIVIL WORKS COST ESTIMATE
LEFT BANK CONCRETE - POWERHOUSE DIVIDING WALLS (CONVENTIONAL CONCRETE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	38'000	32.04	0.00	1'217'556	16
1.02	Water reducing-retarding admixture	---	kg	34'200	1.58		54'036	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	3'691	71.76		264'833	-
		R	hr	738	20.45		15'094	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	-	36.20	29.76	-	-
		R	hr	-	10.88	8.91	-	-
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	-	33'011.77	51'788.38	-	-
		O&R	hr	-	58.84	46.98	-	-
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	-	3.59		-	-
		R	hr	-	3.33		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	-	62.40	79.52	-	-
	(including 10 m3 capacity auger-belt feeder)	R	hr	-	45.20	64.94	-	-
2.06	Electric powered concrete pump, 63 kW	O	hr	1'900	35.82		68'058	-
	(including delivery pipeline)	R	hr	380	21.91		8'326	-
2.07	Foreman	---	hr	1'537	11.81		18'157	-
2.08	Equipment operator	---	hr	6'150	8.14		50'058	-
2.09	Operator's helper	---	hr	6'150	4.48		27'550	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	15'200	0.51	0.77	7'752	11'704
		R	hr	3'800	0.35	0.69	1'330	2'622
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	2'234'400	0.06		134'064	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	18'544	0.41		7'603	-
3.06	Foreman	---	hr	5'795	11.81		68'439	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	33'440	2.26		75'574	-
3.10	General works, skilled	---	hr	6'080	4.48		27'238	-
3.11	General works, semiskilled	---	hr	6'840	2.26		15'458	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	5'320	20.36	0.29	108'315	1'543
4.02	Formwork for structures, finish F1 & F2	---	m^2	1'140	21.52	2.38	24'533	2'713
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	3'700	5.54	0.82	20'498	3'034
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	539	11.81		6'367	-
6.02	Skilled	---	hr	4'313	4.48		19'322	-
6.03	Semiskilled	---	hr	8'626	2.28		19'667	-
7	**Overbreak, Overthickness and Waste**						2'259'829	21'632
7.01	Overbreak (including related cement cost)	---	%	15.00%			526'288	2'790
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			17'543	72
Sub-total				-->>			2'803'660	24'493
Construction Contingencies			%	2.00%	------------------------->>		56'073	490
Total Direct Costs				-->>			2'859'733	24'983
Overhead and Profit			%	48.00%	------------------------->>		1'384'664	
Unit price in Currency Portions			**m^3**	**38'000**	------------------------->>		**111.69**	**0.66**
AGGREGATE UNIT PRICE			**m^3**	-->>				**112.35**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-15*
CIVIL WORKS COST ESTIMATE
LEFT BANK CONCRETE - POWERHOUSE DIVIDING WALLS (RCC)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	334'000	32.04	0.00	10'701'679	137
1.02	Water reducing-retarding admixture	---	kg	300'600	1.58		474'948	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	-	71.76		-	-
		R	hr	-	20.45		-	-
2.02	Rear tipper, 28 t pay load	O	hr	15'105	62.49		943'904	-
		R	hr	3'021	18.75		56'643	-
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	-	33'011.77	51'788.38	-	-
		O&R	hr	-	58.84	46.98	-	-
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	-	3.59		-	-
		R	hr	-	3.33		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	167	62.40	79.52	10'421	13'280
	(including 10 m3 capacity auger-belt feeder)	R	hr	33	45.20	64.94	1'510	2'169
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	4'246	11.81		50'142	-
2.08	Equipment operator	---	hr	16'799	8.14		136'744	-
2.09	Operator's helper	---	hr	17'166	4.48		76'906	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	4'453	22.31	22.49	99'354	100'155
		R	hr	891	9.02	13.16	8'034	11'721
3.02	Smooth drum vibrating roller, weight 10.84 t	O	hr	1'340	34.70		46'489	-
		R	hr	268	15.24		4'084	-
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	11'133	51.69	19.31	575'482	214'985
	with 120 mm dia. hydraulic type framed vibrators	R	hr	2'227	32.00	16.41	71'253	36'540
3.04	Compressed air including distribution pipeline	---	m^3	668'000	0.06		40'080	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	59'140	0.41		24'248	-
3.06	Foreman	---	hr	18'481	11.81		218'265	-
3.07	Equipment operator	---	hr	17'145	8.14		139'563	-
3.08	Operator's helper	---	hr	17'145	4.48		76'811	-
3.09	Vibratorman	---	hr	-	2.26		-	-
3.10	General works, skilled	---	hr	53'440	4.48		239'411	-
3.11	General works, semiskilled	---	hr	60'120	2.26		135'871	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	47'762	20.36	0.29	972'434	13'851
4.02	Formwork for structures, finish F1 & F2	---	m^2	13'026	21.52	2.38	280'320	31'002
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.54	0.82	-	-
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	380	11.81		4'487	-
6.02	Skilled	---	hr	3'039	4.48		13'617	-
6.03	Semiskilled	---	hr	6'079	2.28		13'860	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	0.01%			2'256	42
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			112'814	1'895
Sub-total				--->>			15'481'055	425'777
Construction Contingencies			%	1.50%	-------------------------->>		232'216	6'387
Total Direct Costs				--->>			15'713'271	432'163
Overhead and Profit			%	48.00%	-------------------------->>		7'749'808	
Unit price in Currency Portions			m^3	**334'000**	-------------------------->>		**70.25**	**1.29**
AGGREGATE UNIT PRICE			m^3	--->>				**71.54**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-16*

CIVIL WORKS COST ESTIMATE

LEFT BANK CONCRETE - WALL BETWEEN POWERHOUSE AND ROCKFILL DAM (CONVENTIONAL CONCRETE)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	3'600	32.04	0.00	115'347	1
1.02	Water reducing-retarding admixture	---	kg	3'240	1.58		5'119	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	70	71.76		5'018	-
		R	hr	14	20.45		286	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	130	36.20	29.76	4'715	3'876
		R	hr	26	10.88	8.91	283	232
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	-	33'011.77	51'788.38	-	-
		O&R	hr	-	58.84	46.98	-	-
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	-	3.59		-	-
		R	hr	-	3.33		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	-	62.40	79.52	-	-
	(including 10 m3 capacity auger-belt feeder)	R	hr	-	45.20	64.94	-	-
2.06	Electric powered concrete pump, 63 kW	O	hr	36	35.82		1'290	-
	(including delivery pipeline)	R	hr	7	21.91		158	-
2.07	Foreman	---	hr	65	11.81		767	-
2.08	Equipment operator	---	hr	260	8.14		2'115	-
2.09	Operator's helper	---	hr	260	4.48		1'164	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	1'440	0.51	0.77	734	1'109
		R	hr	360	0.35	0.69	126	248
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	211'680	0.06		12'701	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	1'757	0.41		720	-
3.06	Foreman	---	hr	549	11.81		6'484	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	3'168	2.26		7'160	-
3.10	General works, skilled	---	hr	576	4.48		2'580	-
3.11	General works, semiskilled	---	hr	648	2.26		1'464	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	3'060	20.36	0.29	62'302	887
4.02	Formwork for structures, finish F1 & F2	---	m^2	288	21.52	2.38	6'198	685
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2	4'100	5.54	0.82	22'714	3'362
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	21	11.81		247	-
6.02	Skilled	---	hr	167	4.48		750	-
6.03	Semiskilled	---	hr	335	2.28		763	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	8.00%			20'772	563
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			1'298	27
Sub-total				-->>			283'275	10'992
Construction Contingencies			%	2.00%	-------------------------->>		5'666	220
Total Direct Costs				-->>			288'941	11'212
Overhead and Profit			%	48.00%	-------------------------->>		144'073	
Unit price in Currency Portions			m^3	**3'600**	-------------------------->>		**120.28**	**3.11**
AGGREGATE UNIT PRICE			m^3	--->>				**123.40**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-17*

CIVIL WORKS COST ESTIMATE

LEFT BANK CONCRETE - WALL BETWEEN POWERHOUSE AND ROCKFILL DAM (RCC)

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST L.C.P (US$ eq.)	UNIT COST F.C.P. (US$)	TOTAL COST L.C.P (US$ eq.)	TOTAL COST F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	74'000	32.04	0.00	2'371'031	30
1.02	Water reducing-retarding admixture	---	kg	66'600	1.58		105'228	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	-	71.76		-	-
		R	hr	-	20.45		-	-
2.02	TruckRear tipper, 28 t pay load	O	hr	3'347	62.49		209'128	-
		R	hr	669	18.75		12'550	-
2.03	Tower crane, h=66 m, jib=55m, capacity 14.8 t	O&R	m.th	-	33'011.77	51'788.38	-	-
		O&R	hr	-	58.84	46.98	-	-
2.04	Concrete hydraulic operated bucket, 5.0 m^3	O	hr	-	3.59		-	-
		R	hr	-	3.33		-	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	74	62.40	79.52	4'618	5'884
	(including 10 m3 capacity auger-belt feeder)	R	hr	15	45.20	64.94	669	961
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	961	11.81		11'350	-
2.08	Equipment operator	---	hr	3'763	8.14		30'628	-
2.09	Operator's helper	---	hr	3'925	4.48		17'586	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	987	22.31	22.49	22'013	22'190
		R	hr	197	9.02	13.16	1'780	2'597
3.02	Smooth drum vibrating roller, weight 10.84 t	O	hr	310	34.70		10'769	-
		R	hr	62	15.24		9'445	-
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	2'467	51.69	19.31	127'502	47'631
	with 120 mm dia. hydraulic type framed vibrators	R	hr	493	32.00	16.41	15'787	8'096
3.04	Compressed air including distribution pipeline	---	m^3	148'000	0.06		8'880	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	13'103	0.41		5'372	-
3.06	Foreman	---	hr	4'095	11.81		48'358	-
3.07	Equipment operator	---	hr	3'799	8.14		30'921	-
3.08	Operator's helper	---	hr	3'799	4.48		17'018	-
3.09	Vibratorman	---	hr	-	2.26		-	-
3.10	General works, skilled	---	hr	11'840	4.48		53'043	-
3.11	General works, semiskilled	---	hr	13'320	2.26		30'103	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	22'200	20.36	0.29	451'992	6'438
4.02	Formwork for structures, finish F1 & F2	---	m^2	2'220	21.52	2.38	47'774	5'284
4.03	Formwork for structures, finish F3	---	m^2	-	25.84	2.66	-	-
4.04	Formwork for structures, finish F4	---	m^2	-	29.60	2.70	-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.54	0.82	-	-
5.02	Concrete slab type scaffolding	---	m^3		5.83	1.05	-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	194	11.81		2'294	-
6.02	Skilled	---	hr	1'554	4.48		6'962	-
6.03	Semiskilled	---	hr	3'108	2.28		7'086	-
7	**Overbreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%	0.03%			1'501	30
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			25'014	437
Sub-total				--------------------------------------->>			3'666'187	99'578
Construction Contingencies			%	1.50%	------------------------->>		54'993	1'494
Total Direct Costs				--------------------------------------->>			3'721'180	101'072
Overhead and Profit			%	48.00%	------------------------->>		1'834'681	
Unit price in Currency Portions			m^3	**74'000**	------------------------->>		**75.08**	**1.37**
AGGREGATE UNIT PRICE			m^3	-->>				**76.45**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-18*
CIVIL WORKS COST ESTIMATE
LEFT BANK CONCRETE - POWERHOUSE DENTAL CONCRETE

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COST		TOTAL COST	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**Mixed Concrete**							
1.01	Concrete at the batching and mixing plant	---	m3	9'600	18.82	0.00	180'700	1
1.02	Water reducing-retarding admixture	---	kg	8'640	1.31		11'318	-
2	**Transport and Placing**						-	-
2.01	Truck concrete mixer, 10 m3 capacity	O	hr	1'146	71.76		82'214	-
		R	hr	229	20.45		4'686	-
2.02	Truck concrete screw agitator, 10.6 m^3 capacity	O	hr	-	36.20	29.76	-	-
		R	hr	-	10.88	8.91	-	-
2.03	Tower crane, h=47m, jib=68m, capacity 9.4 t	O&R	m.th	0.32	36'853.18	45'852.73	11'959	14'880
		O&R	hr	91	57.06	42.98	5'217	3'930
2.04	Concrete hydraulic operated bucket, 6.0 m^3	O	hr	0	4.31		1	-
		R	hr	0	3.99		0	-
2.05	Mobile belt c. "Rotec Crater Crane CC-200.24."	O	hr	-	62.40	79.52	-	-
	(including 10 m3 capacity auger-belt feeder)	R	hr	-	45.20	64.94	-	-
2.06	Electric powered concrete pump, 63 kW	O	hr	-	35.82		-	-
	(including delivery pipeline)	R	hr	-	21.91		-	-
2.07	Foreman	---	hr	340	11.81		4'020	-
2.08	Equipment operator	---	hr	1'361	8.14		11'080	-
2.09	Operator's helper	---	hr	1'362	4.48		6'103	-
3	**Pouring and Vibration**							
3.01	Bulldozer with straight type blade, 52 kW	O	hr	-	22.31	22.49	-	-
		R	hr	-	9.02	13.16	-	-
3.02	Air powered immersion type vibrator, 87 mm d.	O	hr	3'840	0.51	0.77	1'958	2'957
		R	hr	960	0.35	0.69	336	662
3.03	Hydraulic excavator for large s. vibrators, 67 kw	O	hr	-	51.69	19.31	-	-
	with 120 mm dia. hydraulic type framed vibrators	R	hr	-	32.00	16.41	-	-
3.04	Compressed air including distribution pipeline	---	m^3	564'480	0.06		33'869	-
3.05	Lighting of working area, 2000 W floodlight	---	hr	4'416	0.41		1'811	-
3.06	Foreman	---	hr	1'380	11.81		16'298	-
3.07	Equipment operator	---	hr	-	8.14		-	-
3.08	Operator's helper	---	hr	-	4.48		-	-
3.09	Vibratorman	---	hr	8'448	2.26		19'092	-
3.10	General works, skilled	---	hr	1'152	4.48		5'161	-
3.11	General works, semiskilled	---	hr	1'440	2.26		3'254	-
4	**Formworks**							
4.01	Steel panel formwork (mass concrete type)	---	m^2	-	16.78		-	-
4.02	Formwork for structures, finish F1 & F2	---	m^2	-	22.73		-	-
4.03	Formwork for structures, finish F3	---	m^2	-	27.56		-	-
4.04	Formwork for structures, finish F4	---	m^2	-	31.32		-	-
5	**Scaffolding**							
5.01	Wall type scaffolding	---	m^2		5.26		-	-
5.02	Concrete slab type scaffolding	---	m^3		5.67		-	-
6	**Finishing and Curing**							
6.01	Foreman	---	hr	-	11.81		-	-
6.02	Skilled	---	hr	-	4.48		-	-
6.03	Semiskilled	---	hr	-	2.28		-	-
7	**Overkreak, Overthickness and Waste**							
7.01	Overbreak (including related cement cost)	---	%					
7.02	Overtickness and waste (includ. r. cement cost)	---	%	0.50%			3'022	112
Sub-total				------------------------------------->>			402'100	22'541
Construction Contingencies			%	2.00%	------------------------>>		8'042	451
Total Direct Costs				------------------------------------->>			410'142	22'992
Overhead and Profit			%	48.00%	------------------------>>		207'905	
Unit price in Currency Portions			m^3	**9'600**	------------------------>>		**64.38**	**2.40**
AGGREGATE UNIT PRICE			m^3	-->>				**66.77**

RIO MADEIRA HYDROPOWER DEVELOPMENT - SANTO ANTONIO HYDROLECTRIC PROJECT *TABLE 8-19*
CIVIL WORKS COST ESTIMATE
PORTLAND CEMENT AND NATURAL POZZOLAN

N°	DESCRIPTION	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
				L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**PORTLAND CEMENT IN 50 KG BAGS**						
1.1	Cement at the Site	t	1.00	127.53		127.53	
1.2	Overhead and profit	%	48.00%			61.22	
	Unit Price ------------->>	**-------**	**---------->**	**---------->**	**---------->**	**188.75**	
2	**PORTLAND CEMENT IN 1.5 T BAGS**						
2.1	Cement at the Site excluding bags	t	1.00	108.97		108.97	-
2.2	Plastic bags for cement, 2 t max. capacity	ea	1.00	270.07			
2.3	Cost of bags assuming 10 uses & 1.5 t/bag	ea	1.00	18.00		18.00	-
	Subtotal					126.97	-
2.4	Overhead and profit	%	48.00%			60.95	
	Unit Price ------------->>	**-------**	**---------->**	**---------->**	**---------->**	**187.92**	**-**
3	**NATURAL POZZOLAN IN 1.5 T BAGS**						
3.1	Pozzolan at the Site excluding bags	t	1.00	99.57		99.57	-
3.2	Plastic bags for cement, 2 t max. capacity	ea	1.00	270.07			
3.3	Cost of bags assuming 10 uses & 1.5 t/bag	ea	1.00	18.00		18.00	-
	Subtotal					117.57	-
3.4	Overhead and profit	%	48.00%			56.44	
	Unit Price ------------->>	**-------**	**---------->**	**---------->**	**---------->**	**156.01**	**-**
	Remark:						
	The cement parices are the average of the						
	quotations of the cement factories which are						
	located in Capanamena, Itaituba and Manaus						

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-20*
CIVIL WORKS COST ESTIMATE
REINFORCING STEEL

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS L.C.P (US$ eq.)	UNIT COSTS F.C.P. (US$)	TOTAL COSTS L.C.P (US$ eq.)	TOTAL COSTS F.C.P. (US$)
1	**CUTTING AND BENDING**							
1.1	**Labour**							
1.1.01	Foreman	----	hr	426'989	11.81		5'042'740	-
1.1.02	Re-steel workmanship, specialist	----	hr	684'885	5.76		3'944'938	-
1.1.03	Re-steel workmanship, skilled	----	hr	1'095'816	3.39		3'714'816	-
1.1.04	Re-steel workmanship, semiskilled	----	hr	1'369'770	3.39		4'643'520	-
1.1.05	Equipment operator	----	hr	13'561	8.14		110'384	-
1.1.06	Operator's helper	----	hr	13'561	4.48		60'752	-
1.1.07	General services, skilled	----	hr	79'440	4.48		355'890	-
1.1.08	General services, semiskilled	----	hr	158'880	2.26		359'068	-
1.2	**Equipment**							
1.2.01	Bar bending and cutting machine	O	hr	152'197	2.96		450'502	-
		R	hr	30'439	1.82		55'400	-
1.2.02	Rought terrain crane, 30 tons	O	hr	12'328	97.97		1'207'767	-
		R	hr	3'082	64.65		199'250	-
1.3	**Materials**							
1.3.01	Deformed type steel bars type CA-50	----	t	136'977	1'990.00		272'584'230	-
1.3.02	Workmanship cutting scrap	----	t	9'588	1'990.00		19'080'896	-
2	**TRANSPORT AND PLACING**							
2.1	**Labour**							
2.1.01	Foreman	----	hr	658'907	11.81		7'781'695	-
2.1.02	Driver	----	hr	32'874	11.81		388'248	-
2.1.03	Crane operator	----	hr	11'999	11.81		141'710	-
2.1.04	Operator's helper	----	hr	89'747	11.81		1'059'916	-
2.1.05	Re-steel fixing, specialist	----	hr	2'054'655	5.76		11'834'813	-
2.1.06	Re-steel fixing, skilled	----	hr	1'369'770	4.48		6'136'570	-
2.1.07	Re-steel fixing, semiskilled	----	hr	1'712'213	2.26		3'869'600	
2.2	**Equipment**							
2.2.01	Flat bed truck, 25 t pay load	O	hr	27'395	52.85		1'447'847	-
		R	hr	5'479	19.76		108'267	-
2.2.02	Rought terrain crane, 30 tons	O	hr	3'287	97.97		322'071	-
		R	hr	657	64.65		42'507	-
2.2.03	Rail mounted tower crane, 814 t/m	O	hr	6'712	79.97	143.98	536'748	966'375
2.3	**Materials**							
2.3.01	Black wire	----	kg	547'908	2.21		1'210'877	-
2.3.02	Stirrups and other steel bars	----	kg	109'582	1.69		185'193	-
Sub-total				----------->			346'876'215	966'375
Construction Contingencies			%	1.50%	----------->>		5'203'143	14'496
Total Direct Costs				----------->			352'079'359	980'871
Overhead and Profit on Steel Supply			%	48.00%	----------->>		171'495'601	
Unit Price in Currency Portions			**t**	**136'977**	----------->>		**3'822.36**	**7.16**
AGGREGATE UNIT PRICE			**t**	-----------				**3'829.52**

RIO MADEIRA HYROPOWER DEVELOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE 8-21*
CIVIL WORKS COST ESTIMATE
GROUTED BARS FOR CONCRETE ANCHORING, 32 MM DIAMETER

N°	DESCRIPTION	AUX.	UNIT	QUANTITY	UNIT COSTS		TOTAL COSTS	
					L.C.P (US$ eq.)	F.C.P. (US$)	L.C.P (US$ eq.)	F.C.P. (US$)
1	**BOREHOLE**							
1.1	**Labour**							
1.1.01	Foreman	---	hr	1'328	11.81		15'689	
1.1.02	Wagon drill operator	---	hr	2'834	8.14		23'069	
1.1.03	Operator's helper	---	hr	5'668	4.48		25'393	
1.1.04	General services, skilled	---	hr	850	4.48		3'809	
1.1.05	General services, semiskilled	---	hr	1'275	2.26		2'882	
							-	
1.2	**Equipment**						-	-
							-	-
1.2.01	Wagon drill, 48 kW	O	hr	2'362	23.81	32.02	56'231	75'621
		R	hr	472	13.65	26.67	6'447	12'597
1.2.02	Button bit grinder grinder	O	hr	28	2.74	1.37	78	39
		R	hr	6	0.81	1.28	5	7
1.3	**Materials**							
1.3.01	Wagon drill sank adaptor	---	ea	18		396.12	-	7'016
1.3.02	Wagon drill 4,915 mm long rod	---	ea	18		612.81	-	10'854
1.3.03	Wagon drill 51 mm button type bit	---	ea	57		162.86	-	9'231
2	**BAR PLACING**							
2.1	**Labour**							
2.1.01	Foreman	---	hr	3'543	11.81		41'837	
2.1.02	Skilled	---	hr	7'085	4.48		31'741	
2.1.03	Semiskilled	---	hr	21'255	2.26		48'036	
2.2	**Materials**							
2.2.01	Deformed type steel bar	---	m	28'340	15.19		430'485	
2.2.02	Non-shrink mortar	---	kg	38'259	1.73		66'188	
							-	
Sub-total --->>							751'889	115'365
Construction Contingencies			%	3.00%	---------------------------->>		22'557	3'461
Total Direct Costs --->>							774'446	118'826
Overhead and Profit			%	48.00%	--------------------------->>		428'770	
Unit price in Currency Portions			**m**	**28'340**	**---------------------------->>**		**42.46**	**4.19**
AGGREGATE UNIT PRICE			**m**	**--->**				**46.65**

SECTION VI

PRICE LIST

1 General

Section VI of the report includes the list of the unit prices that have been applied to the Bill of Quantities included in Section VII of the Cost Estimate.

The unit prices of the main works to be carried out are those of the detailed analyses included in Section V. The unit prices of minor works have been established partly from analogy with the analyzed prices and partly from rates of similar projects.

2 Rates of the List

The list includes the unit prices related to the civil works listed in the Bill of Quantities given in Section VII and to other works deemed necessary for the construction of the plant. In particular the price list covers the items of the following works:

- Land clearing and grubbing
- Excavations
- Protection of common excavation slopes and channel bed
- Construction of auxiliary cofferdams
- Removal of auxiliary cofferdams
- Fills for dam and dam cofferdams
- Concrete works
- Dewatering
- Drilling and grouting
- General construction works.

3 Price List

The Price List is composed of the five (5) sheets which follow.

The rates of the items are given in local and foreign currency according to the splitting established by the unit price analyzes and given in Section V.

