

SECTION 13 : CONSTRUCTION COST ESTIMATES

13.1 INTRODUCTION

13.1.1 LAYOUT OPTIONS

The investment costs were estimated for the following identified options:

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|----------|--|---------------------|-----------------------|
| • Site 2 | FSL 1007.5 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| • Site 4 | FSL 1007.5 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| | FSL 1010.0 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| | FSL 1012.5 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| • Site 5 | FSL 1007.5 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| | FSL 1010.0 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |
| | FSL 1010.0 m.a.m.s.l.
with Sediment By-pass | Hydromatrix Turbine | Concrete Gravity Wall |
| | FSL 1010.0 m.a.m.s.l. | Hydromatrix Turbine | Earth Embankment |
| | FSL 1011.0 m.a.m.s.l. | Hydromatrix Turbine | Concrete Gravity Wall |

The cost estimates include the following:

- Environmental mitigation costs
- Preliminary and general costs
- Civil works
- Hydromechanical equipment
- Electrical equipment
- Transmission line
- Physical contingencies
- Studies
- Professional fees (detailed design & construction)
- Miscellaneous costs
- Value added tax

13.1.2 DESCRIPTION OF COSTS

Based on the pre-feasibility design of the barrage and hydro power structures, a detailed cost estimate has been prepared. The cost estimates used are based on unit rates and lump sum prices applied to the quantities of major work items.

The investment costs comprise the construction costs and other cost items, as explained in the following subsections:

13.1.2.1 Environmental Mitigation Costs

Each alternative may result in different environmental impacts which need to be mitigated and which consequently will result in different costs. The environmental mitigation costs depend, to a large extent, on the full supply level (**FSL**) of the reservoir.

13.1.2.2 Preliminary and General

Since the construction works will be carried out in the Kavango Region, certain preliminary and general works may need to be completed before the main construction works can be carried out. It is recommended that a permanent camp with the corresponding infrastructure should be installed prior to commencement of the Works. Since the alternatives are all within a short distance of paved roads it is assumed that the construction of major access roads will not be required prior to the commencement of the Works.

The required quarry with a crushing plant as well as the concrete mixing plant should be part of the Contractor's site establishment.

13.1.2.3 Civil Works

Materials and quantities required have been determined on the basis of the pre-feasibility design for the construction of the weir and appurtenant structures, which cover:

- Excavations.
- Earthworks, and
- Concrete works.

13.1.2.4 Hydraulic Structures

This item covers the costs for the construction and erection of cast-in-situ spillway gates and associated pipes, fittings and specials. Costs have been based on ruling rates in Namibia and South Africa adjusted for the remoteness of the site and include the transport of equipment and materials to site.

13.1.2.5 Hydro-mechanical Equipment

The cost of hydro-mechanical equipment is based on preliminary quotations received from reputable international manufacturers. The costs for erection, commissioning and testing of the hydro-mechanical equipment, are included in the cost estimates for the respective items. The Hydro matrix turbines as well as the Bulb units for the weir alternative and the canal development alternative will have to be imported. These items will be shipped from the country of origin to the Port of Walvis Bay and special arrangements for its inland transportation will have to be made. The preliminary price quotations are inclusive of carriage, insurance and freight (CIF).

13.1.2.6 Switchyard

The costs for electrical installations include all work required to construct the switchyard, including site works, buildings, auxiliary power and lighting, lighting masts and fencing. The cost of the high tension (HT) installations at the switchyard are included in the costs of the Hydromatrix turbine installations.

13.1.2.7 Transmission Line

The costs of the 220 km transmission line from Divundu to Rundu have been included in the total costs of the project and amounts to MN\$ 45.0

13.1.2.8 Contingencies

All efforts have been made to establish a realistic cost estimate. However, the prices have to be considered as opportunity costs depending on local and international developments. To cover for unpredictable developments and eventual unforeseen items that may be required, a provision of 10% for contingencies has been allowed for all main cost items, such as civil works, hydraulic structures, hydro-mechanical and electrical equipment as well as for the transmission line.

13.1.2.9 Studies

Provision has been made for professional fees for carrying out the detailed feasibility study during which detailed investigations will have to be carried out.

Topographical and geotechnical investigations will have to be carried out to identify potential quarry sites and material borrow pits, and includes for material testing to be carried out by a reputable laboratory.

Provision has also been made for additional sediment transport measurements will have to be undertaken during the feasibility study includingsediment sampling to establish the

relationship between the river discharge and sediment movement, in order to be able to determine the amount of sediment transported, both as bed load and as suspended load throughout the year.

