

TASK ORDER NO.: 598

REF: A11F-17

TITLE OF THE CONTRACT: ENGINEERING AND PROJECT MANAGEMENT SERVICES ON AN "AS AND WHEN REQUIRED" BASIS- CONTRACT NUMBER 4600050572

CONSULTANT: Arup-Tata-Power-Engineers Consortium		EMPLOYER: Eskom Holdings SOC Limited	
Contact Person:		Contact Person:	
THE TASK IS:	GENERATION FLEET RENEWAL AT HENDRINA, KOMATI, CAMDEN AND ARNOT POWER STATIONS.		
Please carry out the Task in accordance with the above referenced contract which includes the data stated in this Task Order.			
Task Start Date is: 26 SEPTEMBER 2018		Task Duration: 31 DECEMBER 2016	

DETAIL DESCRIPTION OF THE TASK

1. BACKGROUND

The current decommissioning strategy of the Employer's power stations is based on an expected technical life of 60 years for coal fired stations. Four power stations are scheduled for decommission in the next 20 years (Komati, Hendrina, Camden and Arnot). It has been recommended that the Employer study the feasibility of a move towards a fleet renewal strategy which has the following advantages:

- Further leverage of existing assets (site, infrastructure, transmission integration, water etc.)
- Eliminate the local socio economic impact of decommissioning stations and associated mines
- The need for flexible base load when renewables are unavailable (e.g solar plants when there is a cloud cover)
- Additional capacity that can be exported to neighbouring countries

The transition to a fleet renewal strategy is dependent on the completion of a pre-feasibility study to quantify the renewal and environmental compliance costs, South Africa's COP21 commitments and possible carbon taxes. Coal contract renegotiations for cheaper coal prices are necessary in order to justify CAPEX required for renewal and environmental compliance. The Consultant will be required to conduct the study from their offices with bi-weekly progress meetings held at the Employer's Megawatt Park offices or through video conferencing/WebEx.