RIO MADEIRA HDROPOWER DEVELEOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT
CIVIL WORKS COST ESTIMATE
PRICE LIST

TABLE PL-1

N°	DESCRIPTION	UNIT	UNIT PRICE Local Currency (US$ eq.)	%	Foreign Currency (US$)	%	AGGREGATE UNIT PRICE (US$)
1	**LAND CLEARING AND GRUBBING**						
01:01	**Clearing:**						
	a) Sparse vegetation	ha	500.00	100%			500.00
	b) Medium density vegetation	ha	1'150.00	100%			1'150.00
	c) Dense vegetation	ha	3'000.00	100%			3'000.00
01:02	**Grubbing:**						
	a) Sparse vegetation	ha	165.00	100%			165.00
	b) Medium density vegetation	ha	380.00	100%			380.00
	c) Dense vegetation	ha	990.00	100%			990.00
2	**EXCAVATION**						
2.1	**Roads:**						
	a) Common, general excavation	m^3	4.40	100%			4.40
	b) Common, trench excavation	m^3	11.00	100%			11.00
	c) Rock, general excavation	m^3	9.20	100%			9.20
	d) Rock, trench excavation	m^3	23.50	100%			23.50
2.2	**Powerhouse Headrace Channel:**						
	a) Topsoil removal and stockpiling in left bank disposal area No. 1	m^3	4.16	81%	1.00	19%	5.16
	b) Common excavation, transport to left bank disposal area No. 1	m^3	3.72	75%	1.23	25%	4.95
	c) Common excavation, transport to fills of left bank area	m^3	2.47	77%	0.74	23%	3.21
	d) Rock excavation, transport to left bank disposal area No. 1	m^3	7.91	78%	2.21	22%	10.12
	e) Rock excavation, transport to fills of left bank area	m^3	6.34	80%	1.59	20%	7.93
2.3	**Power Intakes and Generating Units:**						
	a) Topsoil removal and stockpiling in left bank disposal area No. 1	m^3	4.59	80%	1.15	20%	5.74
	b) Common excavation, transport to left bank disposal area No. 1	m^3	4.06	75%	1.36	25%	5.42
	c) Rock excavation, normal blsting, transport to left bank disposal area No.	m^3	8.35	78%	2.39	22%	10.74
	d) Rock excav., normal blasting, transport to l.b. c. aggregates plant stockp	m^3	8.29	78%	2.37	22%	10.66
	e) Rock excav., controlled blasting, transport to l.b. aggregates plant stock	m^3	9.57	78%	2.70	22%	12.27
2.4	**Wall Between Powerhouse and Rockfill Dam:**						
	a) Common excavation, transport to left bank disposal area No. 1	m^3	4.06	75%	1.36	25%	5.42
	b) Rock excavation, normal, transport to left bank disposal area No. 1	m^3	8.35	78%	2.39	22%	10.74
2.5	**Powerhouse Tailrace Channel:**						
	a) Topsoil removal and stockpiling in left bank disposal area No. 1	m^3	4.58	80%	1.15	20%	5.73
	b) Common excavation, transport to left bank disposal area No. 1	m^3	4.20	75%	1.42	25%	5.62
	c) Common excavation, transport to fills of left bank area	m^3	2.47	77%	0.74	23%	3.21
	d) Soft material excavation (mud dredging), pumping to left bank d. area No	m^3	7.52	100%			7.52
	e) Rock excavation, transport to left bank disposal area No. 1	m^3	8.55	78%	2.47	22%	11.02
2.6	**Rockfill Dam:**						
	a) Rock excavation, transport to right bank stockpile area No. 1	m^3	9.80	76%	3.10	24%	12.90
	b) Removal of loose rock fragments from foundation	m^3	5.90	74%	2.10	26%	8.00
2.7	**Spillway Approach Channel:**						
	a) Topsoil removal and stockpiling in right bank disposal area No. 1	m^3	3.63	82%	0.79	18%	4.42
	b) Common excavation, tranport to right bank disposal area No. 1	m^3	3.19	76%	1.02	24%	4.21
	c) Common excavation, tranport to right bank disposal area No. 2	m^3	4.92	74%	1.70	26%	6.62
	d) Rock excavation, transport to right bank stockpile area No. 1	m^3	7.83	78%	2.19	22%	10.02
	e) Rock excavation, transport to fills of the right bank area.	m^3	6.34	80%	1.59	20%	7.93
2.8	**Spillway Structure and Realated Walls:**						
	a) Topsoil removal and stockpiling in right bank disposal area No. 1	m^3	4.33	80%	1.06	20%	5.39
	b) Common excavation, transport to right bank disposal area No. 2	m^3	5.76	74%	2.04	26%	7.80
	c) Rock excavation, transport to right bank stockpile area No. 1:						
	c1) Excavation with normal blasting	m^3	7.25	79%	1.95	21%	9.20
	c2) Excavation with controlled blasting	m^3	8.44	79%	2.25	21%	10.69

RIO MADEIRA HDROPOWER DEVELEOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT
CIVIL WORKS COST ESTIMATE
PRICE LIST

TABLE PL-1

N°	DESCRIPTION	UNIT	UNIT PRICE Local Currency (US$ eq.)	%	UNIT PRICE Foreign Currency (US$)	%	AGGREGATE UNIT PRICE (US$)
2.9	**Spillway Discharge Channel:**						
	a) Topsoil removal and stockpiling in right bank.disposal area No. 1	m^3	4.33	80%	1.06	20%	5.39
	b) Common excavation, tranport to right bank disposal area No. 2	m^3	5.76	74%	2.04	26%	7.80
	d) Rock excavation in dry conditions, transport to right bank stockpile No. 1	m^3	6.99	79%	1.85	21%	8.84
	d) Rock excavation in water, transport to dam downstream cofferdam toe	m^3	31.86	95%	1.59	5%	33.45
2.10	**Spillway Right Bank Closure Embankment:**						
	b) Common excavation, tranport to right bank disposal area No. 2	m^3	5.63	72%	2.16	28%	7.79
2.11	**Mato Grosso Stream Closure Dike on Right Bank:**						
	a) Topsoil removal and stockpiling in right bank.disposal area No. 1	m^3	4.24	79%	1.15	21%	5.39
	b) Common excavation, tranport to right bank disposal area No. 2	m^3	5.70	72%	2.20	28%	7.90
2.12	**Diversion Tunnel of Mato Grosso Creek:**						
	a) Common excavation, tranport to right bank disposal area No. 2	m^3	6.50	74%	2.33	26%	8.83
	b) Common excavation, tranport to a close area for reuse in backfill	m^3	2.53	75%	0.85	25%	3.38
2.14	**Operator's Village:**						
	a) Common excavation, general	m^3	4.40	100%			4.40
	b) Common excavation, trench	m^3	11.00	100%			11.00
2.15	**Dock Yards:**						
	a) Common excavation in dry	m^3	5.20	100%			5.20
	b) Common excavation in water	m^3	6.30	100%			6.30
2.16	**Miscellaneous:**						
	a) Rock pre-splitting	m^2	14.91	69%	6.69	31%	21.60
3	**PROTECTION OF SLOPES AND CHANNEL BEDS**						
3.1	**Protection of Slopes in Common Excavation:**						
	a) Rockfill, rock from required excavation	m^3	3.44	91%	0.32	9%	3.76
	b) Transition, rock from required excavation	m^3	17.67	92%	1.46	8%	19.13
3.2	**Protection of Channel Bed in Common Excavation:**						
	a) Rockfill, rock from required excavation	m^3	2.17	100%			2.17
	b) Transition, rock from required excavation	m^3	13.35	93%	1.03	7%	14.38
3.3	**Protection of Rock Excavation Slopes:**						
	a) Rock bolts, 26.5 mm diameter	m	36.22	90%	4.19	10%	40.41
	b) Shotcrete, 15 cm thickness	m^2	31.54	97%	1.13	3%	32.67
	c) Welded wire fabric, weight 3.00 kg/m^2	m^2	21.78	100%			21.78
4	**AUXILIARY COFFERDAMS - CONSTRUCTION**						
4.1	**Cofferdams - Auxiliaries No. 1, 2, 3,& 4:**						
	a) Compacted clayfill, clay from right bank.borrow areas	m^3	5.88	82%	1.31	18%	7.19
	b) Clayfill placed in water, clay from right bank borrow areas	m^3	6.85	82%	1.46	18%	8.31
	c) Rockfill dumped into water, rock from required excavation	m^3	1.50	100%			1.50
	d) Compacted transition, rock from required excavation	m^3	14.37	91%	1.45	9%	15.82
	e) Rip-rap, rock from required excavation	m^3	14.15	87%	2.18	13%	16.33
4.2	**Cofferdams - Auxiliaries No. 5, 6, & 7:**						
	a) Compacted clayfill, clay from left bank borrow area	m^3	6.05	81%	1.38	19%	7.43
	b) Clayfill placed in water, clayl from left bank borrow area	m^3	6.85	82%	1.46	18%	8.31
	c) Rockfill dumped into water, rock from required excavation	m^3	1.50	100%			1.50
	d) Compacted transition, rock from required excavation	m^3	14.37	91%	1.45	9%	15.82
	e) Transition placed in water, rock from required excavation	m^3	14.71	92%	1.36	8%	16.07
	f) Rip-rap, rock from required excavation	m^3	14.15	87%	2.18	13%	16.33
4.3	**Cofferdams - Auxiliaries No. 8, 9, 10 & 11:**						
	a) Compacted clayfill, clay from left bank.borrow area	m^3	6.33	81%	1.49	19%	7.82
	b) Compacted transition, rock from required excavation	m^3	14.37	91%	1.45	9%	15.82
	c) Rip-rap, rock from required excavation	m^3	14.15	87%	2.18	13%	16.33

RIO MADEIRA HDROPOWER DEVELEOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT
CIVIL WORKS COST ESTIMATE
PRICE LIST

TABLE PL-1

N°	DESCRIPTION	UNIT	UNIT PRICE Local Currency (US$ eq.)	%	Foreign Currency (US$)	%	AGGREGATE UNIT PRICE (US$)
5	**AUXILIARY COFFERDAMS - REMOVAL**						
5.1	**Right Bank Cofferdams, Auxiliary 1, 2, 3 & 4:**						
	a) Removal and transport to right bank disposal area No. 2	m^3	5.65	73%	2.06	27%	7.71
5.2	**Left Bank Cofferdams, Auxiliary 5, 6 & 7:**						
	a) Removal and transport to left bank disposal area No. 1	m^3	4.01	74%	1.42	26%	5.43
5.3	**Powerhouse Cofferdams, Auxiliary 9, 9, 10 & 11:**						
	a) Removal in dry conditions & transport to right bank disposal area No. 2	m^3	6.70	72%	2.64	28%	9.34
	b) Removal in water & transport to right bank disposal area No. 2	m^3	7.70	73%	2.81	27%	10.51
6	**FILLS FOR DAM AND DAM COFFERDAMS**						
6.1	**Cofferdams - First Stage:**						
	a) Compacted rockfill, rock from right bank stockpile No. 1	m^3	6.21	80%	1.58	20%	7.79
	b) Rockfill placed in water, rock from right bank stockpile No.1	m^3	4.65	78%	1.35	23%	6.00
	c) Clayfill placed in water, clay from right bank borrow areas	m^3	6.63	78%	1.88	22%	8.51
	d) Transition placed in water, crushed rock from right bank stockpile No. 1	m^3	15.77	91%	1.64	9%	17.41
	e) Compacted transition, crushed rock from right bank stockpile No. 1	m^3	15.19	90%	1.75	10%	16.94
6.2	**Cofferdams - Second Stage:**						
	a) Compacted rockfill, rock from right bank stockpile No. 1	m^3	6.21	80%	1.58	20%	7.79
	b) Compacted clayfill, clay from right bank borrow areas	m^3	6.15	79%	1.65	21%	7.80
	c) Compacted transition, crushed rock from right bank stockpile No. 1	m^3	15.19	90%	1.75	10%	16.94
6.3	**Dam:**						
	a) Foundation preparation (rock treatment and cleaning)	m^2	9.00	100%			9.00
	b) Rockfill, rock from right bank. Stockpile No. 1	m^3	6.21	80%	1.58	20%	7.79
	c) Clayfill, clay from right bank clay borrow areas	m^3	6.75	80%	1.65	20%	8.40
	d) Fine transition, material from stockpiled sand of right baqnk borrow area	m^3	8.74	76%	2.69	24%	11.43
	e) Coarse transition, crushed rock from right bank stockpile No. 1	m^3	15.19	90%	1.75	10%	16.94
7	**MISCELLANEOUS FILLS**						
7.1	**Spillway Right Bank Closure Embankment:**						
	a) Foudation preparation (soil compaction)	m^2	0.50	100%			0.50
	b) Rockfill, rock from right bank stockpile No. 1	m^3	6.21	80%	1.58	20%	7.79
	c) Clayfill, clay rom right bank borrow areas	m^3	6.75	80%	1.65	20%	8.40
	d) Horizontal fine filter, stockpiled sand from right bank borrow area	m^3	8.72	76%	2.69	24%	11.41
	e) Horizontal coarse filter, crushed rock from right bank stockpile No. 1	m^3	15.19	90%	1.75	10%	16.94
	f) Vertical fine filter, stockpiled sand from right bank borrow area	m^3	9.62	76%	2.96	24%	12.58
	g) Upstream face coarse transition, crushed rock from r.bank stockpile No.	m^3	16.70	90%	1.93	10%	18.63
	h) Rip-rap, rock from right bank stockpile No. 1	m^3	15.95	87%	2.40	13%	18.35
	i) Sodding	m^2	5.50	100%			5.50
7.2	**Mato Grosso Stream Closure Dike on Right Bank:**						
	a) Foudation preparation (soil compaction)	m^2	0.50	100%			0.50
	b) Rockfill, rock from right bank stockpile No. 1	m^3	6.21	80%	1.58	20%	7.79
	c) Clayfill, clay from right bank borrow areas	m^3	6.75	80%	1.65	20%	8.40
	d) Outer faces protection, fine granular material	m^3	9.60	76%	3.00	24%	12.60
	e) Outer faces protection, coarse granular material	m^3	17.70	90%	1.93	10%	19.63
	f) Base course for dike crest	m^3	13.40	88%	1.80	12%	15.20
7.3	**Other Compacted Fills and Backfills:**						
	a) Powerhouse, erection & unloading areas, material from disp. area No. 1	m^3	5.09	80%	1.31	20%	6.40
	b) Powerhouse tailrace channel, material from required excavation	m^3	1.59	100%			1.59
	c) Spillway right-hand side lateral wall, material from disposal area No. 1	m^3	5.68	79%	1.49	21%	7.17
	d) Mato Grosso diversion tunnel backfill, material from tunnel excavation	m^3	3.30	80%	0.80	20%	4.10
	e) Roads	m^3	3.50	100%			3.50
	f) Operator's village	m^3	4.90	100%			4.90

RIO MADEIRA HDROPOWER DEVELEOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT *TABLE PL-1*
CIVIL WORKS COST ESTIMATE
PRICE LIST

N°	DESCRIPTION	UNIT	UNIT PRICE				AGGREGATE UNIT PRICE
			Local Currency (US$ eq.)	%	Foreign Currency (US$)	%	(US$)
8	**CONCRETE**						
8.1	**Roads:**						
	a) Drain ditches	m^3	125.00	100%			125.00
	b) Box culverts	m^3	163.00	100%			163.00
	c) Retaining walls	m^3	90.00	100%			90.00
	d) Paving	m^3	115.00	100%			115.00
8.2	**Powerhouse:**						
	a) Generating units and power intakes	m^3	152.39	93%	10.90	7%	163.29
	b) Main erection areas EA1 to EA4, structural	m^3	114.14	93%	8.26	7%	122.40
	c) Main erection areas EA1 to EA4, mass	m^3	84.99	94%	5.34	6%	90.33
	d) Auxiliary erection area EA5 to EA8, structural	m^3	110.11	93%	8.06	7%	118.17
	e) Auxiliary erection area EA5 to EA8, mass	m^3	84.99	94%	5.34	6%	90.33
	f) Unloading area, mass	m^3	84.99	94%	5.34		90.33
	g) Bridge deck, prestressed concrete beams	m^3	520.00	100%			520.00
	h) Bridge deck, cast-in-situ concrete	m^3	110.00	91%	10.50	9%	120.50
8.3	**Powerhouse Dividing Walls:**						
	a) Conventional concrete	m^3	111.69	99%	0.66	1%	112.35
	b) RCC	m^3	70.25	98%	1.29	2%	71.54
8.4	**Wall Between Powerhouse and Rockfill Dam:**						
	a) Conventional concrete	m^3	120.28	97%	3.11	3%	123.39
	b) RCC	m^3	75.08	98%	1.37	2%	76.45
8.5	**Spillway Side Walls:**						
	a) Conventional concrete	m^3	92.74	96%	3.87	4%	96.61
8.6	**Spillway Structure:**						
	a) Spillway chute	m^3	88.83	93%	6.79	7%	95.62
	b) Slab downstream of chute	m^3	81.71	95%	4.73	5%	86.44
	c) Spillway piers	m^3	114.26	93%	8.44	7%	122.70
	d) Main bridge piers	m^3	121.02	93%	8.81	7%	129.83
	e) Prestressed concrete beams	m^3	520.00	100%			520.00
8.7	**Mato Grosso Diversion Tunnel:**						
	a) Portal concrete	m^3	134.50	98%	3.00	2%	137.50
	b) Tunnel concrete	m^3	120.10	98%	2.66	2%	122.76
8.8	**Dock Yards:**						
	a) Wall concrete	m^3	140.00	100%			140.00
8.9	**Miscellaneous Concrete Works:**						
	a) Cleaning of concrete foundation in rock	m^2	1.50	100%			1.50
	b) Compaction of concrete foundation in soil	m^2	0.40	100%			0.40
	c) Dental concrete, right bank	m^3	58.38	96%	2.40	4%	60.78
	d) Dental concrete, left bank	m^3	54.16	97%	1.79	3%	55.95
	e) Portland cement	t	187.92	100%			187.92
	f) Pozzolan	t	156.01	100%			156.01
	g) Reinforcing steel	t	3'822.36	100%	7.16	0%	3'829.52
	h) Grouted anchor bars, 32 mm diameter	m	42.46	91%	4.19	9%	46.65
	i) Bearing pads for prestressed concrete beams	ea	300.00	100%			300.00
9	**DEWATERING**						
9.1	**Right Bank and River Bed:**						
	a) Rockfill dam foundation	m^3	0.19	100%			0.19
	b) Spillway foundation and channels of spillway	m^3	0.24	100%			0.24
9.2	**Left Bank:**						
	a) Poverhouse power intakes, generating units, and channels	m^3	0.21	100%			0.21

RIO MADEIRA HDROPOWER DEVELEOPMENT - SANTO ANTONIO HYDROELECTRIC PROJECT
CIVIL WORKS COST ESTIMATE
PRICE LIST

TABLE PL-1

N°	DESCRIPTION	UNIT	UNIT PRICE Local Currency (US$ eq.)	%	Foreign Currency (US$)	%	AGGREGATE UNIT PRICE (US$)
10	**DRILLING AND GROUTING**						
10.1	**Boreholes:**						
	a) Consolidation grouting, rotary drilling AX dia.	m	90.00	100%			90.00
	b) Draiange holes, percussion drilling 100 mm dia.	m	110.00	100%			110.00
10.2	**Grouting:**						
	a) Grouting excluding cement	t	250.00	100%			250.00
	b) Setting paker for grouting	ea	45.00	100%			45.00
	c) Portland cement	t	188.75	100%			188.75
	d) Pozzolan	t	156.01	100%			156.01
11	**MISCELLANEOUS WORKS**						
11.1	**Piles and Diaphragms:**						
	a) Concrete piles, 1.20 m diameter	m	315.00	100%			315.00
	b) Concrete diaphragm wall, 0.80 m thick, 20 m deep	m^2	380.00	100%			380.00
	c) Plastic type diaphragm, 0.60 m thick, 25 m deep	m^2	300.00	100%			300.00
	d) Tendons for diaphragm walls, 120 t capacity	m	36.00	100%			36.00
11.2	**Road Construction:**						
	a) Reinforced concrete pipe, 800 mm diameter	m	76.00	100%			76.00
	b) Reinforced concrete pipe, 1000 mm diameter	m	100.00	100%			100.00
	c) Subgrade preparation	m^2	2.50	100%			2.50
	d) Subbase	m^3	15.20	100%			15.20
	e) Base course	m^3	16.00	100%			16.00
	f) Asphalt concrete	m^3	155.00	100%			155.00
11.3	**Road Maintenance:**						-
	a) Moderate traffic, 8 m roadway width	m.th/km	1'260.00	100%			1'260.00
	b) Moderate traffic, 12 m roadway width	m.th/km	1'930.00	100%			1'930.00
	c) Moderate traffic, 15 m roadway width	m.th/km	2'480.00	100%			2'480.00
	d) Heavy traffic, 8 m roadway width	m.th/km	2'100.00	100%			2'100.00
	e) Heavy traffic, 12 m roadway width	m.th/km	3'210.00	100%			3'210.00
	f) Heavy traffic, 15 m roadway width	m.th/km	4'020.00	100%			4'020.00
11.4	**Road Watering:**						
	a) Watering, 8 m roadway width	m.th/km	1'287.00	100%			1'287.00
	b) Watering, 12 m roadway width	m.th/km	1'833.00	100%			1'833.00
	c) Watering, 15 m roadway width	m.th/km	2'172.00	100%			2'172.00
11.5	**Powerhouse Buildings:**						
	a) Administration building	m^2	400.00	100%			400.00
	b) Warehouses	m^2	290.00	100%			290.00
11.6	**Operator's Village:**						
	a) Houses	m^2	300.00	100%			300.00
	b) Offices	m^2	240.00	100%			240.00
	c) Recreation buildings	m^2	220.00	100%			220.00
	d) School	m^2	230.00	100%			230.00
	e) Stores	m^2	200.00	100%			200.00
	f) Market	m^2	250.00	100%			250.00
	g) Fences on concrete foundation	m	155.00	100%			155.00
	h) Gates	kg	4.80	100%			4.80
	i) Paved roads, yards and walkways	m^2	38.00	100%			38.00

SECTION VII

BILL OF QUANTITIES

1 Introduction

The total cost of the Civil Works has been obtained by applying the established unit prices listed in the Price List of Section VI to the quantities listed in the Bill of Quantities of this Section VII.

The lump sums, other than those for Contractor's camps and buildings, have been obtained by means of separate breakdowns inclusive of the main cost components for labor, materials and construction equipment.

The quantities listed in the Bill of Quantities are substantially those included in the Original BOQ of the Feasibility Study dated October 2005 with the changes that are described in the following Chapter 2.

2 Revised Bill of Quantities

2.1 General

In the following paragraphs are commented the main changes to the Original Bill of Quantities that have been considered for the estimate of the civil works.

2.2 Topsoil

No item was included in the Original BOQ related to the topsoil removal and stockpiling.

It was deemed useful to remove where possible the topsoil before performing the common excavation and stockpile the material for the future reinstatement of the areas after the removal of the camps, buildings and other temporary structures.

2.3 Excavations

2.3.1 Volume Splitting

In the Original BOQ the volumes of common and rock excavation have been quoted with single rates in spite of the different work conditions and lengths of transport to the disposal areas and/or stockpiles.

In the Revised BOQ some quantities of both common and rock excavation have been split where necessary in order to estimate the unit prices according to the actual work conditions.

2.3.2 Soft Soil

The Original BOQ includes an item related to excavation in soft soil which according to the information of the geological report as a matter of fact consists of mud.

It has been considered that for the removal and disposal of the mud was necessary to use dredgers and therefore in the Revised BOQ this type of excavation was named "dredging".

2.3.3 Additional Rock Excavation

The quantities of rock excavation given in the Original BOQ for the right bank area have been deemed not sufficient for the rockfills, transitions, rip-raps, and aggregates for concrete to be executed on the right bank area.

A cost comparison has emphasized that the transport of rock from the left bank area to the right bank area was not convenient due to both the length of transport and the slow speed of the dumpers along the floating bridge.

Therefore in the Revised BOQ was included a new item for the additional rock excavation along the Spillway Approach Channel.

2.3.4 Presplitting

Some items of the rock exaction in the Original BOQ were inclusive of the related presplitting.

In order to perform a more accurate cost estimate, the quantities of presplitting in the Revised BOQ have been calculated and quoted separately from the normal blasting for all the excavation where this activity was deem necessary or convenient.

2.4 Tendons

The Original BOQ includes tendons for the anchoring of some concrete walls to the final surfaces of the rock.

As a matter of fact according to the Drawings of the Feasibility Study the anchoring of the concrete walls was designed with normal grouted anchor bars having the hook in the concrete.

In the Revised BOQ the tendons have been substituted with grouted anchor bars.

2.5 Concrete Works

2.5.1 Cooling of Concrete

The Original BOQ specifies the concrete items that have to be cooled and exclude from the cooling all the mass concrete and roller compacted concrete (RCC).

It was deemed that the un-cooled concretes can suffer significant cracking due to too high temperature drops.

In the Revised BOQ the quantities of all concretes except the dental and lean ones have been considered cooled.

2.5.2 Cement for RCC

The cement content for the roller compacted concrete in the Original BOQ was approx. 100 kg/m3.

The above mentioned cement content was deemed too low and therefore in the Revised BOQ the cement content was increased to approx. 150 kg/m3 including the pozzolan.

2.5.3 Volume Splitting – Bridge Decks

In the Original BOQ the concrete volumes of the decks related to the bridges of Powerhouse and Spillway have not been separated from the other structures.

In the Revised BOQ the quantities of the precast beams and the deck of the bridges have been estimated separately from the other structures.

2.5.4 Volume Splitting – Spillway

In the Original BOQ the concrete of the Spillway was quoted with a sole rate except for the dental one.

In the Revised BOQ not only the quantities of precast beams and deck as mentioned before in Paragraph 2.5.4 of the bridges but also the spillway chute, the terminal chute slab and the piers have been estimated separately.