Once the layout for the hydro power plant is defined, physical model tests will have to be carried out to simulate the hydrodynamics as well as the sediment transport in the river reach under consideration. The site specific sediment rating curves developed from the field measurements will be used for this purpose. The physical model test may be complemented by numerical model testing

13.1.2.10 Professional Fees

This item represents the costs for the Consultant during the detailed design phase, the preparation of tender documents as well as the construction supervision of the project. The costs for the Consultant's professional fees have been estimated at 6% of the total direct construction costs of civil works, hydraulic steel structures, hydro-mechanical equipment, electrical equipment and the transmission line.

13.1.2.11 Miscellaneous

This item covers the costs of site clearance and the construction of temporary access roads to the various components of the Works. .

13.1.2.12 Total Base Cost

The sum of all above costs make up the total estimated project cost excluding value added tax. These were determined for each project alternative commensurate with the degree of accuracy that can be expected for a pre-feasibility study. The detailed cost estimates are given in **Tables A13-1 to A13-9 of Appendix A of Volume 2**, and a summary of cost estimates is in **Tables 13-1 to 13-9 of Section 13.4**.

The total project cost was used for the financial and economic analysis, which is presented in **Section 14** of this report

13.1.2.13 Value Added Tax

A separate cost item has been included for value added tax (VAT) for Namibian goods and services to give an indication of the estimated costs at 2003 price levels. Value added tax has, however, not been included in the financial and economic analyses.

13.1.2.14 Total Project Cost

The total project cost is the sum of the total base cost plus value added tax.

13.2 COST BASIS

13.2.1 PRICE LEVEL

All costs have been based on May 2003 prices.

13.2.2 CURRENCY AND CURRENCY CONVERSION RATES

All costs are quoted in US\$ and are subdivided into local and foreign components. Namibian cost components were converted to US\$ using an exchange rate of US\$ 1.0 = N\$ 9.0

13.2.3 APPLICABLE TAXES

The costs include value added tax (**VAT**) on Namibian goods and services at the current rate of 15%. Import duties on hydro power turbines and generators and associated equipment, are zero rated according to information obtained from the Department of Customs and Excise

13.2.4 LOCAL AND FOREIGN COSTS

The costs were split into local and foreign components according to the availability of locally produced materials. In this context, imports from within the Rand Monetary Area are considered to be local materials and goods.

It was agreed that only the turbine-generator and the associated equipment should be provided by a pre-qualified international manufacturer and was therefore assumed to be imported material.

All other costs, such as civil structures, hydraulic steel structures, mechanical, as well as electrical equipment, will be supplied by local contractors, manufacturers and suppliers.

13.3 UNIT RATES

Unless indicated otherwise, the unit rates include for the cost of supply and installation of each component, including basic material costs, the labour costs, plant costs and contractor's profits, required for the proper execution of the Works.

The unit rates for the main civil works and equipment were estimated on the basis of the comparative costs for similar projects taking into account the specific local conditions.

Where no comparative prices from recent contracts were available, the unit rates were estimated by computing the costs of materials, labour and plant needed for the execution of that portion of the work.

Quotations were obtained from local and international contractors and suppliers of key items.

A compilation of the applied unit rates is given in the detailed cost estimate for each of the alternatives investigated.

The unit costs are based on the actual situation in Namibia and reflect the present local conditions. The costs of cement and reinforcing steel were also based on local market rates in Namibia. The unit prices of concrete aggregates are based on the assumption that all materials are available in the area. The installation of a crusher plant and the concrete mixing-plant were included in the determination of unit concrete rates.

Prices for hydroelectric steel components and hydraulic steelwork are based on rates quoted by South African suppliers as well as from international suppliers. The prices for different alternatives for the hydro power turbine-generator units including the ancillary equipment are based on quotations received from international suppliers.

13.4 INVESTMENT COSTS

The investment costs were determined for each of the alternatives listed in **Section 13.1**. For each assumed full supply level, the corresponding costs for mitigation, civil structures and hydro-mechanical works were determined. The costs for the turbine-generator and related equipment can be considered to be independent of the FSL for this phase of the project. The costs for each of the alternatives are shown in **Tables 13-1** through **Table 13-9**.

In addition costs were determined for two sub-alternatives, namely for both mass gravity flank walls of the weir and earth embankments. Separate cost estimates were not prepared for weirs with conventional radial gates as this type of gate was found to be approximately 60% more costly than the TOPS Gates. In addition, a radial gate option would require permanent operating staff on site which would increase the cost even further.