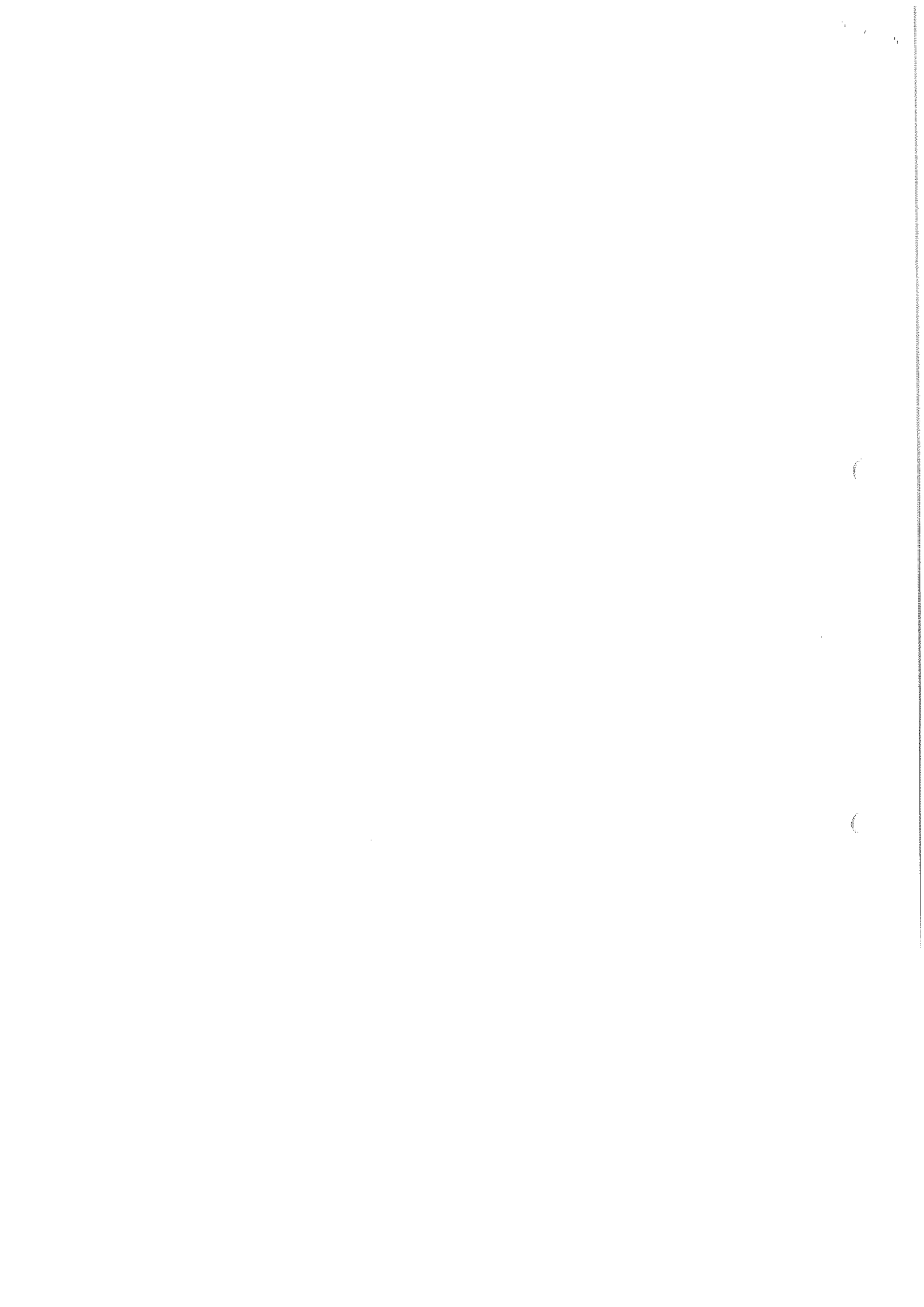
2. SCOPE

The scope of the Consultant work is to conduct a multi-discipline engineering desktop study and integrate other relevant studies conducted by other consultants from functional areas interfacing with engineering on the project; socio-economic studies, environmental studies, primary energy studies, etc. The Consultant has to deliver a consolidated report with options, cost and impact on the assigned plants.

The following scenarios should be investigated:

- Extend life of the plant using existing Infrastructure.

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- Re-firing making use of existing structure.
- Demolish and rebuild.
- Do not renew.

The pre-feasibility study with recommended options for each power station must be submitted to the Employer three months after the commencement of the work. The Consultant shall provide a report for all scenarios which contain input costs to levelised cost of energy calculations. Capex costs, auxiliary power consumption with the recommended option, cost phasing (forecast rate of invoicing, additional life cycle Capex (e.g. Ash dump liner extension), overnight cost per kW (capex R/kW), owner's development cost, transmission integration cost (may not be applicable), local and foreign component spend, O&M (fixed and variable costs), water consumption (before and after refurbishment), coal consumption and quality (before and after refurbishment), sorbent consumption (before and after refurbishment), plant heat rate and load factor after refurbishment, operational life remaining).

The Consultant is expected to lead and co-ordinate the consolidation of overall project studies (engineering studies, socio-economic studies, primary energy studies, etc.).

Once every two weeks, interim reviews of consultant work will be conducted by Eskom.

A. PLANT INFORMATION AND LEVELISED COST MODEL CALCULATION

The Consultant will use the power stations' records as baseline documents for the desktop study; information will include plant operational data, maintenance reports, outage reports, inspection reports, modifications reports, life time assessment study records, position papers, plant components failure reports, plant strategic reports, etc. The Consultant will also be issued with the Levelised cost model input sheet.