2.5.5 Volume Splitting – Mato Grosso

In the Original BOQ the volumes of the structural concrete for Mato Grosso tunnel have been quoted with a sole rate.

In the Revised BOQ the quantity related to inlet and outlet structures has been separated from the tunnel one.

2.5.6 Pozzolan

The Original BOQ includes the unit prices for “Cement + Fly-Ash” without defining the percentage and rates of the two materials.

From the investigations performed the price of fly-ash at the Site is very high due to the transport distances from the location of the thermal power-plants and the Site while was deemed feasible the use of the natural pozzolan.

In the Revised BOQ the quantity and rates of the Portland cement have been separated from the pozzolan. The quantity of the pozzolan was assumed approx. 15% of that of the cement.

2.6 Protection of Rock Surfaces

The protection of the final rock surfaces in the Original BOQ consists of rock bolts, welded wire fabric and shotcrete with a thickness of 5 cm.

The thickness of the shotcrete and the length of the rock bolts was deemed very limited for the actual of rock formation of the Project area and therefore all the quantities of the rock protections have been revised and increased in the revised BOQ.

2.7 Drilling and Grouting

In the Original BOQ the curtains related to Rockfill dam, Powerhouse and Spillway include only two items, i.e. one for the length of grout boreholes and one for the length of drainage holes.

In the Revised BOQ have been introduced six separate items, i.e. grout boreholes, setting packers for grouting, grouting excluding cement, Portland cement, pozzolan, and drainage holes.

2.8 Buildings for Powerhouse

No building for the Powerhouse was included in the Original BOQ.

In the Revised BOQ an administration building and warehouses deemed necessary for the maintenance of the units have been included.

2.9 Mato Grosso Tunnel

No item was included in the Original BOQ related to the backfilling of the artificial tunnel to be executed with the cut and cover method.

In the Revised BOQ was included the quantity for the backfilling of the tunnel.

2.10 Dewatering

In the Original BOQ the estimate of the dewatering was included considering percentages of the works to be carried out in the area.

In the Revised BOQ the dewatering was based on quantities of water to be pumped considering both the foreseen water inflows and the rain water for the different work-areas. Besides in the Revised BOQ have been included items for the general care of water for the same areas.

2.11 Operator's Village

In the Original BOQ the operator's village was given with a lump sum.

In the Revised BOQ the main work quantities for the construction of the operator's village have been estimated in detail.

2.12 General Construction Costs

2.12.1 Original BOQ

The general construction costs listed in the Original BOQ include the following items:

- Construction of the site roads;
- Construction and maintenance of the temporary camps;
- Construction of an airport for small planes; and
- Reinstatement of the Site areas after the completion of the Works.

2.12.2 Revised BOQ

The general construction costs listed in the Revised BOQ include the following items:

- Mobilization and demobilization of construction equipment;
- Land clearing and grubbing of the construction areas;
- Construction and maintenance of the temporary camps and buildings;

- Construction of site roads;
- Maintenance of site roads;
- Construction of dock yards;
- Construction of temporary power lines;
- Camp removal;
- Reinstatement of the Site areas after the completion of the Works.

3 Bill of Quantities

The Bill of Quantities inclusive of the revisions described before in Chapter 2 is given in the sixteen (16) sheets which follow.

The rates of the items have been filled in according to the local and foreign currency component established in the analyses of the unit prices which are included in Section V.

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
			(1)	Price (2)	Amount (1 x 2)	Price (3)	Amount (1 x 3)	Price (2+3)	Amount (1 x (2+3))
1	**GENERAL CONSTRUCTION COSTS**								
1.1	**Mobilization and Demobilization**								
1.1.01	Mobilization of construction equipment	l.s	------	------	93'000'000	------	------		93'000'000
1.1.02	Demobilization of construction equipment	l.s	------	------	30'150'000	------	------		30'150'000
1.2	**Contractor's Camp**				-				
1.2.01	Construction of camps, offices and appurtenant facilities	l.s	------	------	105'300'000	------	------		105'300'000
1.2.02	Construction of auxiliary buildings and appurtenant facilities	l.s	------	------	33'150'000	------	------		33'150'000
1.2.03	Maintenance of camps, offices and appurtenant facilities:								
	a) Up to the starting of power generation	m.th	49	827'357	40'540'500	------	------	827'357.14	40'540'500
	b) From starting of power generation to Works completion	m.th	21	579'150	12'162'150	------	------	579'150.00	12'162'150
1.2.04	Maintenance of auxiliary buildings and appurtenant facilities:								
	a) Up to the starting of power generation	m.th	49	142'071	6'961'500	------	------	142'071.43	6'961'500
	b) From starting of power generation to Works completion	m.th	21	99'450	2'088'450	------	------	99'450.00	2'088'450
1.3	**Construction of Permanent Roads**								
1.3.01	Paved road from spillway to public road BR 364, roadway width 8.00 m	m	2'700	672	1'814'400	------	------	672.00	1'814'400
1.3.02	Road from operator's village to Powerhouse, roadway width 8.00 m	m	3'200	672	2'150'400	------	------	672.00	2'150'400
1.3.03	Roads from left bank dock yard to Powerhouse, roadway width 12.00 m	m	2'100	983	2'064'300	------	------	983.00	2'064'300
1.4	**Construction of Haul Roads in Ecavation Areas**								
1.4.01	Haul road, 12 m wide roadway	m	2'600	90.00	234'000	------	------	90.00	234'000
1.4.02	Haul road, 15 m wide roadway	m	13'500	110.00	1'485'000	------	------	110.00	1'485'000
1.5	**Construction of Haul Roads off Ecavation Areas**								
1.5.01	Haul road, 8 m wide roadway, paved	m	7'200	672.00	4'838'400	------	------	672.00	4'838'400
1.5.02	Haul road, 8 m wide roadway, unpaved	m	8'700	458.00	3'984'600	------	------	458.00	3'984'600
1.5.03	Haul road, 12 m wide roadway, unpaved	m	2'900	555.00	1'609'500	------	------	555.00	1'609'500
1.5.04	Haul road, 15 m wide roadway, unpaved	m	14'800	629.00	9'309'200	------	------	629.00	9'309'200
1.6	**Floating Bridge Across Rio Madeira**								
1.6.01	Lateral ramps:								
	a) Common excavation	m³	78'000	4.40	343'200	------	------	4.40	343'200
	b) Rock excavation	m³	52'000	9.20	478'400	------	------	9.20	478'400
1.6.02	Modular steel floot type pontoon bridge, 12 m wide	l.s.	------	------	10'300'000	------	------		10'300'000
1.6.03	Operation and maintenance of the bridge	m.th	75	20'000.00	1'500'000	------	------	20'000.00	1'500'000

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
1.7	**Maintenance of Haul Roads, Moderate Traffic**								
1.7.01	Haul road, 8 m wide roadway, paved	m.th*km	540	310.00	167'400	------	------	310.00	167'400
1.7.02	Haul road, 8 m wide roadway, unpaved	m.th*km	470	1'260.00	591'948	------	------	1'260.00	591'948
1.7.03	Haul road, 12 m wide roadway, unpaved	m.th*km	140	1'930.00	270'972	------	------	1'930.00	270'972
1.7.04	Haul road, 15 m wide roadway, unpaved	m.th*km	459	2'480.00	1'138'320	------	------	2'480.00	1'138'320
1.8	**Maintenance and Watering of Haul Roads, Heavy Traffic**								
1.8.01	Haul road mainteanance, 15 m wide roadway	m.th*km	1'069	4'020.00	4'298'184	------	------	4'020.00	4'298'184
1.8.02	Haul road watering, 15 m wide roadway	m.th*km	642	3'842.00	2'464'720	------	------	3'842.00	2'464'720
1.9	**Dock Yards (No. 2)**								-
1.9.01	Diaphragm walls excluding cement and re-steel, thickness 80 cm	m^2	4'100	380.00	1'558'000	------	------	380.00	1'558'000
1.9.02	Common excavation, in dry conditions	m^3	9'000	5.20	46'800	------	------	5.20	46'800
1.9.03	Common excavation, in water	m^3	10'000	6.30	63'000	------	------	6.30	63'000
1.9.04	Concrete anchor piles excluding cement and re-steel, 1200 mm diameter	m	810	315.00	255'150	------	------	315.00	255'150
1.9.05	Tendons between piles and diaphragm walls, 120 t capacity	m	1'350	36.00	48'600	------	------	36.00	48'600
1.9.06	Structural concrete	m^3	220	140.00	30'800	------	------	140.00	30'800
1.9.07	Portland cement	t	1'325	187.92	248'935	------	------	187.92	248'935
1.9.08	Reinforcing steel	t	505	3'830.00	1'935'107	------	------	3'830.00	1'935'107
1.9.09	Gantry cranes, 250 t capacity including rails	ea	2	300'000.00	600'000	------	------	300'000.00	600'000
1.10	**Temporary Power Lines**								
1.10.01	Transformer and accessories at the substation, 6 MV capacity	set	1	75'000.00	75'000	------	------		75'000
1.10.02	Power line from Porto Velho to Site, 34 kV	km	10	8'000.00	80'000	------	------		80'000
1.10.03	Power lines to main transformer cabins on Site, 34 kV	km	12	8'000.00	96'000	------	------		96'000
1.10.04	Power cable across the Rio Madeira	m	1'200	1'000.00	1'200'000	------	------		1'200'000
1.11	**Camp Removal and Land Reinstatement**								
1.11.01	Camp removal	l.s.	------	------	13'800'000	------	------		13'800'000
1.11.02	Land reinstatement	l.s.	------	------	5'000'000	------	------		5'000'000
1.12	**Land Clearing (Work-site Only)**								
1.12.1	Sparse vegetation	ha	100	500.00	50'000	------	------	500.00	50'000
1.12.2	Medium vegetation	ha	550	1'150.00	632'500	------	------	1'150.00	632'500
1.12.3	Dense vegetation	ha	400	3'000.00	1'200'000	------	------	3'000.00	1'200'000
1.13	**Land Grubbing (Work-site Only)**								
1.13.1	Sparse vegetation	ha	100	165.00	16'500	------	------	165.00	16'500
1.13.2	Medium vegetation	ha	550	380.00	209'000	------	------	380.00	209'000
1.13.3	Dense vegetation	ha	400	990.00	396'000	------	------	990.00	396'000

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
2	**POWERHOUSE HEADRACE CHANNEL**								
2.1	**Excavation**								
2.1.01	Top soil removal (transport to left bank stockpiling area No. 1)	m³	208'000	4.16	865'280	1.00	208'000	5.16	1'073'280
21.02	Common excavation (transport to left bank disposal area No. 1)	m³	15'101'200	3.72	56'176'464	1.23	18'574'476	4.95	74'750'940
21.03	Common excavation (transport to left bank area fills)	m³	1'050'000	2.47	2'593'500	0.74	777'000	3.21	3'370'500
21.04	Rock excavation (transport to left bank disposal area No. 1)	m³	4'667'200	7.91	36'917'552	2.21	10'314'512	10.12	47'232'064
21.05	Rock excavation (transport to fills & protections works of left bank area)	m³	438'000	6.34	2'776'920	1.59	696'420	7.93	3'473'340
2.2	**Slope Protection**						-	-	-
2.2.01	Rockfill (rock from required excavation)	m³	97'100	3.44	334'024	0.32	31'072	3.76	365'096
2.2.02	Transition (rock from quired excavation)	m³	65'000	17.67	1'148'550	1.46	94'900	19.13	1'243'450
2.2.03	Shotcrete, 15 cm thick	m²	7'500	31.54	236'550	1.13	8'475	32.67	245'025
2.2.04	Portland cement for shotcrete	t	621	187.92	116'698	-	-	187.92	116'698
2.2.05	Welded wire fabric, 3 kg/m²	m²	7'500	21.78	163'350	4.19	31'425	25.97	194'775
2.2.06	Rock bolts, 26.5 mm dia.	m	11'300	36.22	409'286	4.19	47'347	40.41	456'633
2.3	**Sundries**				-				
2.3.01	Miscellaneous works (% on Items 21.1 & 2.2)	%	2%		2'034'763		615'673	-	2'650'436
3	**POWERHOUSE, POWER INTAKES & GENERATING UNITS**								
3.1	**Excavation**								
3.1.01	Top soil removal (transport to left bank disposal/stockpiling area No. 1)	m³	95'000	4.58	435'100	1.15	109'250	5.73	544'350
3.1.02	Common excavation (transport to left bank disposal area No. 1)	m³	2'331'800	4.06	9'467'108	1.36	3'171'248	5.42	12'638'356
3.1.03	Rock excavation, normal blasting (transport to left bank disp. area No.1)	m³	1'118'550	8.35	9'339'893	2.39	2'673'335	10.74	12'013'227
3.1.04	Rock excavation, normal blasting (transport to left bank crushing				-				
	plant stockpiling area)	m³	1'599'750	8.29	13'261'928	2.37	3'791'408	10.66	17'053'335
3.1.05	Rock excavation, controlled blasting (transport to left bank crushing				-				
	plant stockpiling area)	m³	302'100	9.57	2'891'097	2.70	815'670	12.27	3'706'767
3.1.06	Rock presplitting	m²	14'400	14.91	214'704	6.69	96'336	21.60	311'040
3.2	**Foundation Preparation**				-				
3.2.01	Cleaning of concrete foundation	m²	99'700	1.50	149'550		-	1.50	149'550
3.3	**Concrete, Power Intakes and Generating Units**				-				
3.3.01	Structural concrete	m³	1'600'000	152.39	243'824'000	10.90	17'440'000	163.29	261'264'000
3.3.02	Dental concrete	m³	25'000	58.38	1'459'500	2.40	60'000	60.78	1'519'500
3.3.03	Portland cement for concrete of item 3.3.01	t	367'200	187.92	69'004'224	-	-	187.92	69'004'224

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
3.3.04	Portland cement for concrete of item 3.3.02	t	4'582	187.92	860'955	-	-	187.92	860'955
3.3.05	Pozzolan for concrete of items 3.3.01 and 3.3.02	t	65'609	156.01	10'235'660		-	156.01	10'235'660
3.3.06	Reinforcing steel	t	96'000	3'822.36	366'946'560	7.16	687'360	3'829.52	367'633'920
3.4	**Concrete, Main Erection Area - EA1 to EA4**								
3.4.01	Structural concrete	m³	39'400	114.14	4'497'116	8.26	325'444	122.40	4'822'560
3.4.02	Mass concrete	m³	202'200	84.99	17'184'978	5.34	1'079'748	90.33	18'264'726
3.4.03	Dental concrete	m³	1'600	58.38	93'408	2.40	3'840	60.78	97'248
3.4.04	Portland cement for concrete of items 3.4.01 & 3.4.02	t	52'010	187.92	9'773'682		-	187.92	9'773'682
3.4.05	Portland cement for concrete of item 3.4.03	t	367	187.92	69'004		-	187.92	69'004
3.4.06	Pozzolan for concrete of items 3.4.01, 3.4.02 and 3.4.03	t	9'243	156.01	1'442'000		-	156.01	1'442'000
3.4.07	Reinforcing steel	t	2'364	3'822.36	9'036'059	7.16	16'926	3'829.52	9'052'985
3.5	**Concrete, Auxiliary Erection Area - EA5 to EA8**				-				
3.5.01	Structural concrete	m³	36'000	110.11	3'963'960	8.06	290'160	118.17	4'254'120
3.5.02	Mass concrete	m³	88'000	84.99	7'479'120	5.34	469'920	90.33	7'949'040
3.5.03	Dental concrete	m³	1'500	58.38	87'570	2.40	3'600	60.78	91'170
3.5.04	Portland cement for concrete of items 3.5.01 and 3.5.02	t	26'962	187.92	5'066'699		-	187.92	5'066'699
3.5.05	Portland cement for concrete of item 2.5.03	t	344	187.92	64'691		-	187.92	64'691
3.5.06	Pozzolan for concrete of items 3.5.01, 3.5.02 and 3.5.03	t	4'819	156.01	751'812		-	156.01	751'812
3.5.07	Reinforcing steel	t	2'160	3'822.36	8'256'298	7.16	15'466	3'829.52	8'271'763
3.6	**Concrete, Unloading Area**								
3.6.01	Structural concrete	m³	600	114.14	68'484	8.26	4'956	122.40	73'440
3.6.02	Mass concrete	m³	90'000	84.99	7'649'100	5.34	480'600	90.33	8'129'700
3.6.03	Dental concrete	m³	200	58.38	11'676	2.40	480	60.78	12'156
3.6.04	Portland cement for concrete of items 3.6.01 & 3.6.02	t	19'263	187.92	3'619'847		-	187.92	3'619'847
3.6.05	Portland cement for concrete of item 3.6.03	t	46	187.92	8'626		-	187.92	8'626
3.6.06	Pozzolan for concrete of items 3.6.01, 3.6.02 and 3.6.03	t	3'407	156.01	531'526		-	156.01	531'526
3.6.07	Reinforcing steel	t	36	3'822.36	137'605	7.16	258	3'829.52	137'863
3.7	**Downstream Brige Deck**								
3.7.01	Prestressed concrete beams including cement and re-steel	m³	18'200	520.00	9'464'000		-	520.00	9'464'000
3.7.02	Cast-in-situ concrete	m³	6'000	110.00	660'000	10.50	63'000	120.50	723'000
3.7.03	Portland cement for concrete of item 3.7.02	t	1'785	187.92	335'437		-	187.92	335'437
3.7.04	Pozzolan for concrete of item 3.7.02	t	315	156.01	49'143		-	156.01	49'143
3.7.05	Bearing pads for precast concrete beams	ea	1'800	300.00	540'000		-	300.00	540'000

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
3.8	**Drilling and Grouting**								
3.8.01	Consolidation grouting holes, rotary drilling, AX diameter	m	5'400	90.00	486'000		-	90.00	486'000
3.8.02	Packer setting for grouting	ea	1'100	45.00	49'500		-	45.00	49'500
3.8.03	Grouting excluding cement	t	600	250.00	150'000		-	250.00	150'000
3.8.04	Portland cement	t	510	188.75	96'263		-	188.75	96'263
3.8.05	Pozzolan	t	90	156.01	14'041		-	156.01	14'041
3.8.06	Drainage holes, percussion drilling, 100 mm dia.	m	4'700	110.00	517'000		-	110.00	517'000
3.9	**Slope Protection**								
3.9.01	Rockfill (rock from required excavation)	m^3	101'000	3.44	347'440	0.32	32'320	3.76	379'760
3.9.02	Transition (rock from quired excavation)	m^3	67'400	17.67	1'190'958	1.46	98'404	19.13	1'289'362
3.10	**Sundries**								
3.10.01	Compacted backfill, area EA1 to EA4 & UA (material from excavation)	m^3	1'050'000	5.09	5'344'500	1.31	1'375'500	6.40	6'720'000
3.10.02	Administration building	m^2	1'500	400.00	600'000		-	400.00	600'000
3.10.03	Warehouses	m^2	1'600	290.00	464'000		-	290.00	464'000
3.10.04	Miscellaneous works and finishing (% on Item 3.1 to 3.10.3)	%	10%		82'819'182		3'310'523	-	86'129'705
4	**POWERHOUSE TAILRACE CHANNEL**								
4.1	**Excavation**								
4.1.01	Top soil removal (transport to left bank stockpiling area No. 1)	m^3	61'000	4.58	279'380	1.15	70'150	5.73	349'530
4.1.02	Common excavation (transport to left bank disposal area No. 1)	m^3	10'389'460	4.20	43'635'732	1.42	14'753'033	5.62	58'388'765
4.1.03	Common excavation (transport to left bank area fills)	m^3	1'019'340	2.47	2'517'770	0.74	754'312	3.21	3'272'081
4.1.04	Dredging of soft material (pumping to left bank disposal area No. 2)	m^3	7'404'200	7.52	55'679'584		-	7.52	55'679'584
4.1.05	Rock excavation (transport to left bank disposal area No. 1)	m^3	7'767'200	8.55	66'409'560	2.47	19'184'984	11.02	85'594'544
4.2	**Fill and Backfill**								
4.2.01	Compacted random fill (material from required excavation)	m^3	265'000	1.59	421'350		-	1.59	421'350
4.6.02	Compacted random backfill (materail from required excavation)	m^3	754'340	1.59	1'199'401		-	1.59	1'199'401
4.3	**Slope Protection**				-				
4.3.01	Rockfill (rock from required excavation)	m^3	21'300	3.44	73'272	0.32	6'816	3.76	80'088
4.3.02	Transition (rock from quired excavation)	m^3	14'600	17.67	257'982	1.46	21'316	19.13	279'298
4.3.03	Shotcrete, 15 cm thick	m^2	1'600	31.54	50'464	1.13	1'808	32.67	52'272
4.3.04	Portland cement for shotcrete	t	135	187.92	25'369	-	-	187.92	25'369
4.3.05	Welded wire fabric, 3 kg/m^2	m^2	1'600	21.78	34'848	4.19	6'704	25.97	41'552
4.3.06	Rock bolts, 26.5 mm dia.	m	2'400	36.22	86'928	4.19	10'056	40.41	96'984

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
4.4	**Sundries**								
4.4.01	Miscellaneous works (%on Items 4.1, 4.2, & 4.3)	%	2%		3'413'433		696'184	-	4'109'616
5	**LEFT BANK COFFERDAMS (EXCLUDING COFF. OF POWERHOUSE)**								
5.1	**Cofferdam for Headrace Canal Exacavation (Auxiliary 7)**								
5.1.01	Compacted clayfill (clay from left bank borrow area)	m³	243'200	6.05	1'471'360	1.38	335'616	7.43	1'806'976
5.1.02	Compacted transition (rock from required excavation)	m³	16'700	14.37	239'979	1.45	24'215	15.82	264'194
5.1.03	Rip Rap (rock from required excavation)	m³	20'000	14.15	283'000	2.18	43'600	16.33	326'600
5.2	**Cofferdam for Tailrace Canal Excavation (Auxiliary 6)**								
5.2.01	Compacted clayfill (clay from left bank borrow area)	m³	189'200	6.05	1'144'660	1.38	261'096	7.43	1'405'756
5.2.02	Compacted transition (rock from required excavation)	m³	18'100	14.37	260'097	1.45	26'245	15.82	286'342
5.2.03	Rip Rap (rock from required excavation)	m³	21'700	14.15	307'055	2.18	47'306	16.33	354'361
5.2.04	Plastic type diaphragm, thickness 0.60 m, depth 25 m	m³	33'300	300.00	9'990'000		-	300.00	9'990'000
5.3	**Cofferdam Between Powerhouse and Rockfill Dam (Auxiliary 5)**								
5.3.01	Compacted clayfill (clay from left bank borrow area)	m³	329'830	6.05	1'995'472	1.38	455'165	7.43	2'450'637
5.3.02	Compacted transition (rock from required excavation)	m³	31'440	14.37	451'793	1.45	45'588	15.82	497'381
5.3.03	Rip Rap (rock from required excavation)	m³	31'440	14.15	444'876	2.18	68'539	16.33	513'415
5.3.04	Clay placed in water (clay from borrow left bank borrow area)	m³	82'850	6.85	567'523	1.46	120'961	8.31	688'484
5.3.05	Transition placed in water (rock from required excavation)	m³	9'470	14.71	139'304	1.36	12'879	16.07	152'183
5.3.06	Rockfill placed in water (rock from required excavation)	m³	40'170	1.50	60'255		-	1.50	60'255
5.4	**Removal of Cofferdams in Dry Conditions**								
5.4.01	Removal of auxiliary cofferdam 7 (transport to left b. disposal area No. 1)	m³	223'920	4.01	897'919	1.42	317'966	5.43	1'215'886
5.4.02	Removal of auxiliary cofferdam 6 (transport to left b. disposal area No. 1)	m³	229'000	4.01	918'290	1.42	325'180	5.43	1'243'470
5.4.03	Removal of auxiliary cofferdam 5 (transport to left b. disposal area No. 1)	m³	392'710	4.01	1'574'767	1.42	557'648	5.43	2'132'415
5.5	**Sundries**								
5.5.01	Maintenance of cofferdams (% on Items 5.1, 5.2 & 5.3)	%	2%		347'107		52'840	-	399'948
5.5.02	Miscellaneous works (% on Items 5.1, 5.2, 5.3 & 5.4)	%	4%		829'854		105'680	-	935'534
6	**POWERHOUSE COFFERDAMS**								
6.1	**U/S Cofferdams for Units 17-32 & 33-44 (Auxiliaries 8 and 10)**								
6.1.01	Compacted clayfill (clay from left bank borrow area)	m³	314'200	6.33	1'988'886	1.49	468'158	7.82	2'457'044
6.1.02	Compacted transition (rock from required excavation)	m³	27'700	14.37	398'049	1.45	40'165	15.82	438'214
6.1.03	Rip Rap (rock from required excavation)	m³	27'700	14.15	391'955	2.18	60'386	16.33	452'341

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
6.2	**Removal of Upstream Cofferdams**								
6.2.01	Removal of cofferdam in dry cond. (transp. to left b.disposal area No. 1)	m³	314'200	4.43	1'391'906	1.55	487'010	5.98	1'878'916
6.2.02	Removal of cofferdam in water (transport to left b. disposal area No. 1)	m³	55'400	5.36	296'944	1.89	104'706	7.25	401'650
6.3	**D/S Cofferdams for Units 17-32 & 33-44 (Auxiliaries 9 and 11)**								
6.3.01	Compacted clayfill (Clay from left bank borrow area)	m³	650'500	6.33	4'117'665	1.49	969'245	7.82	5'086'910
6.3.02	Compacted transition (rock from required excavation)	m³	40'700	14.37	584'859	1.45	59'015	15.82	643'874
6.3.03	Rip Rap (rock from required excavation)	m³	40'700	14.15	575'905	2.18	88'726	16.33	664'631
6.4	**Removal of Downstream Cofferdams**								
6.4.01	Removal of cofferdam in dry cond. (transp. to right b.disposal area No. 2)	m³	622'110	6.70	4'168'137	2.44	1'517'948	9.14	5'686'085
6.4.02	Removal of cofferdam in water (transport to right b. disposal area No. 2)	m³	109'800	7.70	845'460	2.81	308'538	10.51	1'153'998
6.5	**Sundries**								
6.5.01	Maintenance of cofferdams (% on Items 6.1, & 6.3)	%	2%		194'923		45'548	-	240'472
6.5.02	Miscellaneous works (% on Items 6.1, 6.2, 6.3, & 6.4)	%	4%		590'391		164'156	-	754'547
7	**RIGHT BANK COFFERDAMS EXCLUDING THE DAM ONES**								
7.1	**Spillway Upstream Cofferdam (Auxiliary 2)**								
7.1.01	Compacted clafill (clay from right bank borrow area)	m³	190'000	5.88	1'117'200	1.31	248'900	7.19	1'366'100
7.1.02	Compacted transition (rock from required excavation)	m³	8'400	14.37	120'708	1.45	12'180	15.82	132'888
7.1.03	Rip Rap (rock from required excavation)	m³	10'000	14.15	141'500	2.18	21'800	16.33	163'300
7.1.04	Clayfill placed in water (clay from right bank borrow area)	m³	128'100	6.85	877'485	1.46	187'026	8.31	1'064'511
7.1.05	Rockfill placed in water (rock from required excavation)	m³	26'700	1.50	40'050		-	1.50	40'050
7.2	**Spillway Downstream Cofferdam (Auxiliary 3)**								
7.2.01	Compacted clayfill (clay from right bank borrow area)	m³	147'400	5.88	866'712	1.31	193'094	7.19	1'059'806
7.2.02	Compacted transition (rock from required excavation)	m³	15'700	14.37	225'609	1.45	22'765	15.82	248'374
7.2.03	Rip Rap (rock fro required excavation)	m³	15'700	14.15	222'155	2.18	34'226	16.33	256'381
7.2.04	Clayfill placed in water (clay from right bank borrow area)	m³	146'100	6.85	1'000'785	1.46	213'306	8.31	1'214'091
7.2.05	Rockfill placed in water (rock from required excavation)	m³	28'100	1.50	42'150		-	1.50	42'150
7.3	**Spillway Downstream Cofferdam (Auxiliary 4)**				-				
7.3.01	Compacted clayfill (clay from right bank borrow area)	m³	348'200	5.88	2'047'416	1.31	456'142	7.19	2'503'558
7.3.02	Compacted transition (rock from required excavation)	m³	10'800	14.37	155'196	1.45	15'660	15.82	170'856
7.3.03	Rip Rap (rock fro required excavation)	m³	12'900	14.15	182'535	2.18	28'122	16.33	210'657

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
7.4	**Approach Channel Cofferdam (Auxiliary 1)**				-				
7.4.01	Compacted clayfill (clay from right bank borrow area)	m³	486'600	5.88	2'861'208	1.31	637'446	7.19	3'498'654
7.4.02	Compacted transition (rock from required excavation)	m³	26'800	14.37	385'116	1.45	38'860	15.82	423'976
7.4.03	Rip Rap (rock fro required excavation)	m³	32'200	14.15	455'630	2.18	70'196	16.33	525'826
7.5	**Removal of Cofferdams in Dry Conditions**				-				
7.5.01	Removal of coff. Auxiliary 1 (transport to right bank disposal area No. 2)	m³	545'600	5.65	3'082'640	2.06	1'123'936	7.71	4'206'576
7.5.02	Removal of coff. Auxiliary 2 (transport to right bank disposal area No. 2)	m³	208'400	5.65	1'177'460	2.06	429'304	7.71	1'606'764
7.5.03	Removal of coff. Auxiliary 3 (transport to right bank disposal area No. 2)	m³	178'800	5.65	1'010'220	2.06	368'328	7.71	1'378'548
7.5.04	Removal of coff. Auxiliary 4 (transport to right bank disposal area No. 2)	m³	371'900	5.65	2'101'235	2.06	766'114	7.71	2'867'349
7.6	**Sundries**								
7.6.01	Maintenance of cofferdams (% on Items 7.1, 7.2, 7.3 & 7.4)	%	2%		214'829		43'594	-	258'424
7.6.02	Miscellaneous works (% on Items 7.1, 7.2, 7.3, 7.4 & 7.5)	%	4%		724'520		194'696	-	919'217
8	**DAM COFFERDAMS**								
8.1	**Upstream Cofferdam - First Stage**								
8.1.01	Rockfill dumped into water (rock from right bank stockpile)	m³	2'327'300	4.65	10'821'945	1.35	3'141'855	6.00	13'963'800
8.1.02	Clayfill placed in water (clay from right bank borrow area)	m³	1'929'200	6.63	12'790'596	1.88	3'626'896	8.51	16'417'492
8.1.03	Transition placed in water (scrushed rock from right bank stockpile)	m³	203'300	15.77	3'206'041	1.64	333'412	17.41	3'539'453
8.1.04	Compacted rockfill (rock from right bank stockpile)	m³	62'000	6.21	385'020	1.58	97'960	7.79	482'980
8.1.05	Compacted transition (from right bank stockpile)	m³	33'400	15.19	507'346	1.75	58'450	16.94	565'796
8.2	**Upstream Cofferdam - Second Stage**								
8.2.01	Compacted rockfill (rock from right bank stockpile)	m³	322'400	6.21	2'002'104	1.58	509'392	7.79	2'511'496
8.2.02	Compacted clafill (clay from left bank borrow area)	m³	96'300	6.75	650'025	1.65	158'895	8.40	808'920
8.2.03	Compacted transition (from right bank stockpile)	m³	43'400	15.19	659'246	1.75	75'950	16.94	735'196
8.3	**Downstream Cofferdam - First Stage**								
8.3.01	Rockfill dumped into water (rock from right bank stockpile)	m³	801'100	4.65	3'725'115	1.35	1'081'485	6.00	4'806'600
8.3.02	Clayfill placed in water (clay from right bank borrow area)	m³	373'200	6.63	2'474'316	1.88	701'616	8.51	3'175'932
8.3.03	Transition placed in water (scrushed rock from right bank stockpile)	m³	44'600	15.77	703'342	1.64	73'144	17.41	776'486
8.4	**Downstream Cofferdam - Second Stage**								
8.4.01	Compacted rockfill (rock from right bank stockpile)	m³	127'600	6.21	792'396	1.58	201'608	7.79	994'004
8.4.02	Compacted clayfill (clay from left bank borrow area)	m³	39'500	6.75	266'625	1.65	65'175	8.40	331'800
8.4.03	Compacted transition (from right bank stockpile)	m³	23'200	15.19	352'408	1.75	40'600	16.94	393'008

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
8.5	**Sundries**								
8.5.01	Maintenance of cofferdams (% on items 8.1, 8.2, 8.3 & 8.4)	%	2%		758'502		197'181	-	955'683
8.5.02	Miscellaneous works (% on items 8.1 to 8.5.01)	%	5%		1'966'826		508'322	-	2'475'148
9	**ROCKFILL DAM**								
9.1	**Excavation**								
9.1.01	Rock excavation (material transported to right bank stockpile)	m³	57'200	9.80	560'560	3.10	177'320	12.90	737'880
9.2	**Foundation Preparation**								
9.2.01	Treatment and cleaning of foundation	m²	225'000	9.00	2'025'000		-	9.00	2'025'000
9.2.02	Removal of loose rock fragments	m³	12'000	5.90	70'800	2.10	25'200	8.00	96'000
9.2.03	Dental concrete	m³	3'000	58.38	175'140	2.40	7'200	60.78	182'340
9.2.04	Portland cement for concrete of item 9.2.03	t	689	187.92	129'383		-	187.92	129'383
9.2.05	Pozzolan for concrete of item 9.2.03	t	122	156.01	19'033		-	156.01	19'033
9.2.06	Consolidation grouting holes, rotary drilling, AX diameter	m	4'700	90.00	423'000		-	90.00	423'000
9.2.07	Setting of packers for grouting	ea	1'000	45.00	45'000		-	45.00	45'000
9.2.08	Grouting excluding cement	t	550	250.00	137'500		-	250.00	137'500
9.2.09	Portland cement for grouting	t	467	188.75	88'146		-	188.75	88'146
9.2.10	Pozzolan for grouting	t	83	156.01	12'949		-	156.01	12'949
9.2.11	Drainage holes, percussion drilling, 100 mm diameter	m	4'100	110.00	451'000		-	110.00	451'000
9.3	**Embankment**								
9.3.01	Rockfill (rock from right bank stockpile)	m³	1'418'400	6.21	8'808'264	1.58	2'241'072	7.79	11'049'336
9.3.02	Clay core fill (clay from right bank borrow area)	m³	458'100	6.75	3'092'175	1.65	755'865	8.40	3'848'040
9.3.03	Fine transition (sand from right bank borrow area)	m³	72'400	8.72	631'328	2.69	194'756	11.41	826'084
9.3.04	Coarse transition (rock from right bank stockpile)	m³	80'600	15.19	1'224'314	1.75	141'050	16.94	1'365'364
9.4	**Sundries**								
9.4.01	Control instrumentation (% on Item 9.3)	%	1.50%		206'341		49'991	-	256'332
9.4.02	Miscellaneous works (% on Items 9.1, 9.2, & 9.3)	%	4.00%		550'243		133'310		683'553
10	**CONCRETE WALLS**								
10.1	**Powerhouse Dividing Walls**								
10.1.01	Foundation Preparation:				-				
	a) Cleaning of rock foundation	m^2	23'900	1.50	35'850		-	1.50	35'850
	b) Dental concrete	m³	6'000	58.38	350'280	2.40	14'400	60.78	364'680

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	c) Portland cement	t	1'377	187.92	258'766		-	187.92	258'766
	d) Pozzolan	t	243	156.01	37'910		-	156.01	37'910
10.1.02	Conventional Concrete:								
	a) Concrete, structure	m^3	38'000	111.69	4'244'220	0.66	25'080	112.35	4'269'300
	b) Portland cement	t	8'721	187.92	1'638'850		-	187.92	1'638'850
	c) Pozzolan	t	12'539	156.01	1'956'209		-	156.01	1'956'209
	d) Reinforcing steel	t	2'280	3'822.36	8'714'981	7.16	16'325	3'829.52	8'731'306
10.1.03	Roller Compacted Concrete (RCC):								
	a) RCC	m^3	334'000	70.25	23'463'500	1.29	430'860	71.54	23'894'360
	b) Portland cement	t	42'600	187.92	8'005'392		-	187.92	8'005'392
	c) Pozzolan	t	7'500	156.01	1'170'075		-	156.01	1'170'075
10.1.04	Sundries:								
	a) Control instrumentation (% on Items 10.1.02 & 10.1.03)	%	0.75%		368'949		3'542	-	372'491
	b) Miscellaneous works (% on Items 10.1.01, 10.1.02 & 10.1.03)	%	3.00%		1'496'281		14'600	-	1'510'881
10.2	**Wall Between Powerhouse and Rockfill Dam**								
10.2.01	Excavation:								
	a) Common excavation (transport to left bank disposal area No. 1)	m^3	107'800	4.06	437'668	1.36	146'608	5.42	584'276
	b) Rock excavation (transport to left bank disposal area No. 1)	m^3	44'800	8.35	374'080	2.39	107'072	10.74	481'152
	c) Rock presplitting	m^2	6'300	14.91	93'933	6.69	42'147	21.60	136'080
10.2.02	Foundation Preparation								
	a) Cleaning of rock foundation	m^2	8'100	1.50	12'150		-	1.50	12'150
10.2.03	Conventional Concrete:								
	a) Concrete, structure	m^3	3'600	120.28	433'008	3.11	11'196	123.39	444'204
	b) Dental concrete	m^3	2'000	54.16	108'320	1.79	3'580	55.95	111'900
	c) Portland cement for concrete of Item 10.2.03a)	t	826	187.92	155'260		-	187.92	155'260
	d) Portland cement for concrete of Item 10.2.03b)	t	459	187.92	86'255		-	187.92	86'255
	e) Pozzolan for concrete of items 10.2.03a and 10.2.03b	t	227	156.01	35'414		-	156.01	35'414
	f) Reinforcing steel	t	216	3'822.36	825'630	7.16	1'547	3'829.52	827'176
10.2.04	Roller Compacted Concrete (RCC):								
	a) RCC	m^3	74'000	75.08	5'555'920	1.37	101'380	76.45	5'657'300
	c) Portland cement	t	9'435	187.92	1'773'025		-	187.92	1'773'025
	d) Pozzolan	t	1'665	156.01	259'757		-	156.01	259'757

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
10.2.05	Sundries:								
	a) Grouted anchor bars, 32 mm dia.	m	2'680	42.46	113'793	4.19	11'229	46.65	125'022
	b) Control instrumentation (% on Items 10.2.03 & 10.2.04)	%	1.00%		92'326		1'177	-	93'503
	c) Miscellaneous works (% on Items 10.2.01, 10.2.02, 10.2.03 & 10.2.04)	%	3.00%		276'978		3'531	-	280'509
10.3	**Spillway Left-Hand Side Lateral Wall**								
10.3.01	Excavation:								
	a) Common excavation (transport to right bank disposal area No. 2)	m³	27'400	5.76	157'824	2.04	55'896	7.80	213'720
	b) Rock excavation (transport to right bank stockpile area No. 3)	m³	6'300	7.25	45'675	1.95	12'285	9.20	57'960
	c) Rock presplitting	m^2	3'800	14.91	56'658	6.69	25'422	21.60	82'080
10.3.02	Foundation Preparation								
	a) Cleaning of rock foundation	m^2	2'400	1.50	3'600		-	1.50	3'600
10.3.03	Conventional Concrete:								
	a) Concrete, structure	m³	38'200	92.74	3'542'668	3.87	147'834	96.61	3'690'502
	b) Dental concrete	m³	600	58.38	35'028	2.40	1'440	60.78	36'468
	c) Portland cement for concrete of Item 10.3.03a)	t	8'767	187.92	1'647'476		-	187.92	1'647'476
	d) Portland cement for concrete of Item 10.3.03b)	t	138	187.92	25'877		-	187.92	25'877
	e) Pozzolan for concrete of items 10.3.03a and 10.3.03b	t	1'572	156.01	245'248		-	156.01	245'248
	f) Reinforcing steel	t	2'292	3'822.36	8'760'849	7.16	16'411	3'829.52	8'777'260
10.3.04	Sundries:								
	a) Grouted anchor bars, 32 mm dia.	m	440	42.46	18'682	4.19	1'844	46.65	20'526
	b) Control instrumentation (% of Item 12.3.03)	%	0.50%		71'286		828	-	72'114
	c) Miscellaneous works (% on Items 10.3.01 to 10.3.04a)	%	3.00%		436'188		7'834	-	444'021
10.4	**Spillway Right-Hand Side Lateral Wall**								
10.4.01	Excavation:								
	a) Rock excavation (transport to rigth bank stockpile No. 3)	m³	18'200	7.25	131'950	1.95	35'490	9.20	167'440
	b) Rock pre-splitting	m³	1'500	14.91	22'365	6.69	10'035	21.60	32'400
10.4.02	Foundation Preparation								
	a) Cleaning of rock foundation	m^2	7'000	1.50	10'500		-	1.50	10'500
10.4.03	Conventional Concrete:								
	a) Concrete, structure	m³	137'100	92.74	12'714'654	3.87	530'577	96.61	13'245'231
	b) Dental concrete	m³	1'750	58.38	102'165	2.40	4'200	60.78	106'365
	c) Portland cement for concrete of Item 10.4.03a)	t	31'464	187.92	5'912'799		-	187.92	5'912'799
	d) Portland cement for concrete of Item 10.4.03b)	t	402	187.92	75'473		-	187.92	75'473

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
	e) Pozzolan for concrete of items 10.4.03a) and 10.4.03b)	t	5'630	156.01	878'336		-	156.01	878'336
	f) Reinforcing steel	t	8'226	3'822.36	31'442'733	7.16	58'898	3'829.52	31'501'632
10.4.04	Sundries:								
	a) Grouted anchor bars, 32 mm dia.	m	1'620	42.46	68'785	4.19	6'788	46.65	75'573
	b) Control instrumentation (% of Item 10.4.03)	%	0.50%		255'631		2'968	-	258'599
	c) Miscellaneous works (% on Items 10.4.01 to 10.4.04a)	%	3.00%		1'540'793		19'380	-	1'560'172
11	**SPILLWAY APPROACH CHANNEL**								
11.1	**Excavation**								
11.1.01	Top soil removal (transport to right bank stockpiling area No. 1)	m^3	268'000	3.63	972'840	0.79	211'720	4.42	1'184'560
11.1.02	Common excavation (transport to right bank dispoasal area No. 1)	m^3	8'000'000	3.19	25'520'000	1.02	8'160'000	4.21	33'680'000
11.1.03	Common excavation (transport to right bank dispoasal area No. 2)	m^3	7'958'810	4.92	39'157'345	1.70	13'529'977	6.62	52'687'322
11.1.04	Rock excavation (transport to right bank main stockpile area)	m^3	1'523'860	7.83	11'931'824	2.19	3'337'253	10.02	15'269'077
11.1.05	Additional rock excavation (transport to right bank stockpile area No. 3)	m^3	470'540	7.83	3'684'328	2.19	1'030'483	10.02	4'714'811
11.1.06	Additional rock excav. (transport to right b. area for rockfills, ripraps etc.)	m^3	1'020'600	6.34	6'470'604	1.59	1'622'754	7.93	8'093'358
11.2	**Slopes and Channel Bed Protection**								
11.2.01	Rockfill for slopes (rock from required excavation)	m^3	51'300	3.44	176'472	0.32	16'416	3.76	192'888
11.2.02	Rockfill for channel bed (rock from required excavation)	m^3	719'200	2.17	1'560'664		-	2.17	1'560'664
11.2.03	Transition for slopes (rock from required excavation)	m^3	27'600	17.67	487'692	1.48	40'848	19.15	528'540
11.2.04	Transition for channel bed (rock from required excavation)	m^3	401'500	13.35	5'360'025	1.03	413'545	14.38	5'773'570
11.3	**Sundries**								
11.3.01	Miscellaneous works (% on Items 11.1. & 11.2)	%	2%		1'906'436		567'260	-	2'473'696
12	**SPILWAY STRUCTURE**								
12.1	**Excavation**								
12.1.01	Top soil removal (transport to right bank stockpiling area No. 1)	m^3	7'000	4.33	30'310	1.06	7'420	5.39	37'730
12.1.02	Common excavation (transport to right bank dispoasal area No. 2)	m^3	161'800	5.76	931'968	2.04	330'072	7.80	1'262'040
12.1.03	Rock excavation, normal b.(transport to right bank main stockpiling area)	m^3	553'800	7.25	4'015'050	1.95	1'079'910	9.20	5'094'960
12.1.04	Rock excavation, controlled blasting (transp. to right b. stock a. No.3)	m^3	121'500	8.44	1'025'460	2.25	273'375	10.69	1'298'835
12.1.05	Presplitting for rock excavation	m^2	12'700	14.91	189'357	6.69	84'963	21.60	274'320
12.2	**Foundation Preparation**								
12.2.01	Cleaning of rock foundation	m^2	38'400	1.50	57'600		-	1.50	57'600
12.2.02	Consolidation grouting holes, rotary drilling, AX diameter	m	1'800	90.00	162'000		-	90.00	162'000

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
12.2.03	Setting of packers for grouting	ea	360	45.00	16'200		-	45.00	16'200
12.2.04	Grouting excluding cement	t	220	250.00	55'000		-	250.00	55'000
12.2.05	Portland cement for grouting	t	187	188.75	35'296		-	188.75	35'296
12.2.06	Pozzolan for grouting	t	33	156.01	5'148		-	156.01	5'148
12.2.07	Drainage holes, percussion drilling, 100 mm diameter	m	1'600	110.00	176'000		-	110.00	176'000
12.3	**Concrete Works**								
12.3.01	Chute concrete	m³	223'500	88.83	19'853'505	6.79	1'517'565	95.62	21'371'070
12.3.02	Slab concrete downstream of chute	m³	33'700	81.71	2'753'627	4.73	159'401	86.44	2'913'028
12.3.03	Piers concrete of gated structure	m³	145'000	114.26	16'567'700	8.44	1'223'800	122.70	17'791'500
12.3.04	Piers concrete of road bridge structure	m³	22'600	121.02	2'735'052	8.81	199'106	129.83	2'934'158
12.3.05	Dental concrete	m³	9'600	58.38	560'448	2.40	23'040	60.78	583'488
12.3.06	Prestressed concrete beams of bridge d. including cement and re-steel	m³	22'200	520.00	11'544'000		-	520.00	11'544'000
12.3.07	Portland cement for concrete of items 12.3.01 to 12.3.04	t	113'785	187.92	21'382'444		-	187.92	21'382'444
12.3.08	Portland cement for concrete of item 12.3.05	t	2'203	187.92	414'025		-	187.92	414'025
12.3.09	Pozzolan for concrete of items 12.3.01 to 12.3.05	t	20'468	156.01	3'193'213		-	156.01	3'193'213
12.3.10	Reinforcing steel	t	20'283	3'822.36	77'527'017	7.16	145'223	3'829.52	77'672'239
12.3.11	Bearing pads for prestressed beams	ea	1'386	300.00	415'800		-	300.00	415'800
12.4	**Sundries**								
12.4.01	Miscellaneous works (% on Items 12.1, 12.2, & 12.3)	%	4%		6'545'849		201'755	-	6'747'604
13	SPILLWAY DISCHARGE CHANNEL								
13.1	**Excavation**								
13.1.01	Top soil removal (transport to right bank stockpiling area No. 1)	m³	48'000	4.33	207'840	1.06	50'880	5.39	258'720
13.1.02	Common excavation (transport to right bank disposal area No. 2)	m³	775'000	5.76	4'464'000	2.04	1'581'000	7.80	6'045'000
13.1.03	Rock excavation in dry cond. (transport to right bank main stockpil. area)	m³	2'784'000	6.99	19'460'160	1.85	5'150'400	8.84	24'610'560
13.1.04	Rock excavation under water (transport to river-bed downstream of dam)	m³	400'000	31.86	12'744'000	1.59	636'000	33.45	13'380'000
13.2	**Slope Protection**								
13.2.01	Rockfill (rock from required excavation)	m³	3'000	3.44	10'320	0.32	960	3.76	11'280
13.2.02	Transition (rock from required excavation)	m³	2'400	17.67	42'408	1.46	3'504	19.13	45'912
13.2.03	Shotcrete, 15 cm thikness	m²	14'100	31.54	444'714	1.13	15'933	32.67	460'647
13.2.04	Portland cement for shotcrete	t	1'161	187.92	218'175	-	-	187.92	218'175
13.2.05	Welded wire fabric, 3 kg/m^2	m²	14'100	21.78	307'098	4.19	59'079	25.97	366'177
13.2.06	Rock bolts, 26.5 mm dia.	m	21'200	36.22	767'864	4.19	88'828	40.41	856'692