B. MULTI-DISCIPLINE DESKTOP STUDY

The following plant areas shall be covered in the study:

- Turbine Centreline: major components to be covered shall include turbine rotors, turbine casings, turbine inlet piping, turbine inlet valves, turbine blading and diaphragms.
- Turbine balance of plant: components to be covered shall include cooling towers, main condenser, storage tanks, critical pumps and heaters.
- Boiler pressure parts: components to be covered in the study shall include components that are governed by pressure parts design code BS EN: 12952-3/1113 and those governed by HP Piping design code BS EN: 13480-3/806. Further, the study must cover soot blowers lances and piping, cladding, insulation, skin casing and all pipe supports.
- Boiler Auxiliary: The Consultant will assess the pre-feasibility of using existing Boiler auxiliary infrastructure (boiler draught plant, pulverised fuel system, and firing system) taking into consideration the health of the plant by extending the life of the plant and re-powering the existing station using combination co-firing methods. Provide estimates of associated maintenance costs, replacement cost for major equipment, and reliability of the plant after refurbishment work.

In undertaking the option of renewal the Consultant will also take into consideration the emissions legislations as indicated in the table below and will provide options for meeting the legislations in the renewal options to reduce the Employer's environmental footprint.

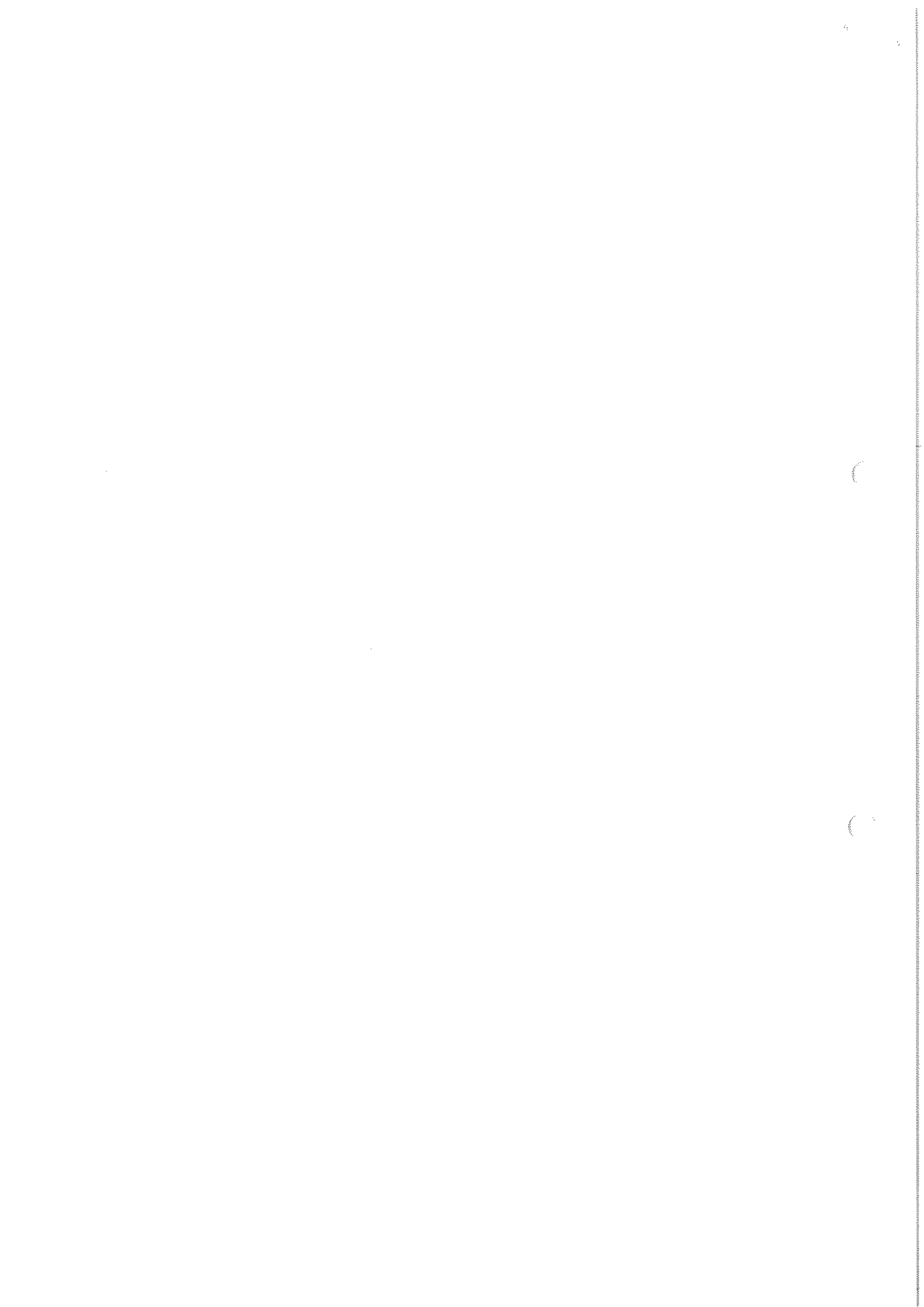
	Existing plant limit (mg/Nm ³ at 273K, 101.3kPa, 10% O ₂) – effective 1 April 2015	New plant limit (mg/Nm ³ at 273K, 101.3kPa, 10% O ₂) – effective 1 April 2020
Particulates PM	100	50
Sulphur Dioxide SO ₂	3500	500
Oxides of Nitrogen (NO _x as NO ₂)	1100	750