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
13.3	**Sundries**								
13.3.01	Backfills (material from right bank disposal area No. 1)	m^3	603'800	5.68	3'429'584	1.49	899'662	7.17	4'329'246
13.3.02	Miscellaneous works (% on Items 13.1, 13.2, & 13.3a)	%	2%		841'923		169'725	-	1'011'648
14	**SPILLWAY CLUSURE EMBANKMENT ON RIGHT BANK**								
14.1	**Excavation**								
14.1.01	Common excavation (transport to right bank disposal area No. 2)	m^3	36'200	5.63	203'806	2.16	78'192	7.79	281'998
14.2	**Foundation Preparation**								
14.2.01	Foundation preparation (compaction)	m^2	14'500	0.50	7'250		-	0.50	7'250
14.3	**Compacted Embankment**								
14.3.01	Rockfill toe (rock from right bank main stockpiling area)	m^3	500	6.21	3'105	1.58	790	7.79	3'895
14.3.02	Clayfill (clay from right bank borrow area)	m^3	81'500	6.75	550'125	1.65	134'475	8.40	684'600
14.3.03	Horizontal fine filter (sand from right bank borrow arae)	m^3	2'300	8.72	20'056	2.69	6'187	11.41	26'243
14.3.04	Horizontal coarse filter & u/s protection (rock from right b. stock No.3)	m^3	3'500	15.19	53'165	1.75	6'125	16.94	59'290
14.3.05	Rip Rap (rock from right bank stockpiling area No. 3)	m^3	2'700	15.95	43'065	2.40	6'480	18.35	49'545
14.3.06	Fine vertical filter (sand from right bank borrow area)	m^3	1'600	9.62	15'392	2.96	4'736	12.58	20'128
14.3.07	Sodding	m^2	2'800	5.50	15'400		-	5.50	15'400
14.4	**Sundries**								
14.4.01	Control instrumentation (% of item 14.3)	%	1.50%		10'274		2'382	-	12'656
14.4.02	Miscellaneous works (% on items 14.1, 14.2 & 14.3)	%	5.00%		45'568		11'849	-	57'417
15	**MATO GROSSO STREAM CLOSURE DIKE**								
15.1	**Excavation**								
15.1.01	Topsoil removal (transport to right bank stockpiling area No. 1)	m^3	17'000	4.24	72'080	1.15		-	72'080
15.1.02	Common excavation (transport to right bank disposal area No. 2)	m^3	223'600	5.70	1'274'520	2.20	491'920	7.90	1'766'440
15.2	**Foundation Preparation**								
15.2.01	Foundation preparation (compaction)	m^2	89'000	0.50	44'500		-	0.50	44'500
15.3	**Embankment**								
15.3.01	Rockfill toe (rock from right bank main stockpiling area)	m^3	53'600	6.21	332'856	1.58	84'688	7.79	417'544
15.3.02	Clayfill (clay from right bank borrow area)	m^3	388'900	6.75	2'625'075	1.65	641'685	8.40	3'266'760
15.3.03	Slope fine protection (sand from right bank borrow area)	m^3	10'100	9.60	96'960	3.00	30'300	12.60	127'260
15.3.04	Slope coarse protection (rock from right bank main stockpiling area)	m^3	24'200	17.70	428'340	1.93	46'706	19.63	475'046
15.3.05	Granular material for dike crest roadway (rock from r.b. main stock. area)	m^3	3'500	13.40	46'900	1.80	6'300	15.20	53'200

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
15.4	**Sundries**								
15.4.01	Control instrumentation (% of Item 15.3)	%	0.50%		17'651		4'048	-	21'699
15.4.02	Miscellaneous works (% on Items 15.1, 15.2, & 15.3)	%	4.00%		196'849		52'064	-	248'913
16	**MATO GROSSO DIVERSION TUNNEL**								
16.1	**Excavation and Backfill**								
16.1.01	Common excavation (material to right bank disposal area No. 2)	m³	59'800	6.50	388'700	2.33	139'334	8.83	528'034
16.1.02	Common excavation (material to a close stock for subseq. tunnel backfill)	m³	65'000	2.33	151'450	0.85	55'250	3.18	206'700
16.1.03	Random backfill	m³	65'000	3.30	214'500	0.80	52'000	4.10	266'500
16.2	**Concrete Works**								
16.2.01	Foundation compaction	m²	14'000	0.50	7'000		-	0.50	7'000
16.2.02	Concrete, inlet and outlet	m³	2'600	134.50	349'700	3.00		137.50	349'700
16.2.03	Concrte, tunnel	m³	49'400	120.10	5'932'940	2.66	131'404	122.76	6'064'344
16.2.04	Concrete, lean	m³	3'500	58.38	204'330	2.40	8'400	60.78	212'730
16.2.05	Portland cement for concrete of items 16.2.02 and 16.2.03	t	11'934	187.92	2'242'637		-	187.92	2'242'637
16.2.06	Portland cement for concrete of Item 16.2.04	t	179	187.92	33'544		-	187.92	33'544
16.2.07	Pozzolan for concrete of items 12.2.02 to 12.3.04	t	2'138	156.01	333'549		-	156.01	333'549
16.2.08	Reinforcing steel	t	3'120	3'822.36	11'925'763	7.16	22'339	3'829.52	11'948'102
16.3	**Sundries**								
16.3.01	Miscellaneous works (% on items 16.1 and 16.2)	%	4%		871'365		16'349	-	887'714
17	**DEWATERING AND CARE OF WATER**								
17.1	**Right Bank Areas**								
17.1.01	Dewatering	m³	4'518'720	0.19	858'557		-	0.19	858'557
17.1.02	Care of water	l.s.			576'000		-	-	576'000
17.2	**Left Bank Areas**								
17.2.01	Dewatering	m³	3'674'000	0.21	771'540		-	0.21	771'540
17.2.02	Care of water	l.s.			552'000		-	-	552'000
17.3	**Rockfill Dam Foundation Area**								
17.3.01	Dewatering	m³	2'954'360	0.24	709'046		-	0.24	709'046
17.3.02	Care of water	l.s.			95'000		-	-	95'000

Item	Description	Unit	Quantity	Local Currency (US$ equiv.)		Foreign Currency (US$)		Total (US$ equivalent)	
				Price	Amount	Price	Amount	Price	Amount
			(1)	(2)	(1 x 2)	(3)	(1 x 3)	(2+3)	(1 x (2+3))
17.4	**Sundries**								
17.4.01	Miscellaneous works (% on items 17.1, 17.2 and 17.3)	%	10%		356'214		-	-	356'214
18	**OPERATOR'S VILLAGE**								
18.1	**Land Preparation**								
18.1.01	General excavation, common	m^3	130'000	3.70	481'000		-	3.70	481'000
18.1.02	Trench excavation, common	m^3	12'000	9.30	111'600		-	9.30	111'600
18.1.03	Fills and backfills	m^3	60'000	4.90	294'000		-	4.90	294'000
18.1.04	Grassing, sodding and planting	m^3	34'000	6.00	204'000		-	6.00	204'000
18.2	**Buildings**								
18.2.01	Houses, single type	m^2	10'200	300.00	3'060'000		-	300.00	3'060'000
18.2.02	Houses, double type	m^2	4'910	270.00	1'325'700		-	270.00	1'325'700
18.2.03	Office	m^2	350	240.00	84'000		-		84'000
18.2.04	School	m^2	450	230.00	103'500			240.00	103'500
18.2.05	Recreation building	m^2	300	220.00	66'000		-	220.00	66'000
18.2.06	Store	m^2	250	200.00	50'000		-	200.00	50'000
18.2.07	Market	m^2	300	250.00	75'000		-	250.00	75'000
18.3	**General Works**								
18.3.01	Fences	m	1'100	155.00	170'500		-	155.00	170'500
18.3.02	Gates	kg	3'000	4.80	14'400		-	4.80	14'400
18.3.03	Paved roads, yards and walkways	m^2	27'300	38.00	1'037'400		-	38.00	1'037'400
18.3.04	Electric power, telephone, drainage and sewarage systems	l.s.	------		1'000'000			-	1'000'000
18.4	**Sundries**								
18.4.01	Grounds for football, tennis, basket-ball, etc	ls.	------		200'000				200'000
18.4.02	Furnitures, office equipment etc	ls.	------		800'000				800'000
18.4.03	Miscellaneous works (% on items 18.1 to 18.4.02)	%	10%		585'480		-	-	585'480
GRAND TOTAL --->>					**2'198'099'641**		**176'876'204**		**2'366'190'694**

Annex 2

Cost Estimate of Hydromechanical Equipment

Where applicable (gates, stoplogs and trash racks) the cost estimates of the hydro-mechanical equipment have been developed estimating first the weight, on the basis of the design data given in the Feasibility report, and then applying unit prices for manufacturing on the basis of international unit prices of comparable equipment. The prices of other items, like cranes, hydraulic units etc. have been estimated on the basis of international prices for items of comparable characteristics.

For the purpose of cost splitting between local and foreign currency, it has been considered that the Brazilian industry will have the capacity to manufacture all items required, and thus the entire cost has been considered local. The exchange rate applied for the conversion is

1 USD = 2.10 Reais

Cost Estimate - Hydromechanical Equipment

No.	Item	Unit	Quantity	Dimensions (m)			Unit	Capacity	Unit	Total Price	
				Width	Height	Head	Weight (t)	(t)	Price ($)	(USD)	(Reais)
1	**Surface Spillway**	**gl**								**64'493'000**	**135'435'000**
1.1	Radial Gates	un								44'400'000	93'240'000
1.1.1	FOB Price - Gate	un	21	20.00	21.90	21.90	204.4		7'000	30'047'000	63'099'000
1.1.2	FOB Price - Embedded Parts	un	21				54.8		3'500	4'028'000	8'459'000
1.1.3	FOB Price - Hoists & Hydraulic System	un	21						200'000	4'200'000	8'820'000
1.1.4	Transport & Insurance	%	6%							2'297'000	4'824'000
1.1.5	Erection & Tests	%	10%							3'828'000	8'039'000
1.2	Upstream Stoplogs									10'502'000	22'054'000
1.2.1	FOB Price - Stoplog	un	5	20.00	30.00	30.00	262.6		6'000	7'878'000	16'544'000
1.2.2	FOB Price - Provisional Embedded Parts	un	10				12.8		3'500	448'000	941'000
1.2.3	FOB Price - Permanent Embedded Parts	un	21				9.9		3'500	728'000	1'529'000
1.2.4	Transport & Insurance	%	6%							543'000	1'140'000
1.2.5	Erection & Tests	%	10%							905'000	1'901'000
1.3	Downstream Stoplogs									2'165'000	4'547'000
1.3.1	FOB Price - Stoplog	un	5	20.00	8.00	8.00	48.0		6'000	1'440'000	3'024'000
1.3.2	FOB Price - Embedded Parts	un	21				5.8		3'500	426'000	895'000
1.3.3	Transport & Insurance	%	6%							112'000	235'000
1.3.4	Erection & Tests	%	10%							187'000	393'000

Cost Estimate - Hydromechanical Equipment

No.	Item	Unit	Quantity	Dimensions (m)			Unit	Capacity	Unit	Total Price	
				Width	Height	Head	Weight (t)	(t)	Price ($)	(USD)	(Reais)
1.4	Gantry Crane	un								413'000	867'000
1.4.1	FOB Price	un	1					32.0	350'000	350'000	735'000
1.4.2	Transport & Insurance	%	6%							21'000	44'000
1.4.3	Erection & Tests	%	12%							42'000	88'000
1.5	Miscellaneous Metalworks	gl					173.0		4'000	692'000	1'453'000
1.6	Painting	gl								0	0
1.7	Electrical Equipment	m	575						2'000	1'150'000	2'415'000
1.8	Control Equipment	un	21						100'000	2'100'000	4'410'000
1.9	Miscellaneous Costs	%	5%							3'071'000	6'449'000
2	**Power Intakes**	**gl**								**96'674'000**	**203'015'000**
2.1	Stoplogs	gl								32'900'000	69'090'000
2.1.1	FOB Price - Stoplog	un	48	7.55	19.20	46.80	86.5		6'000	24'912'000	52'315'000
2.1.2	FOB Price - Embedded Parts	gl	88	7.55	50.30		11.2		3'500	3'450'000	7'245'000
2.1.3	Transport & Insurance	%	6%							1'702'000	3'574'000
2.1.4	Erection & Tests	%	10%							2'836'000	5'956'000
2.2	Gantry Crane& Rack Cleaning Machine	gl								885'000	1'859'000
2.2.1	FOB Price	un	3					17.0	250'000	750'000	1'575'000
2.2.2	Transport & Insurance	%	6%							45'000	95'000
2.2.3	Erection & Tests	%	12%							90'000	189'000
2.3	Trash Racks	gl								32'535'000	68'324'000
2.3.1	FOB Price - Mobile Panels	un	176	4.50	30.30		34.1		4'500	26'997'000	56'694'000
2.3.2	FOB Price - Embedded Parts	un	176				1.7		3'500	1'050'000	2'205'000
2.3.3	Transport & Insurance	%	6%							1'683'000	3'534'000
2.3.4	Erection & Tests	%	10%							2'805'000	5'891'000
2.4	Miscellaneous Metalworks	gl					350.0		4'000	1'400'000	2'940'000
2.5	Painting	gl								0	0
2.6	Electrical Equipment	gl								2'350'000	4'935'000
2.7	Floating Debris Complementary Interceptor System	m	1100.00						20'000	22'000'000	46'200'000
2.8	Control Equipment	gl								0	0
2.9	Miscellaneous Costs	%	5%							4'604'000	9'668'000

Cost Estimate - Hydromechanical Equipment

No.	Item	Unit	Quantity	Dimensions (m)			Unit	Capacity	Unit	Total Price	
				Width	Height	Head	Weight (t)	(t)	Price ($)	(USD)	(Reais)
3	**Draft Tubes**	**gl**								**123'655'000**	**259'676'000**
3.1	Stoplogs	gl								10'348'000	21'731'000
3.1.1	FOB Price - Stoplog	un	8	15.30	16.60	39.21	145.1		6'000	6'965'000	14'627'000
3.1.2	FOB Price - Embedded Parts	gl	44		40.25		12.7		3'500	1'956'000	4'108'000
3.1.3	Transport & Insurance	%	6%							535'000	1'124'000
3.1.4	Erection & Tests	%	10%							892'000	1'873'000
3.2	Emergency Gates									98'207'000	206'235'000
3.2.1	FOB Price - Gate	un	44	15.30	16.60	26.90	218.7		7'000	67'360'000	141'456'000
3.2.2	FOB Price - Embedded Parts	gl	44	15.30	40.25		55.2		3'500	8'501'000	17'852'000
3.2.3	FOB Price - Hoists & Hydraulic System	gl	44						200'000	8'800'000	18'480'000
3.2.4	Transport & Insurance	%	6%							5'080'000	10'668'000
3.2.5	Erection & Tests	%	10%							8'466'000	17'779'000
3.3	Downstream Gantry Crane	gl								1'062'000	2'230'000
3.3.1	FOB Price	un	2					52.0	450'000	900'000	1'890'000
3.3.2	Transport & Insurance	%	6%							54'000	113'000
3.3.3	Erection & Tests	%	12%							108'000	227'000
3.4	Miscellaneous Metalworks	gl					350.0		4'000	1'400'000	2'940'000
3.5	Painting	gl								0	0
3.6	Electrical Equipment	gl								2'350'000	4'935'000
3.7	Control Equipment	un	44						100'000	4'400'000	9'240'000
3.8	Miscellaneous Costs	%	5%							5'888'000	12'365'000
4	**Mato Grosso Stream Diversion**	**gl**								**507'000**	**1'065'000**
4.1	Stoplogs	gl								483'000	1'014'000
4.1.1	FOB Price - Stoplog	un	4	5.00	5.00	23.45	13.3		6'000	319'000	670'000
4.1.2	FOB Price - Upstream Embedded Parts	un	4	5.00	26.45		4.7		3'500	66'000	139'000
4.1.3	FOB Price - Downstream Embedded Parts	un	2	5.00	21.50	20.50	4.4		3'500	31'000	65'000
4.1.4	Transport & Insurance	%	6%							25'000	53'000
4.1.5	Erection & Tests	%	10%							42'000	88'000
4.2	Miscellaneous Costs	%	5%							24'000	50'000
	Total, Hydromechanical Equipment									**285'329'000**	**599'191'000**

Annex 3

Cost Estimate of Electromechanical Equipment

The detailed cost estimate has been developed in USD, on the basis of international prices for comparable types of equipment offered in recent bids or awarded in on-going or recently completed contracts, complemented by the Colenco's internal data base. For the purpose of cost splitting between local and foreign currency, it has been considered that:

- All minor and auxiliary mechanical and electrical equipment (pumps, motors, cranes, MV and LV electrical equipment etc.) will be manufactured in Brazil;
- The bulb units (turbines and generators) could also be mostly manufactured in Brazil, except for some specific items, such as the unit shafts. The critical aspect in this regards is related to the capacity of the Brazilian industry to manufacture all units foreseen at the one month per unit sequence planned in the project implementation schedule. Pending an investigation of this issue, it has been assumed that the units will be manufactured by a consortium of manufacturers, with one unit alternatively coming from Brazil and from abroad. For the units nominally manufactured in Brazil, the foreign currency component on the FOB cost was assumed as 20% of the total, while for the machines nominally manufactured abroad it was assumed that the foreign currency component will increase to 50%.
- The main transformers are assumed to be fully manufactured in Brazil, while the GIS switchyard is assumed to have an 80% foreign currency component.
- Control, metering and protection equipment is assumed to have 50% foreign currency component.
- Equipment transportation cost have been computed according to estimated % of the FOB prices for the international transportation when relevant (in foreign currency) and for the local transportation (always in Reais). Erection costs have been considered local in any case.

The exchange rates applied for the conversion is

2.10 Reais = 1 USD.

Cost Estimate - Electromechanical Equipment

No.	Item	Unit	Quantity	Technical Data	Unit Price ($)	Foreign Portion (%)	Total Price		
							Foreign Portion (USD)	Local Portion (Reais)	Total (USD Eq.)
1	**Turbine, Governors & Ancillaries**	**gl**					**165'175'472**	**898'868'309**	**593'208'000**
1.1	FOB Price	un	44	73 MW at 13.9 m Head, 81.8 rpm, Rotor diameter 8.15	10'700'000	35.00%	164'780'000	642'642'000	470'800'000
1.2	Transport & Insurance	%	6%			1.40%	395'472	58'490'309	28'248'000
1.3	Erection & Tests	%	20%			0.00%	0	197'736'000	94'160'000
2	**Generators & Excitation**	**gl**					**96'017'894**	**522'520'123**	**344'837'000**
2.1	FOB Price	un	44	80 MVA	6'220'000	35.00%	95'788'000	373'573'200	273'680'000
2.2	Transport & Insurance	%	6%			1.40%	229'894	34'001'323	16'421'000
2.3	Erection & Tests	%	20%			0.00%	0	114'945'600	54'736'000
3	**Generator Connections, Switchgear & Ass. Eq.**	**gl**					**0**	**24'448'200**	**11'642'000**
3.1	FOB Price	un	44		210'000	0.00%	0	19'404'000	9'240'000
3.2	Transport & Insurance	%	6%			0.00%	0	1'163'400	554'000
3.3	Erection & Tests	%	20%			0.00%	0	3'880'800	1'848'000
4	**Power Transformers and Auxiliaries**	**gl**					**0**	**45'595'200**	**21'712'000**
4.1	FOB Price	un	12	320 MVA, 13.8/500 kV	1'630'000	0.00%	0	41'076'000	19'560'000
4.2	Transport & Insurance	%	6%			0.00%	0	2'465'400	1'174'000
4.3	Erection & Tests	%	5%			0.00%	0	2'053'800	978'000
5	**Gas Insulated Switchgear**	**gl**					**19'671'104**	**18'446'182**	**28'455'000**
5.1	FOB Price	gl		11 + 3 bays		80.00%	19'624'000	10'302'600	24'530'000
5.2	Transport & Insurance	%	6%			3.20%	47'104	2'992'282	1'472'000
5.3	Erection & Tests	%	10%			0.00%	0	5'151'300	2'453'000
6	**Connection to Porto Velho Substation**	**km**	**10.00**	**500 kV double line**	**850'000**	**0.00%**	**0**	**17'850'000**	**8'500'000**
7	**Power Cables and Accessories**	**gl**					**0**	**22'247'400**	**10'594'000**
7.1	FOB Price	un	44		199'000	0.00%	0	18'387'600	8'756'000
7.2	Transport & Insurance	%	6%			0.00%	0	1'102'500	525'000
7.3	Erection & Tests	%	15%			0.00%	0	2'757'300	1'313'000
8	**Auxiliary Electrical Plant**						**0**	**42'535'500**	**20'255'000**
8.1	FOB Price	gl				0.00%	0	35'154'000	16'740'000
8.2	Transport & Insurance	%	6%			0.00%	0	2'108'400	1'004'000
8.3	Erection & Tests	%	15%			0.00%	0	5'273'100	2'511'000

Cost Estimate - Electromechanical Equipment

No.	Item	Unit	Quantity	Technical Data	Unit Price ($)	Foreign Portion (%)	Total Price		
							Foreign Portion (USD)	Local Portion (Reais)	Total (USD Eq.)
9	**Control, Metering and Protection**						**10'655'520**	**40'575'108**	**29'977'000**
9.1	FOB Price	gl				50.00%	10'630'000	22'323'000	21'260'000
9.2	Transport & Insurance	%	6%			2.00%	25'520	2'626'008	1'276'000
9.3	Erection & Tests	%	35%			0.00%	0	15'626'100	7'441'000
10	**Communications and Data Transmission**						**0**	**2'173'500**	**1'035'000**
10.1	FOB Price	gl				0.00%	0	1'659'000	790'000
10.2	Transport & Insurance	%	6%			0.00%	0	98'700	47'000
10.3	Erection & Tests	%	25%			0.00%	0	415'800	198'000
11	**Cabling**						**0**	**14'483'700**	**6'897'000**
11.1	FOB Price	gl				0.00%	0	11'970'000	5'700'000
11.2	Transport & Insurance	%	6%			0.00%	0	718'200	342'000
11.3	Erection & Tests	%	15%			0.00%	0	1'795'500	855'000
12	**Earthing and Lightning Protection**						**0**	**4'890'900**	**2'329'000**
12.1	FOB Price	un	44		42'000	0.00%	0	3'880'800	1'848'000
12.2	Transport & Insurance	%	6%			0.00%	0	233'100	111'000
12.3	Erection & Tests	%	20%			0.00%	0	777'000	370'000
13	**Lighting and Small Power**						**0**	**19'229'700**	**9'157'000**
13.1	FOB Price	un	44		172'000	0.00%	0	15'892'800	7'568'000
13.2	Transport & Insurance	%	6%			0.00%	0	953'400	454'000
13.3	Erection & Tests	%	15%			0.00%	0	2'383'500	1'135'000
14	**Ventilation and Air Conditioning System**						**0**	**26'386'500**	**12'565'000**
14.1	FOB Price	un	44		236'000	0.00%	0	21'806'400	10'384'000
14.2	Transport & Insurance	%	6%			0.00%	0	1'308'300	623'000
14.3	Erection & Tests	%	15%			0.00%	0	3'271'800	1'558'000
15	**Elevators**						**0**	**5'065'200**	**2'412'000**
15.1	FOB Price	un	11		174'000	0.00%	0	4'019'400	1'914'000
15.2	Transport & Insurance	%	6%			0.00%	0	241'500	115'000
15.3	Erection & Tests	%	20%			0.00%	0	804'300	383'000
16	**Fire Detection**						**0**	**11'180'400**	**5'324'000**
16.1	FOB Price	un	44		100'000	0.00%	0	9'240'000	4'400'000
16.2	Transport & Insurance	%	6%			0.00%	0	554'400	264'000
16.3	Erection & Tests	%	15%			0.00%	0	1'386'000	660'000

Cost Estimate - Electromechanical Equipment

No.	Item	Unit	Quantity	Technical Data	Unit Price ($)	Foreign Portion (%)	Total Price		
							Foreign Portion (USD)	Local Portion (Reais)	Total (USD Eq.)
17	**Auxiliary Mechanical Plant**						**0**	**10'012'800**	**4'768'000**
17.1	FOB Price	un	44		86'000	0.00%	0	7'946'400	3'784'000
17.2	Transport & Insurance	%	6%			0.00%	0	476'700	227'000
17.3	Erection & Tests	%	20%			0.00%	0	1'589'700	757'000
18	**Cranes and Lifting Equipment**						**0**	**12'654'600**	**6'026'000**
18.1	FOB Price						0	10'458'000	4'980'000
17.1.1	Main Cranes	un	2	250 t, 22 m span, 980 m length	1'050'000	0.00%	0	4'410'000	2'100'000
17.1.2	Auxiliary Cranes	un	3	50 t, 21 m span, 980 m length	520'000	0.00%	0	3'276'000	1'560'000
17.1.3	Crane of Erection Area	un	4	250t, 12 m span, 64 m length	330'000	0.00%	0	2'772'000	1'320'000
18.2	Transport & Insurance	%	6%			0.00%	0	627'900	299'000
18.3	Erection & Tests	%	15%			0.00%	0	1'568'700	747'000
19	**Maintenance Tools and Equipment**						**71'572**	**1'439'399**	**757'000**
19.1	FOB Price	gl				10.00%	71'400	1'349'460	714'000
19.2	Transport & Insurance	%	6%			0.40%	172	89'939	43'000
19.3	Erection & Tests	%	0%			0.00%	0	0	0
20	**Spare Parts**						**6'660'948**	**84'623'809**	**46'958'000**
20.1	FOB Price	%	5%	of equipment cost		15.00%	6'645'000	79'075'500	44'300'000
20.2	Transport & Insurance	%	6%			0.60%	15'948	5'548'309	2'658'000
20.3	Erection & Tests	%	0%			0.00%	0	0	0
21	**Tests on Plant**						**2'034'400**	**13'250'160**	**8'344'000**
	During manufacturing	un	44		38'000	20.00%	334'400	2'808'960	1'672'000
	Model testing	gl				100.00%	600'000	0	600'000
	Site tests	un	44		88'000	0.00%	0	8'131'200	3'872'000
	Reliability test	un	44		25'000	0.00%	0	2'310'000	1'100'000
	Witness testing	un	44		25'000	100.00%	1'100'000	0	1'100'000
	Total, Electromechanical Equipment						**300'286'910**	**1'838'476'689**	**1'175'752'000**

Annex 4

Estimate of
Land Acquisition, Relocations, Social and Environmental Costs

The budget foreseen by PCE/Furnas/Odebrecht has been reviewed, taking into account the description of the different social – environmental actions described in the Chapter 9 of the feasibility report, and some general reference cost data from other international projects.