- **Civil and Structural:** The study shall cover engineering assessments of all Civil Engineering assets. The Civil Engineering assessments shall take into consideration applicable legislative and regulatory requirements that shall apply to the extension of the life of plant.

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The following Critical Structures Assessment Reports have been developed and will be made available to the *Consultant*:

❖ **Komati Power Station**

Investigation commenced at Komati Power Station during September/October 2012 and the scope of work included visual inspections on all cooling towers, shape deformation on all cooling towers and aerial survey on all cooling towers, Non Destructive Testing on the worst case unit and a non-linear analysis on the worst case unit. Visual inspections were conducted on other structures like the Chimney facing west, a concrete inspection on the windshield and internal flue inspection on 3 of the 6 Boiler house structures and a visual inspection on the Water Treatment Plant building. Inspections at this station were concluded with CCTV and infrared subsurface drainage inspections at the Water Treatment Plant unit.

❖ **Arnot Power Station**

Investigations commenced in June 2012 at Arnot Power Station included visual inspections on all cooling towers, shape deformation on all cooling towers, aerial survey on all cooling towers and a structural integrity report on cooling tower 1. Non Destructive Testing was also conducted on the worst case unit which in this case was cooling tower 1. Visual, aerial and concrete inspections were conducted on the 2 Chimneys. Visual inspections were conducted on other structures like the 2 worst case Coal Stailhe units, the 4 worst case Boiler structure units and the Water Treatment Plant. Inspections at this station were concluded with subsurface drainage CCTV and infra-red video inspection at the Water Treatment Plant unit.

❖ **Camden Power Station**

Investigation commenced at Camden Power Station during November 2013 and the scope of work included visual inspections on all cooling towers, shape deformation on all cooling towers and aerial survey on all cooling towers. Visual inspections were conducted on the Chimneys, a concrete inspection and Non Destructive Testing was also done on the windshield. Visual inspections were done on 4 of the 8 Boiler house structures as well as the Water Treatment Plant building and coal stailhe structures.

❖ **Hendrina Power Station**

Investigation commenced at Hendrina Power Station during January 2013 and the scope of work included visual inspections on all cooling towers, Shape deformation on all cooling towers and aerial survey on all cooling towers. Visual inspections were conducted on other structures like Coal Stailhe 1, the 3 worst case Boiler structure units and the Water Treatment Plant. Visual and structural investigations conducted on the Ash Silo. Inspections at this station were concluded with CCTV and infrared subsurface drainage inspections at the Water Treatment Plant unit.