Land Acquisition, Relocations, Social & Environmental Costs

No	Item	Odbrecht Estimate					Colenco Estimate (USD)	Comments
		Unit	Quantity	Unit Price Reais	Cost 10^3 Reais	Cost USD		
.10.10	**Land Acquisition**	**gl**			**114'820**	**54'676'333**	**19'796'000**	**The amount indicated by Odebretcht would correspond to about 3020 $/ha, which is deemed too high. The amount calculated by Colenco corresponds to an average cost for the land acquisition of 1090 $ha.**
.10.10.10	City Properties	gl			4'338	2'065'561	0	
.10.10.10.10	Reservoir	gl	1	2'148'925	2'149	1'023'298		Not understood - Reservoir?
.10.10.10.40	Areas to be Permanently Protected	gl	1	2'188'753	2'189	1'042'263		Not Understood. Inside the city?
.10.10.11	Rural Properties	gl			90'478	43'084'641	16'394'000	
.10.10.11.10a	Reservoir	gl	1	21'351'145	21'351	10'167'212	10'167'000	Assuming to purchase the area up to the maximum exceptional water level (180.9 km2), the value indicated by Odebrecht means an average price of about 560 $/ha. This value is deemed reasonable.
.10.10.11.11	Construction Facilities, Camps, borrow Area & Similar	gl	1	205'950	206	98'071	765'000	The area required is about 500 ha: the corresponding average unit price is assumed by Colenco to be about three times the price for the reservoir land.
.10.10.11.40a	Conservation Units / Areas to be Permanently Protected	gl	1	11'470'200	11'470	5'462'000	5'462'000	With the same unit price of .10.10.11.10a, the area to be protected would be about 10710 ha. This is accepted, although no information has been found in the feasibility report
.10.10.11.41	Rural Relocation	gl	1	8'234'815	8'235	3'921'340		Not understood - It seems a duplication of .10.11.20.41
.10.10.11.43	Town and Settlements	gl	1	176'370	176	83'986		Not understood.
.10.10.11.17	Other (Areas subject to restrictions of use because of the plant)	gl	1	49'039'266	49'039	23'352'031		Not understood. Having purchased the reservoir area, it is not clear which area could be still subject to restrictions of use.
.10.10.12	Legal Land Acquisition Costs	gl	1	5'083'872	5'084	2'420'891	820'000	The amount indicated by Odebrecht is about 5% of the total of .10.10.10 + .10.10.11. This percentage is deemed reasonable and is applied to Colenco's estimate.
.10.10.13	Other Costs		1	14'921'005	14'921	7'105'241	2'582'000	The amount indicated by Odebrecht is about 15% of the total of .10.10.10 + .10.10.11 + .10.10.12. This percentage is deemed acceptable, although rather high.
.10.11	**Relocations**	**gl**			**71'085**	**33'849'935**	**30'360'000**	
.10.11.14.01	National Road BR-364	gl	1	4'051'256	4'051	1'929'170	14'700'000	The amount indicated by Odebrecht is way too low. See Approximate Estimate (Separate Sheet)
.10.11.18	Transmission / Distribution System	gl	1	604'707	605	287'956	290'000	We have no elements to check this amount
.10.11.20	Population Resettlement				65'352	31'119'941	15'370'000	The data on affected population according to the feasibility report are - Total population affected 2046 persons (437 urban and 1609 rural) - Families affected 561 (106 urban and 455 rural) - Families to be relocated 30, population to be relocated about 120. The total estimate of resettlement costs of Colenco considers the item .10.11.20.41 + 20'000 $ for each other family affected.
.10.11.20.41	Rural Resettlement (30 families)	gl	1	23'314'965	23'315	11'102'364	1'200'000	In another IPP project in Laos, the total budget foreseen in the Concession Agreement for population resettlement was 20.0 million $ for a population to be resettled of 5759 persons (982 families) - Average resettlment cost about 20'000 $/family. The estimate of Colenco for Santo Antonio is based on a unit cost of 40'000 $/family

Land Acquisition, Relocations, Social & Environmental Costs

No	Item	Odbrecht Estimate					Colenco Estimate (USD)	Comments
		Unit	Quantity	Unit Price Reais	Cost 10^3 Reais	Cost USD		
.10.11.20.43	Town and Settlements	gl	1	8'587'739	8'588	4'089'399		Not Justified
.10.11.20.44	Isolated Social and Economic Infrastructure	gl	1	195'502	196	93'096		Not Justified
.10.11.20.17	Other	gl	1	33'253'670	33'254	15'835'081	3'550'000	The amount indicated by Odebrecht is about 104% of items .10.11.20.41, .10.11.20.43 and .10.11.20.44. This percentage is too high. Colenco proposes to apply 30%.
.10.11.21	Other Relocations	gl	1	309'076	309	147'179		Not Justified
.10.11.13	Other Costs	gl	1	767'949	768	365'690		Not Justified
.10.15	**Other Social-Environmental Actions**	**gl**			**307'855**	**146'597'457**	**90'585'000**	
.10.15.44	Social-Environmental Communication	gl			7'264	3'459'060	2'000'000	In the opinion of Colenco the budget indicated by Odebrecht is too high
.10.15.44.10	Communication Actions in the Field	gl	1	1'336'858	1'337	636'599		
.10.15.44.11	Environmental Education Actions	gl	1	3'244'800	3'245	1'545'143		
.10.15.44.12	Workshops	vb	1	540'800	541	257'524		
.10.15.44.13	Public Meetings	gl	4	270'400	1'082	515'048		
.10.15.44.14	Informations to Media	gl	1	1'059'968	1'060	504'747		
.10.15.45	Physical / Biological Environment	gl			163'352	77'786'580	51'070'000	
.10.15.45.18	Reservoir Clearing	ha	8000	1'676	13'412	6'386'590	6'000'000	The unit price indicated (about 750 $/ha) is deemed reasonable.
.10.15.45.40.01	Conservation Units (Resolução 02/96 CONAMA)	%	0.5	11'243'500'000	56'218	26'770'238	22'500'000	The amount indicated under "Unit Price - Reais" is the Odebrecht estimate of the total cost (minus some item, it is not clear which one). According to Colenco estimate this amount shall be aboutt 4'500'000'000 USD
.10.15.45.40.02	Reservoir Environmental Plan (including APP)	relat.	1	378'560	379	180'267	180'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.45.45	Conservation of Flora/Salvage/Etnobotanics/Bank of Species	ano	4	865'280	3'461	1'648'152	1'648'000	The amount indicated by Odebrecht is deemed acceptable, although rather high.
.10.15.45.46	Conservation of Fauna	gl			45'075	21'464'094	17'242'000	
.10.15.45.46.01	Salvage	ano	5	540'800	2'704	1'287'619	500'000	In the opinion of Colenco the budget indicated by Odebrecht is too high
.10.15.45.46.02	Establishment of an Environmental Research Center	ano	2	811'200	1'622	772'571		This item shall be included in .10.15.45.40.01
.10.15.45.46.03	Monitoring of Herpetofauna	ano	4	202'259	809	385'256		
.10.15.45.46.04	Monitoring of Avifauna	ano	4	223'891	896	426'459		
.10.15.45.46.05	Monitoring of Mastofauna				3'405	1'621'370	2'742'000	The total budget foreseen by Odebrecht for these activities (2742114 $) is deemed adequate, although on the high side.
.10.15.45.46.05.01	Small Mammals	ano	4	256'339	1'025	488'265		
.10.15.45.46.05.02	Medium and Large Size Mammals	ano	4	162'240	649	309'029		
.10.15.45.46.05.03	Waterborne and Amphybious Mammals	ano	4	432'640	1'731	824'076		
.10.15.45.46.06	Monitoring of Entomofauna	ano	4	162'240	649	309'029		
.10.15.45.46.07	Monitoring of Ictiofauna, Inv. & Study of Fishes Migration Facilities	ano	12	1'622'400	19'469	9'270'857	4'000'000	The budget indicated by Odebrecht is too high for a purely monitoring activity.
.10.15.45.46.08	Construction of Fishes Migration Facilities	un	1	14'060'800	14'061	6'695'619	10'000'000	Nothing is foreseen at the moment in the project. It is deemed prudent to allocate a budget higher than foreseen by Odebrecht
.10.15.45.46.09	Salvage of Ictiofauna	resg.	5	292'032	1'460	695'314		Shall be included in .10.15.45.46.01
.10.15.45.47	Limnology and Water Quality	camp.	114	86'528	9'864	4'697'234	1'000'000	Item .10.15.45.47.01 shall be included in .10.15.45.47. In the opinion of Colenco, the amounts foreseen by Odebrecht are too high.
.10.15.45.47.01	Hydrobiological and Geochemical Monitoring	camp.	38	162'240	6'165	2'935'771		
.10.15.45.48	Reinstatement of Camp and Work Areas	ano	8	1'352'000	10'816	5'150'476		Included in the cost estiimate of civil works.
.10.15.45.17	Physical Monitoring	gl			8'223	3'915'907	2'500'000	
.10.15.45.17.01	Meteorological Monitoring	ano	10	135'200	1'352	643'810	100'000	There is no reason for the cost indicated by Odebrecht (telemetric stations, reading personnel not required).
.10.15.45.17.02	Procurement and Erection of 4 Meteorological Stations	un	4	120'598	482	229'711	230'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.45.17.03	Sesmological Monitoring	ano	10	81'120	811	386'286	100'000	In the opinion of Colenco the budget indicated by Odebrecht is too high. It shall only be required to record the data at a research center, and provide an annual report.

Land Acquisition, Relocations, Social & Environmental Costs

No	Item	Odbrecht Estimate					Colenco Estimate (USD)	Comments
		Unit	Quantity	Unit Price Reais	Cost 10^3 Reais	Cost USD		
.10.15.45.17.04	Procurement and Erection of 3 Seismic Stations	un	3	201'178	604	287'397	290'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.45.17.05	Monitoring and Modelling of Reservoir Morphodynamics	ano	6	400'192	2'401	1'143'406	1'140'000	The amount indicated by Odebrecht is deemed acceptable, although rather high.
.10.15.45.17.06	Groundwater Level Monitoring	ano	7	27'040	189	90'133	200'000	The amount indicated by Odebrecht is deemed low.
.10.15.45.17.07	Monitoring of Mineral Rights	ano	4	54'080	216	103'010	100'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.45.17.08	Hydrological and Sediimentological Monitoring	camp.	192	7'571	1'454	692'224		This item shall be part of .10.15.45.17.05
.10.15.45.17.09	Procurement and Erection of 4 Hydrometric Stations	un	4	178'464	714	339'931	340'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.45.18	Other	%	10	97'394'835	9'739	4'637'849		Not Justified
.10.15.46	Socio-Economic and Cultural Environment				108'447	51'641'250	35'700'000	
.10.15.46.42	Follow up of Indigenous Issues	ano	5	540'800	2'704	1'287'619		Not foreseen in the feasibiliity report, Chapter 9.
.10.15.46.49	Monitoring of Diseases Vectors, Health and Epidemics	ano	12	1'189'760	14'277	6'798'629	6'800'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.46.50	Preservation of Paleontological Heritage	ano	5	843'648	4'218	2'008'686	2'010'000	The amount indicated by Odebrecht is deemed acceptable, although rather high.
.10.15.46.51	Preservation of Arqueological, Pre-historical, Historical and Colutural Heritage	ano	5	1'081'600	5'408	2'575'238	2'580'000	The amount indicated by Odebrecht is deemed acceptable, although rather high.
.10.15.46.52	Support to Porto Velho Municipality	gl			24'877	11'846'095	11'850'000	
.10.15.46.52.10	Jaci-paraná	fam.	750	15'142	11'357	5'408'000	5'410'000	It is understood that this settlement will not be directly affected by the reservoir. The budget foreseen by Odebrecht is deemed generous.
.10.15.46.52.11	Inmigrants	fam.	750	10'816	8'112	3'862'857	3'860'000	The budget foreseen by Odebrecht is deemed acceptable, provided the personnel directly employed in the construction is housed in the contractor's camp, as foreseen in Colenco's cost estimate for the civil works, and only persons providing indirect services for the construction (logistics etc.) will be requiring housing in town.
.10.15.46.52.12	Porto Velho City	vb	1	5'408'000	5'408	2'575'238	2'580'000	Same comment as above.
.10.15.46.53	Socioeconomic Monitoring				2'774	1'321'097	500'000	
.10.15.46.53.10	Support to Fishermen	ano	10	155'750	1'558	741'669	300'000	The amount indicated by Odebrecht is high, for monitoring only.
.10.15.46.53.11	Life Quality of Porto Velho and Jaci-Paraná Population	ano	5	243'360	1'217	579'429	200'000	The amount indicated by Odebrecht is high, for monitoring only.
.10.15.46.54	Reorganisation of Economic Activities				7'679	3'656'838	1'960'000	
.10.15.46.54.10	Fishing Activity	pesc.	150	43'264	6'490	3'090'286	1'500'000	The amount indicated by Odebrecht is high (20600 $/person).
.10.15.46.54.11	Commercial Activities	un	20	32'448	649	309'029	310'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.46.54.12	Industrial Activities	un	5	108'160	541	257'524	150'000	The amount indicated by Odebrecht is high (51500 $ for each activity).
.10.15.46.55	Social Compensations	gl			46'509	22'147'048	10'000'000	The budget foreseen by Odebrecht is deemed too high, not justified by the proposals made in the feasibility report, Chapter 9.
.10.15.46.55.10	Support to the Technology of Exploitation of Forest Products	vb	1	9'193'600	9'194	4'377'905		
.10.15.46.55.11	Support to the Development of Tourism Activities	vb	1	5'948'800	5'949	2'832'762		
.10.15.46.55.12	Support to Social Activities Aimed to Generate Income	vb	1	5'948'800	5'949	2'832'762		
.10.15.46.55.13	Support to Education Area	vb	1	4'867'200	4'867	2'317'714		
.10.15.46.55.14	Support to Health Area	vb	1	4'326'400	4'326	2'060'190		
.10.15.46.55.15	Support to the Area of Basic Sanitation	vb	1	4'326'400	4'326	2'060'190		
.10.15.46.55.16	Support to the Development of River Transportation	vb	1	3'244'800	3'245	1'545'143		
.10.15.46.55.17	Support to Activities of Assistance to Vulnerable Population Groups	vb	1	3'244'800	3'245	1'545'143		
.10.15.46.55.18	Support to the Development of Associations	vb	1	2'163'200	2'163	1'030'095		
.10.15.46.55.19	Restructuring of he Museum of the Madeira Mamoré Railway	vb	1	3'244'800	3'245	1'545'143		
.10.15.47	Licensing and Institutional Management	gl			28'792	13'710'568	1'815'000	
.10.15.47.53.01	Licensing	gl	1	2'163'200	2'163	1'030'095	1'030'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.47.53.02	Environmental Management of the Construction	ano	10	2'271'360	22'714	10'816'000		Meeting environmental requirements in the construction shall be included in the specifications. The relevant costs are included in the cost estimate for the civil works
.10.15.47.55	Management of Institutional Aspects	gl	1	1'297'920	1'298	618'057	620'000	The amount indicated by Odebrecht is deemed acceptable.
.10.15.47.17	Other	%	10	26'174'720	2'617	1'246'415	165'000	Applying the 10% indicated by Odebrecht to Colenco's Estimate
.10.27	**Unforeseen**	**gl**	**1**	**11'346'542**	**11'347**	**5'403'115**	**7'037'000**	**The amount indicated by Odebrecht is about 2.3% of .10.10 + .10.11 + .10.15, which is deemed low. Colenco proposes to apply 5%.**
.10	**Land Acquisition, Relocations, Social & Emvironmental Actions - Total**	**gl**			**505'106**	**240'526'841**	**147'778'000**	

Annex 5

Disbursement Schedule

Santo Antonio Hydroelectric Plant

Disbursement - Local Currency - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

No.	Item	Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
			1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
	Units in Operation									
	Advance Payment & Retention Return - Civil			10.0%						
	Advance Payment & Retention Return - Hydromechanical			5.0%						
	Advance Payment & Retention Return - Electromechanical			5.0%						
1	**Civil Works**									
1.1	General Construction Costs	399'936'936		39'993'694	99'984'234	99'984'234	16'997'320	16'997'320	16'997'320	16'997'320
		100.0%		10.0%	25.0%	25.0%	4.3%	4.3%	4.3%	4.3%
1.2	Powerhouse Headrace Channel	103'772'938		10'377'294	13'836'392	13'836'392	13'836'392	13'836'392	13'836'392	13'836'392
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.3	Intake-Powerhouse Building	911'011'003		91'101'100	70'147'847	70'147'847	70'147'847	70'147'847	70'147'847	70'147'847
		100.0%		10.0%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
1.4	Concrete Walls	130'578'023		13'057'802		13'057'802	30'468'205	30'468'205	30'468'205	
		100.0%		10.0%		10.0%	23.3%	23.3%	23.3%	
1.5	Powerhouse Tailrace Channel	174'085'072		17'408'507	23'211'343	23'211'343	23'211'343	23'211'343	23'211'343	23'211'343
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.6	Auxiliary Cofferdams									
1.6.1	For Left Bank (No.5, 6 & 7)	21'923'310		2'192'331	2'192'331	8'769'324	730'777	730'777	730'777	4'384'662
		100.0%		10.0%	10.0%	40.0%	3.3%	3.3%	3.3%	20.0%
1.6.2	For Right Bank (No. 1, 2, 3 & 4)	19'052'360		1'905'236	1'905'236	7'620'944	635'079	635'079	635'079	3'810'472
		100.0%		10.0%	10.0%	40.0%	3.3%	3.3%	3.3%	20.0%
1.6.3	For Powerhouse Second Stage - U. 17 to 34' (No.8 & 9)	9'993'266		999'327						4'996'633
		100.0%		10.0%						50.0%
1.6.4	For Powerhouse Third Stage - U. 35 to 44 (No. 10 & 11)	5'551'814		555'181						2'775'907
		100.0%		10.0%						50.0%
1.7	Spillway Approach Channel	97'228'230		9'722'823	12'963'764	12'963'764	12'963'764	12'963'764	12'963'764	12'963'764
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.8	Spillway Structure	170'192'069		17'019'207		17'019'207	54'461'462	54'461'462	8'509'603	
		100.0%		10.0%		10.0%	32.0%	32.0%	5.0%	
1.9	Spillway Discharge Channel	42'938'086		4'293'809	5'725'078	5'725'078	5'725'078	5'725'078	5'725'078	5'725'078
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.10	Main Dam Cofferdams	42'061'853		4'206'185						33'649'482
		100.0%		10.0%						80.0%
1.11	Main Rockfill Dam	18'650'177		1'865'018						
		100.0%		10.0%						
1.12	Right Bank Closure Embankment	967'206		96'721	96'721	48'360		628'684		
		100.0%		10.0%	10.0%	5.0%		65.0%		
1.13	Right Bank Closure Dike	5'135'731		513'573	770'360				3'338'225	
		100.0%		10.0%	15.0%				65.0%	
1.14	Mato Grosso Creek Diversion Tunnel	22'655'478		2'265'548	4'531'096	6'796'643	6'796'643			
		100.0%		10.0%	20.0%	30.0%	30.0%			
1.15	Dewatering and Care of Water	3'918'358		391'836	391'836	391'836	391'836	391'836	391'836	783'672
				10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	20.0%
1.16	Operators' Village	9'662'580		1'932'516	2'898'774	2'898'774		966'258		
		100.0%		20.0%	30.0%	30.0%		10.0%		
	Subtotal - Civil Works	**2'189'314'490**		**219'897'707**	**238'655'011**	**282'471'549**	**236'365'746**	**231'164'045**	**186'955'469**	**193'282'572**
	Contingencies on Civil Works	**175'145'159**		**17'591'817**	**19'092'401**	**22'597'724**	**18'909'260**	**18'493'124**	**14'956'438**	**15'462'606**
	Total - Civil Works	**2'364'459'649**		**237'489'524**	**257'747'412**	**305'069'273**	**255'275'006**	**249'657'168**	**201'911'907**	**208'745'178**

Santo Antonio Hydroelectric Plant

Disbursement - Local Currency - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

No.	Item	2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
	Units in Operation	**8**	**14**	**20**	**26**	**32**	**38**	**44**	**44**	**44**	**44**
	Advance Payment & Retention Return - Civil	**5.0%**			**2.5%**					**2.5%**	
	Advance Payment & Retention Return - Hydromechanical	**2.5%**								**2.5%**	
	Advance Payment & Retention Return - Electromechanical	**2.5%**								**2.5%**	
1	**Civil Works**										
1.1	General Construction Costs	39'993'694	3'999'369	3'999'369	13'997'793	3'999'369	3'999'369	3'999'369	7'998'739	9'998'423	
		10.0%	1.0%	1.0%	3.5%	1.0%	1.0%	1.0%	2.0%	2.5%	
1.2	Powerhouse Headrace Channel	5'188'647			2'594'323					2'594'323	
		5.0%			2.5%					2.5%	
1.3	Intake-Powerhouse Building	115'698'397	70'147'847	70'147'847	92'923'122	9'110'110	9'110'110	9'110'110		22'775'275	
		12.7%	7.7%	7.7%	10.2%	1.0%	1.0%	1.0%		2.5%	
1.4	Concrete Walls	6'528'901			3'264'451					3'264'451	
		5.0%			2.5%					2.5%	
1.5	Powerhouse Tailrace Channel	8'704'254			4'352'127					4'352'127	
		5.0%			2.5%					2.5%	
1.6	Auxiliary Cofferdams										
1.6.1	For Left Bank (No.5, 6 & 7)	1'096'166			548'083					548'083	
		5.0%			2.5%					2.5%	
1.6.2	For Right Bank (No. 1, 2, 3 & 4)	952'618			476'309					476'309	
		5.0%			2.5%					2.5%	
1.6.3	For Powerhouse Second Stage - U. 17 to 34' (No.8 & 9)	999'327	499'663	1'998'653	249'832					249'832	
		10.0%	5.0%	20.0%	2.5%					2.5%	
1.6.4	For Powerhouse Third Stage - U. 35 to 44 (No. 10 & 11)	388'627	111'036	111'036	249'832	111'036	1'110'363			138'795	
		7.0%	2.0%	2.0%	4.5%	2.0%	20.0%			2.5%	
1.7	Spillway Approach Channel	4'861'412			2'430'706					2'430'706	
		5.0%			2.5%					2.5%	
1.8	Spillway Structure	10'211'524			4'254'802					4'254'802	
		6.0%			2.5%					2.5%	
1.9	Spillway Discharge Channel	2'146'904			1'073'452					1'073'452	
		5.0%			2.5%					2.5%	
1.10	Main Dam Cofferdams	2'103'093			1'051'546					1'051'546	
		5.0%			2.5%					2.5%	
1.11	Main Rockfill Dam	2'797'527	6'527'562	6'527'562	466'254					466'254	
		15.0%	35.0%	35.0%	2.5%					2.5%	
1.12	Right Bank Closure Embankment	48'360			24'180					24'180	
		5.0%			2.5%					2.5%	
1.13	Right Bank Closure Dike	256'787			128'393					128'393	
		5.0%			2.5%					2.5%	
1.14	Mato Grosso Creek Diversion Tunnel	1'132'774			566'387					566'387	
		5.0%			2.5%					2.5%	
1.15	Dewatering and Care of Water	352'652	78'367	78'367	97'959	39'184	39'184			97'959	
		9.0%	2.0%	2.0%	2.5%	1.0%	1.0%			2.5%	
1.16	Operators' Village	483'129			241'565					241'565	
		5.0%			2.5%					2.5%	
	Subtotal - Civil Works	**203'944'791**	**81'363'845**	**82'862'835**	**128'991'115**	**13'259'699**	**14'259'026**	**13'109'479**	**7'998'739**	**54'732'862**	
	Contingencies on Civil Works	**16'315'583**	**6'509'108**	**6'629'027**	**10'319'289**	**1'060'776**	**1'140'722**	**1'048'758**	**639'899**	**4'378'629**	
	Total - Civil Works	**220'260'374**	**87'872'953**	**89'491'862**	**139'310'404**	**14'320'475**	**15'399'748**	**14'158'238**	**8'638'638**	**59'111'491**	

Santo Antonio Hydroelectric Plant

Disbursement - Local Currency - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

No.	Item	Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
			1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
	Units in Operation									
	Advance Payment & Retention Return - Civil			**10.0%**						
	Advance Payment & Retention Return - Hydromechanical			**5.0%**						
	Advance Payment & Retention Return - Electromechanical			**5.0%**						
2	**Hydromechanical Equipment**									
2.1	Spillway	64'493'000		6'449'300	15'048'367	15'048'367	15'048'367	6'449'300	3'224'650	
		100.0%		10.0%	23.3%	23.3%	23.3%	10.0%	5.0%	
2.2	Power Intakes	96'674'000		4'833'700		4'833'700	19'334'800	19'334'800	14'501'100	14'501'100
		100.0%		5.0%		5.0%	20.0%	20.0%	15.0%	15.0%
2.3	Draft Tubes	123'655'000		6'182'750		6'182'750	10'510'675	10'510'675	10'510'675	10'510'675
		100.0%		5.0%		5.0%	8.5%	8.5%	8.5%	8.5%
2.4	Mato Grosso Stream Diversion	507'000		25'350				101'400	202'800	152'100
		100.0%		5.0%				20.0%	40.0%	30.0%
3	**Electromechanical Equipment**	**875'465'090**		43'773'255		21'886'627	74'414'533	74'414'533	74'414'533	74'414'533
		100.0%		5.0%		2.5%	8.5%	8.5%	8.5%	8.5%
	Subtotal - Equipment	**1'160'794'090**		**61'264'355**	**15'048'367**	**47'951'444**	**119'308'374**	**110'810'708**	**102'853'758**	**99'578'408**
	Contingencies on Equipment	**58'039'705**		**3063217.725**	**752418.3333**	**2397572.196**	**5965418.716**	**5540535.383**	**5142687.883**	**4978920.383**
	Total - Equipment	**1'218'833'795**		**64'327'572**	**15'800'785**	**50'349'016**	**125'273'793**	**116'351'243**	**107'996'446**	**104'557'328**
	Construction Costs	**3'583'293'444**		**301'817'096**	**273'548'197**	**355'418'289**	**380'548'799**	**366'008'411**	**309'908'352**	**313'302'506**
		100.0%		8.4%	7.6%	9.9%	10.6%	10.2%	8.6%	8.7%
4	**Other Implementation Costs at EPC Contractor Level**	**270'386'812**		**22'774'401**	**20'641'297**	**26'819'020**	**28'715'308**	**27'618'125**	**23'384'948**	**23'641'063**
5	**Social & Environmental Costs**	**147'778'000**		16'888'914	16'888'914	16'888'914	16'888'914	16'888'914	16'888'914	16'888'914
		100.0%		11.4%	11.4%	11.4%	11.4%	11.4%	11.4%	11.4%
6	**Other Implementation Costs at Developer Level**	**346'709'301**		**47'881'042**	**25'398'793**	**32'587'682**	**34'794'354**	**33'517'585**	**28'591'523**	**28'889'559**
	Total Implementation Cost	**4'348'167'557**		**389'361'453**	**336'477'201**	**431'713'905**	**460'947'376**	**444'033'036**	**378'773'738**	**382'722'041**
	Price Escalation on Local Currency	**682'465'026**		**15'574'458**	**20'389'192**	**35'227'855**	**47'486'753**	**55'443'741**	**55'733'032**	**65'008'615**
	Annual Price Escalation	4%								

Santo Antonio Hydroelectric Plant

Disbursement - Local Currency - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

No.	Item	2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
	Units in Operation	8	14	20	26	32	38	44	44	44	44
	Advance Payment & Retention Return - Civil	5.0%			2.5%					2.5%	
	Advance Payment & Retention Return - Hydromechanical	2.5%								2.5%	
	Advance Payment & Retention Return - Electromechanical	2.5%								2.5%	
2	**Hydromechanical Equipment**										
2.1	Spillway	1'612'325								1'612'325	
		2.5%								2.5%	
2.2	Power Intakes	4'833'700	2'416'850	2'416'850	2'416'850	2'416'850	2'416'850			2'416'850	
		5.0%	2.5%	2.5%	2.5%	2.5%	2.5%			2.5%	
2.3	Draft Tubes	13'602'050	10'510'675	10'510'675	10'510'675	10'510'675	10'510'675			3'091'375	
		11.0%	8.5%	8.5%	8.5%	8.5%	8.5%			2.5%	
2.4	Mato Grosso Stream Diversion	12'675								12'675	
		2.5%								2.5%	
3	**Electromechanical Equipment**	96'301'160	74'414'533	74'414'533	74'414'533	74'414'533	74'414'533	21'886'627		21'886'627	
		11.0%	8.5%	8.5%	8.5%	8.5%	8.5%	2.5%		2.5%	
	Subtotal - Equipment	**116'361'910**	**87'342'058**	**87'342'058**	**87'342'058**	**87'342'058**	**87'342'058**	**21'886'627**		**29'019'852**	
	Contingencies on Equipment	**5818095.495**	**4367102.883**	**4367102.883**	**4367102.883**	**4367102.883**	**4367102.883**	**1094331.363**		**1450992.613**	
	Total - Equipment	**122'180'005**	**91'709'161**	**91'709'161**	**91'709'161**	**91'709'161**	**91'709'161**	**22'980'959**		**30'470'845**	
	Construction Costs	**342'440'379**	**179'582'113**	**181'201'022**	**231'019'565**	**106'029'636**	**107'108'908**	**37'139'196**	**8'638'638**	**89'582'336**	
		9.6%	5.0%	5.1%	6.4%	3.0%	3.0%	1.0%	0.2%	2.5%	
4	**Other Implementation Costs at EPC Contractor Level**	**25'839'738**	**13'550'840**	**13'672'999**	**17'432'188**	**8'000'744**	**8'082'184**	**2'802'436**	**651'851**	**6'759'670**	
5	**Social & Environmental Costs**	4'222'229	4'222'229	4'222'229	4'222'229	4'222'229	4'222'229	4'222'229			
		2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%			
6	**Other Implementation Costs at Developer Level**	**30'413'907**	**16'113'569**	**16'255'723**	**20'630'214**	**9'655'037**	**9'749'806**	**3'605'871**	**758'546**	**7'866'090**	
	Total Implementation Cost	**402'916'253**	**213'468'751**	**215'351'973**	**273'304'195**	**127'907'646**	**129'163'127**	**47'769'732**	**10'049'035**	**104'208'096**	
	Price Escalation on Local Currency	**77'773'444**	**46'248'624**	**51'845'423**	**72'512'801**	**37'141'473**	**40'806'737**	**16'336'884**	**3'703'763**	**41'232'232**	
	Annual Price Escalation										

Santo Antonio Hydroelectric Plant

Disbursement - Foreign Currency - All Figures in USD

No.	Item	Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
			1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
	Units in Operation									
	Advance Payment & Retention Return - Civil			**10.0%**						
	Advance Payment & Retention Return - Hydromechanical			**5.0%**						
	Advance Payment & Retention Return - Electromechanical			**5.0%**						
1	**Civil Works**									
1.1	General Construction Costs									
		100.0%		10.0%	25.0%	25.0%	4.3%	4.3%	4.3%	4.3%
1.2	Powerhouse Headrace Channel	31'399'300		3'139'930	4'186'573	4'186'573	4'186'573	4'186'573	4'186'573	4'186'573
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.3	Intake-Powerhouse Building	36'415'750		3'641'575	2'804'013	2'804'013	2'804'013	2'804'013	2'804'013	2'804'013
		100.0%		10.0%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
1.4	Concrete Walls	1'872'403		187'240		187'240	436'894	436'894	436'894	
		100.0%		10.0%		10.0%	23.3%	23.3%	23.3%	
1.5	Powerhouse Tailrace Channel	35'505'362		3'550'536	4'734'048	4'734'048	4'734'048	4'734'048	4'734'048	4'734'048
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.6	Auxiliary Cofferdams									
1.6.1	For Left Bank (No.5, 6 & 7)	2'800'526		280'053	280'053	1'120'210	93'351	93'351	93'351	560'105
		100.0%		10.0%	10.0%	40.0%	3.3%	3.3%	3.3%	20.0%
1.6.2	For Right Bank (No. 1, 2, 3 & 4)	5'105'696		510'570	510'570	2'042'278	170'190	170'190	170'190	1'021'139
		100.0%		10.0%	10.0%	40.0%	3.3%	3.3%	3.3%	20.0%
1.6.3	For Powerhouse Second Stage - U. 17 to 34' (No.8 & 9)	2'773'030		277'303						1'386'515
		100.0%		10.0%						50.0%
1.6.4	For Powerhouse Third Stage - U. 35 to 44 (No. 10 & 11)	1'540'572		154'057						770'286
		100.0%		10.0%						50.0%
1.7	Spillway Approach Channel	28'930'256		2'893'026	3'857'367	3'857'367	3'857'367	3'857'367	3'857'367	3'857'367
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.8	Spillway Structure	5'245'630		524'563		524'563	1'678'602	1'678'602	262'282	
		100.0%		10.0%		10.0%	32.0%	32.0%	5.0%	
1.9	Spillway Discharge Channel	8'655'971		865'597	1'154'129	1'154'129	1'154'129	1'154'129	1'154'129	1'154'129
		100.0%		10.0%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
1.10	Main Dam Cofferdams	10'871'941		1'087'194						8'697'553
		100.0%		10.0%						80.0%
1.11	Main Rockfill Dam	3'725'764		372'576						
		100.0%		10.0%						
1.12	Right Bank Closure Embankment	251'216		25'122	25'122	12'561		163'290		
		100.0%		10.0%	10.0%	5.0%		65.0%		
1.13	Right Bank Closure Dike	1'357'711		135'771	203'657				882'512	
		100.0%		10.0%	15.0%				65.0%	
1.14	Mato Grosso Creek Diversion Tunnel	425'076		42'508	85'015	127'523	127'523			
		100.0%		10.0%	20.0%	30.0%	30.0%			
1.15	Dewatering and Care of Water									
				10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	20.0%
1.16	Operators' Village									
		100.0%		20.0%	30.0%	30.0%		10.0%		
	Subtotal - Civil Works	**176'876'204**		**17'687'620**	**17'840'547**	**20'750'507**	**19'242'690**	**19'278'458**	**18'581'360**	**29'171'729**
	Contingencies on Civil Works	**14'150'096**		**1'415'010**	**1'427'244**	**1'660'041**	**1'539'415**	**1'542'277**	**1'486'509**	**2'333'738**
	Total - Civil Works	**191'026'300**		**19'102'630**	**19'267'791**	**22'410'548**	**20'782'106**	**20'820'735**	**20'067'868**	**31'505'468**

Santo Antonio Hydroelectric Plant

Disbursement - Foreign Currency - All Figures in USD

No.	Item	2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
	Units in Operation	**8**	**14**	**20**	**26**	**32**	**38**	**44**	**44**	**44**	**44**
	Advance Payment & Retention Return - Civil	**5.0%**			**2.5%**					**2.5%**	
	Advance Payment & Retention Return - Hydromechanical	**2.5%**								**2.5%**	
	Advance Payment & Retention Return - Electromechanical	**2.5%**								**2.5%**	
1	**Civil Works**										
1.1	General Construction Costs										
		10.0%	1.0%	1.0%	3.5%	1.0%	1.0%	1.0%	2.0%	2.5%	
1.2	Powerhouse Headrace Channel	1'569'965			784'983					784'983	
		5.0%			2.5%					2.5%	
1.3	Intake-Powerhouse Building	4'624'800	2'804'013	2'804'013	3'714'407	364'158	364'158	364'158		910'394	
		12.7%	7.7%	7.7%	10.2%	1.0%	1.0%	1.0%		2.5%	
1.4	Concrete Walls	93'620			46'810					46'810	
		5.0%			2.5%					2.5%	
1.5	Powerhouse Tailrace Channel	1'775'268			887'634					887'634	
		5.0%			2.5%					2.5%	
1.6	Auxiliary Cofferdams										
1.6.1	For Left Bank (No.5, 6 & 7)	140'026			70'013					70'013	
		5.0%			2.5%					2.5%	
1.6.2	For Right Bank (No. 1, 2, 3 & 4)	255'285			127'642					127'642	
		5.0%			2.5%					2.5%	
1.6.3	For Powerhouse Second Stage - U. 17 to 34' (No.8 & 9)	277'303	138'651	554'606	69'326					69'326	
		10.0%	5.0%	20.0%	2.5%					2.5%	
1.6.4	For Powerhouse Third Stage - U. 35 to 44 (No. 10 & 11)	107'840	30'811	30'811	69'326	30'811	308'114			38'514	
		7.0%	2.0%	2.0%	4.5%	2.0%	20.0%			2.5%	
1.7	Spillway Approach Channel	1'446'513			723'256					723'256	
		5.0%			2.5%					2.5%	
1.8	Spillway Structure	314'738			131'141					131'141	
		6.0%			2.5%					2.5%	
1.9	Spillway Discharge Channel	432'799			216'399					216'399	
		5.0%			2.5%					2.5%	
1.10	Main Dam Cofferdams	543'597			271'799					271'799	
		5.0%			2.5%					2.5%	
1.11	Main Rockfill Dam	558'865	1'304'017	1'304'017	93'144					93'144	
		15.0%	35.0%	35.0%	2.5%					2.5%	
1.12	Right Bank Closure Embankment	12'561			6'280					6'280	
		5.0%			2.5%					2.5%	
1.13	Right Bank Closure Dike	67'886			33'943					33'943	
		5.0%			2.5%					2.5%	
1.14	Mato Grosso Creek Diversion Tunnel	21'254			10'627					10'627	
		5.0%			2.5%					2.5%	
1.15	Dewatering and Care of Water										
		9.0%	2.0%	2.0%	2.5%	1.0%	1.0%			2.5%	
1.16	Operators' Village										
		5.0%			2.5%					2.5%	
	Subtotal - Civil Works	**12'242'319**	**4'277'493**	**4'693'448**	**7'256'729**	**394'969**	**672'272**	**364'158**		**4'421'905**	
	Contingencies on Civil Works	**979'385**	**342'199**	**375'476**	**580'538**	**31'598**	**53'782**	**29'133**		**353'752**	
	Total - Civil Works	**13'221'704**	**4'619'693**	**5'068'923**	**7'837'268**	**426'566**	**726'054**	**393'290**		**4'775'658**	

Santo Antonio Hydroelectric Plant

Disbursement - Foreign Currency - All Figures in USD

No.	Item	Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
			1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
	Units in Operation									
	Advance Payment & Retention Return - Civil			**10.0%**						
	Advance Payment & Retention Return - Hydromechanical			**5.0%**						
	Advance Payment & Retention Return - Electromechanical			**5.0%**						
2	**Hydromechanical Equipment**									
2.1	Spillway									
		100.0%		10.0%	23.3%	23.3%	23.3%	10.0%	5.0%	
2.2	Power Intakes									
		100.0%		5.0%		5.0%	20.0%	20.0%	15.0%	15.0%
2.3	Draft Tubes									
		100.0%		5.0%		5.0%	8.5%	8.5%	8.5%	8.5%
2.4	Mato Grosso Stream Diversion									
		100.0%		5.0%				20.0%	40.0%	30.0%
3	**Electromechanical Equipment**	**300'286'910**		15'014'346		7'507'173	25'524'387	25'524'387	25'524'387	25'524'387
		100.0%		5.0%		2.5%	8.5%	8.5%	8.5%	8.5%
	Subtotal - Equipment	**300'286'910**		**15'014'346**		**7'507'173**	**25'524'387**	**25'524'387**	**25'524'387**	**25'524'387**
	Contingencies on Equipment	**15'014'346**		**750717.275**		**375358.6375**	**1276219.368**	**1276219.368**	**1276219.368**	**1276219.368**
	Total - Equipment	**315'301'256**		**15'765'063**		**7'882'531**	**26'800'607**	**26'800'607**	**26'800'607**	**26'800'607**
	Construction Costs	**506'327'556**		**34'867'693**	**19'267'791**	**30'293'079**	**47'582'712**	**47'621'341**	**46'868'475**	**58'306'075**
		100.0%		6.9%	3.8%	6.0%	9.4%	9.4%	9.3%	11.5%
4	**Other Implementation Costs at EPC Contractor Level**	**30'953'683**		**2'131'591**	**1'177'912**	**1'851'928**	**2'908'908**	**2'911'269**	**2'865'244**	**3'564'467**
5	**Social & Environmental Costs**									
		100.0%		11.4%	11.4%	11.4%	11.4%	11.4%	11.4%	11.4%
6	**Other Implementation Costs at Developer Level**	**46'458'728**	300'250'574	**47'881'042**	**25'398'793**	**32'587'682**	**34'794'354**	**33'517'585**	**28'591'523**	**28'889'559**
	Total Implementation Cost	**583'739'966**	300'250'574	**84'880'326**	**45'844'495**	**64'732'689**	**85'285'974**	**84'050'195**	**78'325'242**	**90'760'100**
	Price Escalation on Foreign Currency	**71'098'046**		**1'697'607**	**1'382'189**	**2'615'201**	**4'328'476**	**5'144'544**	**5'621'210**	**7'481'551**
	Annual Price Escalation	2%								

Santo Antonio Hydroelectric Plant

Disbursement - Foreign Currency - All Figures in USD

No.	Item	2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
	Units in Operation	**8**	**14**	**20**	**26**	**32**	**38**	**44**	**44**	**44**	**44**
	Advance Payment & Retention Return - Civil	**5.0%**			**2.5%**					**2.5%**	
	Advance Payment & Retention Return - Hydromechanical	**2.5%**								**2.5%**	
	Advance Payment & Retention Return - Electromechanical	**2.5%**								**2.5%**	
2	**Hydromechanical Equipment**										
2.1	Spillway										
		2.5%								2.5%	
2.2	Power Intakes										
		5.0%	2.5%	2.5%	2.5%	2.5%	2.5%			2.5%	
2.3	Draft Tubes										
		11.0%	8.5%	8.5%	8.5%	8.5%	8.5%			2.5%	
2.4	Mato Grosso Stream Diversion										
		2.5%								2.5%	
3	**Electromechanical Equipment**	33'031'560	25'524'387	25'524'387	25'524'387	25'524'387	25'524'387	7'507'173		7'507'173	
		11.0%	8.5%	8.5%	8.5%	8.5%	8.5%	2.5%		2.5%	
	Subtotal - Equipment	**33'031'560**	**25'524'387**	**25'524'387**	**25'524'387**	**25'524'387**	**25'524'387**	**7'507'173**		**7'507'173**	
	Contingencies on Equipment	**1651578.005**	**1276219.368**	**1276219.368**	**1276219.368**	**1276219.368**	**1276219.368**	**375358.6375**		**375358.6375**	
	Total - Equipment	**34'683'138**	**26'800'607**	**26'800'607**	**26'800'607**	**26'800'607**	**26'800'607**	**7'882'531**		**7'882'531**	
	Construction Costs	**47'904'842**	**31'420'299**	**31'869'530**	**34'637'874**	**27'227'173**	**27'526'660**	**8'275'821**		**12'658'189**	
		9.5%	6.2%	6.3%	6.8%	5.4%	5.4%	1.6%		2.5%	
4	**Other Implementation Costs at EPC Contractor Level**	**2'928'601**	**1'920'840**	**1'948'303**	**2'117'542**	**1'664'498**	**1'682'807**	**505'932**		**773'842**	
5	**Social & Environmental Costs**										
		2.9%	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%			
6	**Other Implementation Costs at Developer Level**	**30'413'907**	**16'113'569**	**16'255'723**	**20'630'214**	**9'655'037**	**9'749'806**	**3'605'871**	**758'546**	**7'866'090**	
	Total Implementation Cost	**81'247'350**	**49'454'708**	**50'073'556**	**57'385'630**	**38'546'708**	**38'959'274**	**12'387'625**	**758'546**	**21'298'121**	
	Price Escalation on Foreign Currency	**7'572'488**	**5'147'286**	**5'761'811**	**7'239'910**	**5'295'095**	**5'792'686**	**1'983'453**	**130'211**	**3'904'328**	
	Annual Price Escalation										

Annex 6

Cash Flow Model

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

Item	Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
Units in Operation									
Total Implementation Cost at Constant Prices - Local Currency	4'348'167'557		389'361'453	336'477'201	431'713'905	460'947'376	444'033'036	378'773'738	382'722'041
Operation & Maintenance Cost at Constant Prices - Local Currency	7'019'217'501		0	0	0	0	0	0	0
Total Disbursement at Constant Prices - Local Currency	11'367'385'058		389'361'453	336'477'201	431'713'905	460'947'376	444'033'036	378'773'738	382'722'041
Price Escalation on Local Currency	17'278'842'068		15'574'458	20'389'192	35'227'855	47'486'753	55'443'741	55'733'032	65'008'615
Total Disbursement - Local Currency	**28'646'227'125**		**404'935'912**	**356'866'393**	**466'941'760**	**508'434'129**	**499'476'776**	**434'506'770**	**447'730'656**
Total Implementation Cost at Constant Prices - Foreign Currency									
Operation & Maintenance Cost at Constant Prices - Foreign Currency									
Total Disbursement at Constant Prices - Foreign Currency	953'172'466		84'880'326	45'844'495	64'732'689	85'285'974	84'050'195	78'325'242	90'760'100
Price Escalation on Foreign Currency	362'371'737		1'697'607	1'382'189	2'615'201	4'328'476	5'144'544	5'621'210	7'481'551
Total Disbursement - Foreign Currency	**1'315'544'204**		**86'577'933**	**47'226'684**	**67'347'890**	**89'614'450**	**89'194'740**	**83'946'453**	**98'241'651**
Energy Production (GWh)			0	0	0	0	0	0	0
Base Energy Tariff ($/GWh)									
Local Currency	45'000								
Foreign Currency	10'000								
Annual Escalation of Energy Tariffs									
Local Currency	0%								
Foreign Currency	0%								
Project Revenues									
Local Currency			**0**	**0**	**0**	**0**	**0**	**0**	**0**
Foreign Currency			**0**	**0**	**0**	**0**	**0**	**0**	**0**
Balance: Revenues - Disbursements									
Local Currency	**44'862'396'213**		**-404'935'912**	**-356'866'393**	**-466'941'760**	**-508'434'129**	**-499'476'776**	**-434'506'770**	**-447'730'656**
Foreign Currency	**14'719'454'853**		**-86'577'933**	**-47'226'684**	**-67'347'890**	**-89'614'450**	**-89'194'740**	**-83'946'453**	**-98'241'651**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
	1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
Units in Operation	**8**	**14**	**20**	**26**	**32**	**38**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency	402'916'253	213'468'751	215'351'973	273'304'195	127'907'646	129'163'127	47'769'732	10'049'035	104'208'096	
Operation & Maintenance Cost at Constant Prices - Local Currency	33176163.47	43887939	52456120.3	59809179.26	66352326.94	72305771.95	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	436'092'417	257'356'690	267'808'093	333'113'374	194'259'973	201'468'899	125'574'732	87'854'035	182'013'096	77'805'000
Price Escalation on Local Currency	84'177'317	55'757'074	64'474'096	88'381'313	56'408'681	63'650'428	42'945'599	32'380'278	72'017'496	32'935'776
Total Disbursement - Local Currency	**520'269'733**	**313'113'763**	**332'282'189**	**421'494'688**	**250'668'654**	**265'119'327**	**168'520'331**	**120'234'313**	**254'030'593**	**110'740'776**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	82'993'464	51'764'599	52'834'404	60'533'482	42'038'936	42'764'840	16'482'625	4'853'546	25'393'121	4'095'000
Price Escalation on Foreign Currency	7'735'231	5'387'701	6'079'494	7'637'050	5'774'817	6'358'519	2'639'126	833'157	4'655'015	798'904
Total Disbursement - Foreign Currency	**90'728'695**	**57'152'300**	**58'913'898**	**68'170'532**	**47'813'753**	**49'123'359**	**19'121'751**	**5'686'702**	**30'048'136**	**4'893'904**
Energy Production (GWh)	7'721	10'214	12'208	13'919	15'442	16'827	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**347'436'748**	**459'615'616**	**549'345'734**	**626'350'506**	**694'873'497**	**757'220'838**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**77'208'166**	**102'136'804**	**122'076'830**	**139'189'001**	**154'416'333**	**168'271'297**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**-172'832'985**	**146'501'853**	**217'063'545**	**204'855'818**	**444'204'843**	**492'101'511**	**646'291'069**	**694'577'087**	**560'780'807**	**704'070'624**
Foreign Currency	**-13'520'529**	**44'984'503**	**63'162'932**	**71'018'469**	**106'602'580**	**119'147'938**	**161'947'449**	**175'382'498**	**151'021'064**	**176'175'296**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