❖ **Komati Visual Assessment of Internal Roads**

❖ **Arnot Visual Assessment of Internal Roads**

❖ **Camden Visual Assessment of Internal Roads**

❖ **Hendrina Visual Assessment Internal Roads**

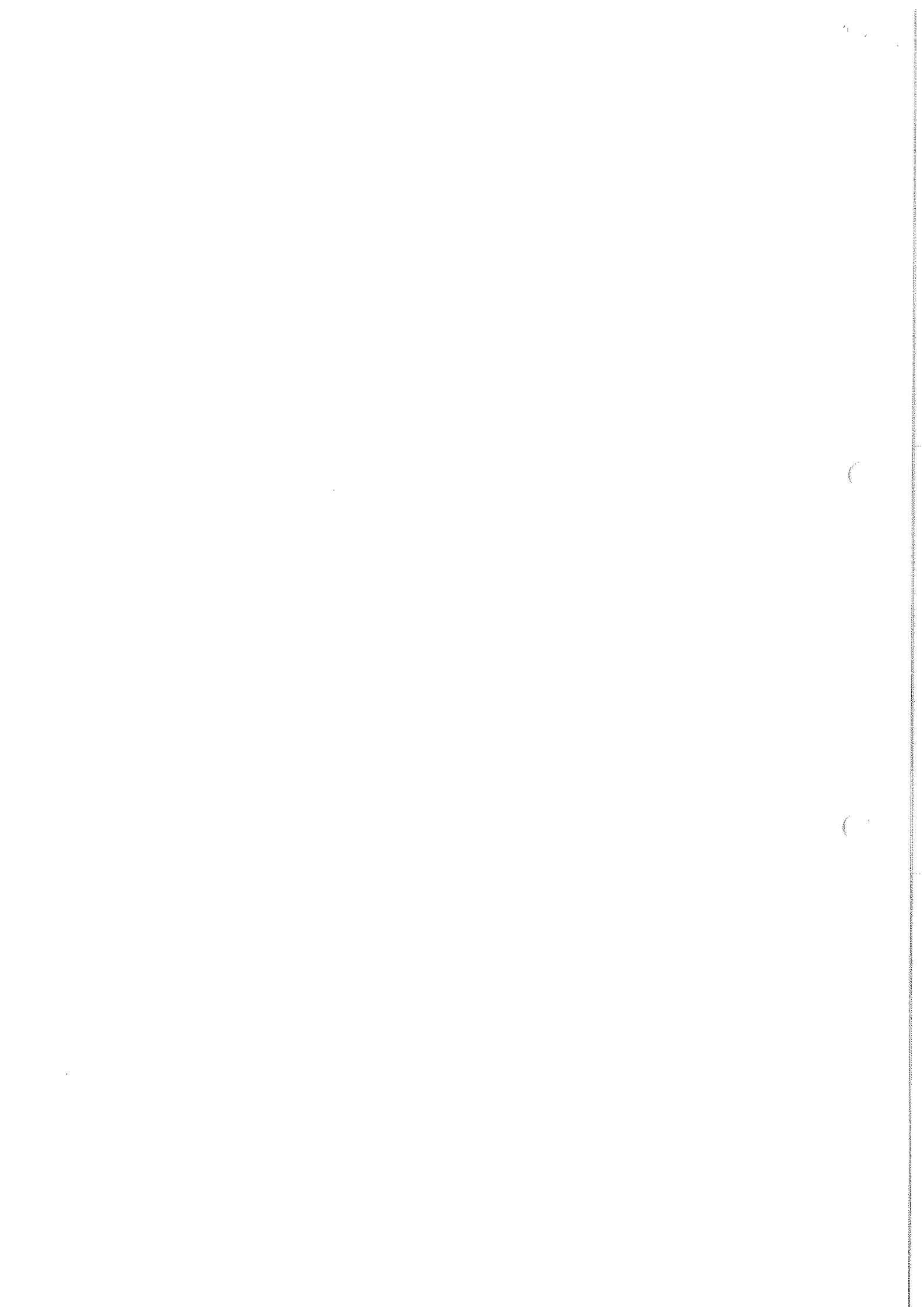
❖ **Visual Inspections of storm water drainage structures for Komati, Arnot, Camden and Hendrina**

❖ **Generation Power Station Ash Dams and Dumps -- Remnant Life Evaluation**

❖ **Civil Group Technology Strategic Report 2016**

- **Electrical:** Electrical systems at the applicable power stations includes for this study includes generator transformers and generators. The study shall evaluate and conduct appropriate engineering studies, including load flow studies for these electrical systems and related costs. The report must take cognisance of standards that are legislated nationally and internationally on the electrical plant and equipment.
- **Low pressure services:** For scenario 1, Provide estimates of associated maintenance costs, replacement cost for major equipment, and reliability of the plant after refurbishment work. For scenario 2 and 3: Based on the proposed boiler options to support scenario 2 & 3, develop high level Low Pressure services (compressed air, auxiliary cooling, raw water, potable water,

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demineralised water, dirty water, turbine lubrication oil) options. For these scenarios, the *Consultant* shall provide systems descriptions together with plant layout drawings.