Item	2016 Year 10		2017 Year 11		2018 Year 12		2019 Year 13		2020 Year 14	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	35'128'875	37'365'407	39'646'230	41'972'223	44'344'279	46'763'312	49'230'250	51'746'044	54'311'661	56'928'086
Total Disbursement - Local Currency	**112'933'875**	**115'170'407**	**117'451'230**	**119'777'223**	**122'149'279**	**124'568'312**	**127'035'250**	**129'551'044**	**132'116'661**	**134'733'086**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	847'601	896'782	946'453	996'618	1'047'282	1'098'450	1'150'128	1'202'319	1'255'030	1'308'266
Total Disbursement - Foreign Currency	**4'942'601**	**4'991'782**	**5'041'453**	**5'091'618**	**5'142'282**	**5'193'450**	**5'245'128**	**5'297'319**	**5'350'030**	**5'403'266**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**701'877'525**	**699'640'993**	**697'360'170**	**695'034'177**	**692'662'121**	**690'243'088**	**687'776'150**	**685'260'356**	**682'694'739**	**680'078'314**
Foreign Currency	**176'126'599**	**176'077'418**	**176'027'747**	**175'977'582**	**175'926'918**	**175'875'750**	**175'824'072**	**175'771'881**	**175'719'170**	**175'665'934**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2021 Year 15		2022 Year 16		2023 Year 17		2024 Year 18		2025 Year 19	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	59'596'327	62'317'409	65'092'380	67'922'306	70'808'275	73'751'398	76'752'806	79'813'654	82'935'118	86'118'400
Total Disbursement - Local Currency	**137'401'327**	**140'122'409**	**142'897'380**	**145'727'306**	**148'613'275**	**151'556'398**	**154'557'806**	**157'618'654**	**160'740'118**	**163'923'400**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	1'362'031	1'416'331	1'471'171	1'526'557	1'582'495	1'638'989	1'696'045	1'753'668	1'811'866	1'870'642
Total Disbursement - Foreign Currency	**5'457'031**	**5'511'331**	**5'566'171**	**5'621'557**	**5'677'495**	**5'733'989**	**5'791'045**	**5'848'668**	**5'906'866**	**5'965'642**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**677'410'073**	**674'688'991**	**671'914'020**	**669'084'094**	**666'198'125**	**663'255'002**	**660'253'594**	**657'192'746**	**654'071'282**	**650'888'000**
Foreign Currency	**175'612'169**	**175'557'869**	**175'503'029**	**175'447'643**	**175'391'705**	**175'335'211**	**175'278'155**	**175'220'532**	**175'162'334**	**175'103'558**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2026 Year 20		2027 Year 21		2028 Year 22		2029 Year 23		2030 Year 24	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	89'364'723	92'675'336	96'051'512	99'494'550	103'005'773	106'586'532	110'238'204	113'962'193	117'759'932	121'632'881
Total Disbursement - Local Currency	**167'169'723**	**170'480'336**	**173'856'512**	**177'299'550**	**180'810'773**	**184'391'532**	**188'043'204**	**191'767'193**	**195'564'932**	**199'437'881**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	1'930'003	1'989'955	2'050'503	2'111'654	2'173'413	2'235'787	2'298'781	2'362'402	2'426'657	2'491'551
Total Disbursement - Foreign Currency	**6'025'003**	**6'084'955**	**6'145'503**	**6'206'654**	**6'268'413**	**6'330'787**	**6'393'781**	**6'457'402**	**6'521'657**	**6'586'551**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**647'641'677**	**644'331'064**	**640'954'888**	**637'511'850**	**634'000'627**	**630'419'868**	**626'768'196**	**623'044'207**	**619'246'468**	**615'373'519**
Foreign Currency	**175'044'197**	**174'984'245**	**174'923'697**	**174'862'546**	**174'800'787**	**174'738'413**	**174'675'419**	**174'611'798**	**174'547'543**	**174'482'649**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2031 Year 25		2032 Year 26		2033 Year 27		2034 Year 28		2035 Year 29	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	125'582'529	129'610'396	133'718'030	137'907'012	142'178'951	146'535'492	150'978'309	155'509'112	160'129'642	164'841'676
Total Disbursement - Local Currency	**203'387'529**	**207'415'396**	**211'523'030**	**215'712'012**	**219'983'951**	**224'340'492**	**228'783'309**	**233'314'112**	**237'934'642**	**242'646'676**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	2'557'090	2'623'282	2'690'132	2'757'647	2'825'834	2'894'700	2'964'251	3'034'494	3'105'436	3'177'084
Total Disbursement - Foreign Currency	**6'652'090**	**6'718'282**	**6'785'132**	**6'852'647**	**6'920'834**	**6'989'700**	**7'059'251**	**7'129'494**	**7'200'436**	**7'272'084**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**611'423'871**	**607'396'004**	**603'288'370**	**599'099'388**	**594'827'449**	**590'470'908**	**586'028'091**	**581'497'288**	**576'876'758**	**572'164'724**
Foreign Currency	**174'417'110**	**174'350'918**	**174'284'068**	**174'216'553**	**174'148'366**	**174'079'500**	**174'009'949**	**173'939'706**	**173'868'764**	**173'797'116**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2036 Year 30		2037 Year 31		2038 Year 32		2039 Year 33		2040 Year 34	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	169'647'027	174'547'543	179'545'108	184'641'645	189'839'113	195'139'511	200'544'877	206'057'291	211'678'872	217'411'783
Total Disbursement - Local Currency	**247'452'027**	**252'352'543**	**257'350'108**	**262'446'645**	**267'644'113**	**272'944'511**	**278'349'877**	**283'862'291**	**289'483'872**	**295'216'783**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	3'249'445	3'322'526	3'396'334	3'470'876	3'546'160	3'622'194	3'698'984	3'776'538	3'854'863	3'933'968
Total Disbursement - Foreign Currency	**7'344'445**	**7'417'526**	**7'491'334**	**7'565'876**	**7'641'160**	**7'717'194**	**7'793'984**	**7'871'538**	**7'949'863**	**8'028'968**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**567'359'373**	**562'458'857**	**557'461'292**	**552'364'755**	**547'167'287**	**541'866'889**	**536'461'523**	**530'949'109**	**525'327'528**	**519'594'617**
Foreign Currency	**173'724'755**	**173'651'674**	**173'577'866**	**173'503'324**	**173'428'040**	**173'352'006**	**173'275'216**	**173'197'662**	**173'119'337**	**173'040'232**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2041 Year 35		2042 Year 36		2043 Year 37		2044 Year 38		2045 Year 39	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	223'258'227	229'220'454	235'300'756	241'501'472	247'824'987	254'273'731	260'850'186	267'556'881	274'396'394	281'371'356
Total Disbursement - Local Currency	**301'063'227**	**307'025'454**	**313'105'756**	**319'306'472**	**325'629'987**	**332'078'731**	**338'655'186**	**345'361'881**	**352'201'394**	**359'176'356**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	4'013'861	4'094'548	4'176'038	4'258'339	4'341'459	4'425'405	4'510'188	4'595'814	4'682'291	4'769'630
Total Disbursement - Foreign Currency	**8'108'861**	**8'189'548**	**8'271'038**	**8'353'339**	**8'436'459**	**8'520'405**	**8'605'188**	**8'690'814**	**8'777'291**	**8'864'630**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**513'748'173**	**507'785'946**	**501'705'644**	**495'504'928**	**489'181'413**	**482'732'669**	**476'156'214**	**469'449'519**	**462'610'006**	**455'635'044**
Foreign Currency	**172'960'339**	**172'879'652**	**172'798'162**	**172'715'861**	**172'632'741**	**172'548'795**	**172'464'012**	**172'378'386**	**172'291'909**	**172'204'570**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2046 Year 40		2047 Year 41		2048 Year 42		2049 Year 43		2050 Year 44	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency										
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	288'484'449	295'738'410	303'136'027	310'680'146	318'373'668	326'219'552	334'220'815	342'380'534	350'701'848	359'187'956
Total Disbursement - Local Currency	**366'289'449**	**373'543'410**	**380'941'027**	**388'485'146**	**396'178'668**	**404'024'552**	**412'025'815**	**420'185'534**	**428'506'848**	**436'992'956**
Total Implementation Cost at Constant Prices - Foreign Currency										
Operation & Maintenance Cost at Constant Prices - Foreign Currency										
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	4'857'837	4'946'922	5'036'894	5'127'761	5'219'532	5'312'216	5'405'823	5'500'360	5'595'839	5'692'268
Total Disbursement - Foreign Currency	**8'952'837**	**9'041'922**	**9'131'894**	**9'222'761**	**9'314'532**	**9'407'216**	**9'500'823**	**9'595'360**	**9'690'839**	**9'787'268**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)										
Local Currency										
Foreign Currency										
Annual Escalation of Energy Tariffs										
Local Currency										
Foreign Currency										
Project Revenues										
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements										
Local Currency	**448'521'951**	**441'267'990**	**433'870'373**	**426'326'254**	**418'632'732**	**410'786'848**	**402'785'585**	**394'625'866**	**386'304'552**	**377'818'444**
Foreign Currency	**172'116'363**	**172'027'278**	**171'937'306**	**171'846'439**	**171'754'668**	**171'661'984**	**171'568'377**	**171'473'840**	**171'378'361**	**171'281'932**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item	2051 Year 45		2052 Year 46		2053 Year 47		2054 Year 48		2055 Year 49		2056 Year 50	
Units in Operation	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**	**44**
Total Implementation Cost at Constant Prices - Local Currency												
Operation & Maintenance Cost at Constant Prices - Local Currency	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000	77805000
Total Disbursement at Constant Prices - Local Currency	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000	77'805'000
Price Escalation on Local Currency	367'842'122	376'667'674	385'668'007	394'846'581	404'206'927	413'752'644	423'487'404	433'414'950	443'539'100	453'863'748	464'392'864	475'130'498
Total Disbursement - Local Currency	**445'647'122**	**454'472'674**	**463'473'007**	**472'651'581**	**482'011'927**	**491'557'644**	**501'292'404**	**511'219'950**	**521'344'100**	**531'668'748**	**542'197'864**	**552'935'498**
Total Implementation Cost at Constant Prices - Foreign Currency												
Operation & Maintenance Cost at Constant Prices - Foreign Currency												
Total Disbursement at Constant Prices - Foreign Currency	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000	4'095'000
Price Escalation on Foreign Currency	5'789'656	5'888'013	5'987'349	6'087'673	6'188'996	6'291'327	6'394'676	6'499'053	6'604'469	6'710'934	6'818'459	6'927'053
Total Disbursement - Foreign Currency	**9'884'656**	**9'983'013**	**10'082'349**	**10'182'673**	**10'283'996**	**10'386'327**	**10'489'676**	**10'594'053**	**10'699'469**	**10'805'934**	**10'913'459**	**11'022'053**
Energy Production (GWh)	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107	18'107
Base Energy Tariff ($/GWh)												
Local Currency												
Foreign Currency												
Annual Escalation of Energy Tariffs												
Local Currency												
Foreign Currency												
Project Revenues												
Local Currency	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**	**814'811'400**
Foreign Currency	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**	**181'069'200**
Balance: Revenues - Disbursements												
Local Currency	**369'164'278**	**360'338'726**	**351'338'393**	**342'159'819**	**332'799'473**	**323'253'756**	**313'518'996**	**303'591'450**	**293'467'300**	**283'142'652**	**272'613'536**	**261'875'902**
Foreign Currency	**171'184'544**	**171'086'187**	**170'986'851**	**170'886'527**	**170'785'204**	**170'682'873**	**170'579'524**	**170'475'147**	**170'369'731**	**170'263'266**	**170'155'741**	**170'047'147**

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

Item		Total Cost	2007 Year 1		2008 Year 2		2009 Year 3		2010 Year 4	
			1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12
Cumulated Balance										
Local Currency				-404'935'912	-761'802'305	-1'228'744'064	-1'737'178'193	-2'236'654'970	-2'671'161'739	-3'118'892'396
Foreign Currency				-86'577'933	-133'804'617	-201'152'507	-290'766'957	-379'961'697	-463'908'150	-562'149'801
Equities Disbursement										
Local Currency	30%	1'304'450'283		404'935'912	356'866'393	466'941'760	75'706'219			
Foreign Currency	30%	175'121'990		86'577'933	47'226'684	41'317'373				
Loans Net Disbursement										
Local Currency		1'987'275'098		0	0	0	432'727'910	499'476'776	434'506'770	447'730'656
Foreign Currency		400'548'340		0	0	26'030'517	89'614'450	89'194'740	83'946'453	98'241'651
Interests on Loans during Disbursement Period										
Local Currency	20%	633'840'593		0	0	0	0	41'301'765	92'916'435	143'256'404
Foreign Currency	12%	63'652'343		0	0	0	1'517'593	6'830'639	12'428'969	18'047'706
Total Loans										
Local Currency		2'621'115'691		0	0	0	432'727'910	540'778'542	527'423'205	590'987'060
Foreign Currency		464'200'683		0	0	26'030'517	91'132'043	96'025'379	96'375'421	116'289'357
Loans Repayment										
Local Currency										
Interest		1'050'737'392								
Capital		2'621'115'691								
Foreign Currency										
Interest										
Capital										
Net Balance (Available for Equity Remuneration)										
Local Currency				0	0	0	0	0	0	0
Foreign Currency				0	0	0	0	0	0	0
Interest on Equities Before Repayment	24.7%	5'762'973'017			57'355'508	111'202'655	183'488'607	213'734'451	238'675'453	266'526'860
Total Equities		7'242'545'289		491'513'845	461'448'585	619'461'788	259'194'825	213'734'451	238'675'453	266'526'860
Equities Repayment										
Interest		26'841'176'015								
Capital		7'242'545'289								

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2011 Year 5		2012 Year 6		2013 Year 7		2014 Year 8		2015 Year 9	
		1-6	7-12	1-7	7-12	1-6	7-12	1-7	7-12	1-6	7-12
Cumulated Balance											
Local Currency		-3'291'725'380	-3'145'223'528	-2'928'159'983	-2'723'304'165	-2'279'099'322	-1'786'997'811	-1'140'706'743	-446'129'655	114'651'152	818'721'776
Foreign Currency		-575'670'330	-530'685'827	-467'522'895	-396'504'426	-289'901'846	-170'753'908	-8'806'459	166'576'039	317'597'103	493'772'399
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency		172'832'985									
Foreign Currency		13'520'529									
Interests on Loans during Disbursement Period											
Local Currency	20%	199'663'232	88'714'323	26'619'980	41'368'454						
Foreign Currency	12%	24'827'437									
Total Loans											
Local Currency		372'496'216	88'714'323	26'619'980	41'368'454						
Foreign Currency		38'347'966									
Loans Repayment											
Local Currency											
Interest						250'172'689	231'653'267	206'794'755	164'846'978	114'286'827	71'671'158
Capital						194'032'154	260'448'244	439'496'314	529'730'109	446'493'980	632'399'466
Foreign Currency											
Interest			27'063'143	26'018'319	23'852'768	21'102'983	16'118'312	10'111'630	1'259'523	0	
Capital			17'921'360	37'144'613	47'165'701	85'499'597	103'029'626	151'835'819	21'603'967	0	
Net Balance (Available for Equity Remuneration)											
Local Currency		0	0	0	0	0	0	0	0	0	0
Foreign Currency		0	0	0	0	0	0	0	152'519'008	151'021'064	176'175'296
Interest on Equities Before Repayment	24.7%	297'628'290	332'358'994	371'142'478	414'451'666	462'814'670	516'821'227	577'129'893	491'957'062	550'862'235	589'988'966
Total Equities		297'628'290	332'358'994	371'142'478	414'451'666	462'814'670	516'821'227	577'129'893	491'957'062	550'862'235	589'988'966
Equities Repayment											
Interest											
Capital											

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of 2.10 Reais/$

Item		2016 Year 10		2017 Year 11		2018 Year 12		2019 Year 13		2020 Year 14	
Cumulated Balance											
Local Currency		1'520'599'301	2'220'240'295	2'917'600'465	3'612'634'642	4'305'296'762	4'995'539'851	5'683'316'000	6'368'576'356	7'051'271'095	7'731'349'409
Foreign Currency		669'898'998	845'976'416	1'022'004'163	1'197'981'745	1'373'908'663	1'549'784'413	1'725'608'485	1'901'380'366	2'077'099'536	2'252'765'471
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest		11'311'718	0								
Capital		118'515'423	0								
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		572'050'384	699'640'993	697'360'170	695'034'177	692'662'121	690'243'088	687'776'150	685'260'356	682'694'739	680'078'314
Foreign Currency		176'126'599	176'077'418	176'027'747	175'977'582	175'926'918	175'875'750	175'824'072	175'771'881	175'719'170	175'665'934
Interest on Equities Before Repayment	24.7%	86'834'001									
Total Equities		86'834'001									
Equities Repayment											
Interest			845'143'778	841'575'977	837'863'792	833'995'705	829'958'956	825'739'403	821'321'366	816'687'443	811'818'317
Capital			30'574'633	31'811'940	33'147'967	34'593'334	36'159'883	37'860'819	39'710'871	41'726'466	43'925'931

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2021 Year 15		2022 Year 16		2023 Year 17		2024 Year 18		2025 Year 19	
Cumulated Balance											
Local Currency		8'408'759'482	9'083'448'473	9'755'362'493	10'424'446'587	11'090'644'712	11'753'899'714	12'414'153'308	13'071'346'054	13'725'417'335	14'376'305'335
Foreign Currency		2'428'377'640	2'603'935'509	2'779'438'538	2'954'886'180	3'130'277'886	3'305'613'097	3'480'891'252	3'656'111'784	3'831'274'119	4'006'377'677
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		677'410'073	674'688'991	671'914'020	669'084'094	666'198'125	663'255'002	660'253'594	657'192'746	654'071'282	650'888'000
Foreign Currency		175'612'169	175'557'869	175'503'029	175'447'643	175'391'705	175'335'211	175'278'155	175'220'532	175'162'334	175'103'558
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		806'692'533	801'286'247	795'572'958	789'523'191	783'104'159	776'279'376	769'008'228	761'245'496	752'940'818	744'038'094
Capital		46'329'710	48'960'612	51'844'091	55'008'546	58'485'671	62'310'837	66'523'521	71'167'781	76'292'798	81'953'464

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2026 Year 20		2027 Year 21		2028 Year 22		2029 Year 23		2030 Year 24	
Cumulated Balance											
Local Currency		15'023'947'012	15'668'278'076	16'309'232'964	16'946'744'814	17'580'745'441	18'211'165'310	18'837'933'506	19'460'977'714	20'080'224'182	20'695'597'701
Foreign Currency		4'181'421'874	4'356'406'119	4'531'329'816	4'706'192'363	4'880'993'150	5'055'731'563	5'230'406'982	5'405'018'779	5'579'566'323	5'754'048'972
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		647'641'677	644'331'064	640'954'888	637'511'850	634'000'627	630'419'868	626'768'196	623'044'207	619'246'468	615'373'519
Foreign Currency		175'044'197	174'984'245	174'923'697	174'862'546	174'800'787	174'738'413	174'675'419	174'611'798	174'547'543	174'482'649
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		734'474'818	724'181'333	713'080'003	701'084'278	688'097'663	674'012'556	658'708'959	642'053'031	623'895'481	604'069'759
Capital		88'211'056	95'133'976	102'798'582	111'290'119	120'703'752	131'145'726	142'734'657	155'602'973	169'898'531	185'786'410

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2031 Year 25		2032 Year 26		2033 Year 27		2034 Year 28		2035 Year 29	
Cumulated Balance											
Local Currency		21'307'021'572	21'914'417'577	22'517'705'946	23'116'805'335	23'711'632'784	24'302'103'692	24'888'131'782	25'469'629'070	26'046'505'829	26'618'670'552
Foreign Currency		5'928'466'082	6'102'817'000	6'277'101'069	6'451'317'622	6'625'465'987	6'799'545'487	6'973'555'436	7'147'495'142	7'321'363'906	7'495'161'022
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		611'423'871	607'396'004	603'288'370	599'099'388	594'827'449	590'470'908	586'028'091	581'497'288	576'876'758	572'164'724
Foreign Currency		174'417'110	174'350'918	174'284'068	174'216'553	174'148'366	174'079'500	174'009'949	173'939'706	173'868'764	173'797'116
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		582'390'056	558'649'054	532'615'420	504'031'008	472'607'734	438'024'085	399'921'225	357'898'639	311'509'275	260'254'120
Capital		203'450'925	223'097'868	244'957'018	269'284'933	296'368'081	326'526'322	360'116'814	397'538'355	439'236'247	485'707'719

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2036 Year 30		2037 Year 31		2038 Year 32		2039 Year 33		2040 Year 34	
Cumulated Balance											
Local Currency		27'186'029'925	27'748'488'782	28'305'950'073	28'858'314'828	29'405'482'116	29'947'349'005	30'483'810'527	31'014'759'636	31'540'087'164	32'059'681'781
Foreign Currency		7'668'885'777	7'842'537'451	8'016'115'317	8'189'618'641	8'363'046'681	8'536'398'687	8'709'673'903	8'882'871'566	9'055'990'903	9'229'031'134
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		567'359'373	562'458'857	557'461'292	552'364'755	547'167'287	541'866'889	536'461'523	530'949'109	525'327'528	519'594'617
Foreign Currency		173'724'755	173'651'674	173'577'866	173'503'324	173'428'040	173'352'006	173'275'216	173'197'662	173'119'337	173'040'232
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		203'576'138	140'853'501	71'392'041	0	0	0	0	0	0	0
Capital		537'507'990	595'257'030	611'801'330	0	0	0	0	0	0	0

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2041 Year 35		2042 Year 36		2043 Year 37		2044 Year 38		2045 Year 39	
Cumulated Balance											
Local Currency		32'573'429'954	33'081'215'899	33'582'921'543	34'078'426'471	34'567'607'884	35'050'340'553	35'526'496'766	35'995'946'286	36'458'556'292	36'914'191'337
Foreign Currency		9'401'991'474	9'574'871'126	9'747'669'288	9'920'385'150	10'093'017'891	10'265'566'686	10'438'030'698	10'610'409'084	10'782'700'993	10'954'905'563
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		513'748'173	507'785'946	501'705'644	495'504'928	489'181'413	482'732'669	476'156'214	469'449'519	462'610'006	455'635'044
Foreign Currency		172'960'339	172'879'652	172'798'162	172'715'861	172'632'741	172'548'795	172'464'012	172'378'386	172'291'909	172'204'570
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		0	0	0	0	0	0	0	0	0	0
Capital		0	0	0	0	0	0	0	0	0	0

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2046 Year 40		2047 Year 41		2048 Year 42		2049 Year 43		2050 Year 44	
Cumulated Balance											
Local Currency		37'362'713'287	37'803'981'277	38'237'851'650	38'664'177'904	39'082'810'635	39'493'597'483	39'896'383'068	40'291'008'934	40'677'313'486	41'055'131'930
Foreign Currency		11'127'021'926	11'299'049'203	11'470'986'509	11'642'832'949	11'814'587'617	11'986'249'601	12'157'817'978	12'329'291'818	12'500'670'179	12'671'952'111
Equities Disbursement											
Local Currency	30%										
Foreign Currency	30%										
Loans Net Disbursement											
Local Currency											
Foreign Currency											
Interests on Loans during Disbursement Period											
Local Currency	20%										
Foreign Currency	12%										
Total Loans											
Local Currency											
Foreign Currency											
Loans Repayment											
Local Currency											
Interest											
Capital											
Foreign Currency											
Interest											
Capital											
Net Balance (Available for Equity Remuneration)											
Local Currency		448'521'951	441'267'990	433'870'373	426'326'254	418'632'732	410'786'848	402'785'585	394'625'866	386'304'552	377'818'444
Foreign Currency		172'116'363	172'027'278	171'937'306	171'846'439	171'754'668	171'661'984	171'568'377	171'473'840	171'378'361	171'281'932
Interest on Equities Before Repayment	24.7%										
Total Equities											
Equities Repayment											
Interest		0	0	0	0	0	0	0	0	0	0
Capital		0	0	0	0	0	0	0	0	0	0

Santo Antonio Hydroelectric Plant

Cash Flow - All Figures in USD Equivalent at the Exchange Rate of

Item		2051 Year 45		2052 Year 46		2053 Year 47		2054 Year 48		2055 Year 49		2056 Year 50	
Cumulated Balance													
Local Currency		41'424'296'209	41'784'634'935	42'135'973'328	42'478'133'147	42'810'932'621	43'134'186'376	43'447'705'373	43'751'296'823	44'044'764'123	44'327'906'775	44'600'520'311	44'862'396'213
Foreign Currency		12'843'136'655	13'014'222'842	13'185'209'693	13'356'096'220	13'526'881'424	13'697'564'298	13'868'143'822	14'038'618'969	14'208'988'699	14'379'251'965	14'549'407'706	14'719'454'853
Equities Disbursement													
Local Currency	30%												
Foreign Currency	30%												
Loans Net Disbursement													
Local Currency													
Foreign Currency													
Interests on Loans during Disbursement Period													
Local Currency	20%												
Foreign Currency	12%												
Total Loans													
Local Currency													
Foreign Currency													
Loans Repayment													
Local Currency													
Interest													
Capital													
Foreign Currency													
Interest													
Capital													
Net Balance (Available for Equity Remuneration)													
Local Currency		369'164'278	360'338'726	351'338'393	342'159'819	332'799'473	323'253'756	313'518'996	303'591'450	293'467'300	283'142'652	272'613'536	261'875'902
Foreign Currency		171'184'544	171'086'187	170'986'851	170'886'527	170'785'204	170'682'873	170'579'524	170'475'147	170'369'731	170'263'266	170'155'741	170'047'147
Interest on Equities Before Repayment	24.7%												
Total Equities													
Equities Repayment													
Interest		0	0	0	0	0	0	0	0	0	0	0	0
Capital		0	0	0	0	0	0	0	0	0	0	0	0