- **Chemical:** For scenario 1: Provide estimates of associated maintenance costs, replacement cost for major equipment and reliability of the plant after refurbishment work. For scenario 2 and 3: Based on the proposed boiler options to support scenario 2 & 3, develop high level Chemical plant (Condensate Polishing Plant, Wastewater Treatment Plant, Sewage Treatment Plant, Water Treatment Plant, Chemical Storage, handling and Dosing Plants, Sample Analysis and Conditioning, Laboratory, Water-cooled stator cooling treatment plant, Cooling Water (CW) Treatment System) options. For these scenarios, the *Consultant* shall provide systems descriptions together with plant layout drawings. The water management aspects shall take into consideration legislative and regulatory environment that will apply for the extension of the life of plant.
- **Bulk materials handling:** For scenario 1: Provide estimates of associated maintenance costs, replacement cost for major equipment, and reliability of the plant after refurbishment work. For scenario 2 and 3: Based on the proposed boiler options to support scenario 2 & 3, develop high level Bulk Materials Handling options. For these scenarios, the *Consultant* shall provide systems descriptions together with plant layout drawings.

3. KEY DELIVERABLES/EXPECTED OUTPUTS

The following key deliverables or outputs are expected from this Task Order:

- ❖ **Scenario one: extend life of plant using existing infrastructure**
 - Life of plant after modification
 - Plant availability and reliability
 - Financial Model Inputs
 - Emissions technology, each station to meet the new requirements
 - Land foot print relative to the existing power station footprint
 - Ashing and by-products disposal requirements relative to current and planned capacities
 - Refurbishment duration
 - Plant operating regime
 - Sourcing of major components (lead times and percent local content)
 - Socio-Economic Development of the area
 - Sourcing of labour
 - Employment, including disaggregation of skills levels and wages
 - Decreasing CO₂ (CO₂ tax and budget).
- ❖ **Scenario two: re-firing making use of the existing infrastructure**
 - Life of plant
 - Plant availability and reliability
 - Financial Model Inputs
 - Staffing requirements (employment created during construction and in operation)
 - Land foot print relative to the existing power station footprint
 - Ashing and by-product disposal requirements relative to current and planned capacities
 - Construction duration and major milestones
 - Contracting strategy
 - Plant operating regime
 - Sourcing of major components (lead times and percent local content)
 - Sourcing of labour
 - Employment, including disaggregation of skills levels and wages
 - Socio-economic development of the area
 - Emissions technology requirements
- ❖ **Scenario three: demolish and rebuild**
 - Life of plant
 - Plant availability and reliability
 - Financial Model Inputs
 - Staffing requirements (employment created in construction and operation)

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- Emissions technology; must ensure each station meets its new requirements
 - Land foot print relative to the existing power station footprint
 - Ashing and by-product disposal requirements relative to current and planned capacities
 - Demolishing and disposing duration
 - Construction duration and major milestones
 - Contracting strategy of new build
 - Plant operating regime
 - Sourcing of major components (lead times and percent local content)
 - Sourcing of labour
 - Employment, including disaggregation of skills levels and wages
 - Socio-Economic Development of the area.
- ❖ Scenario four: Do not renew
- Options for this scenario include
 - Continue operating the power station five years at a time until there is certainty on CO2 budgets and demand profiles
 - Sell the power plant
 - Mothball the plant
 - Utilise power plant components as spares for the Employer's other plants
 - Decommission the power plant

4. RESOURCES and COST ESTIMATE

The Consultant will engage the following resources for this task order:

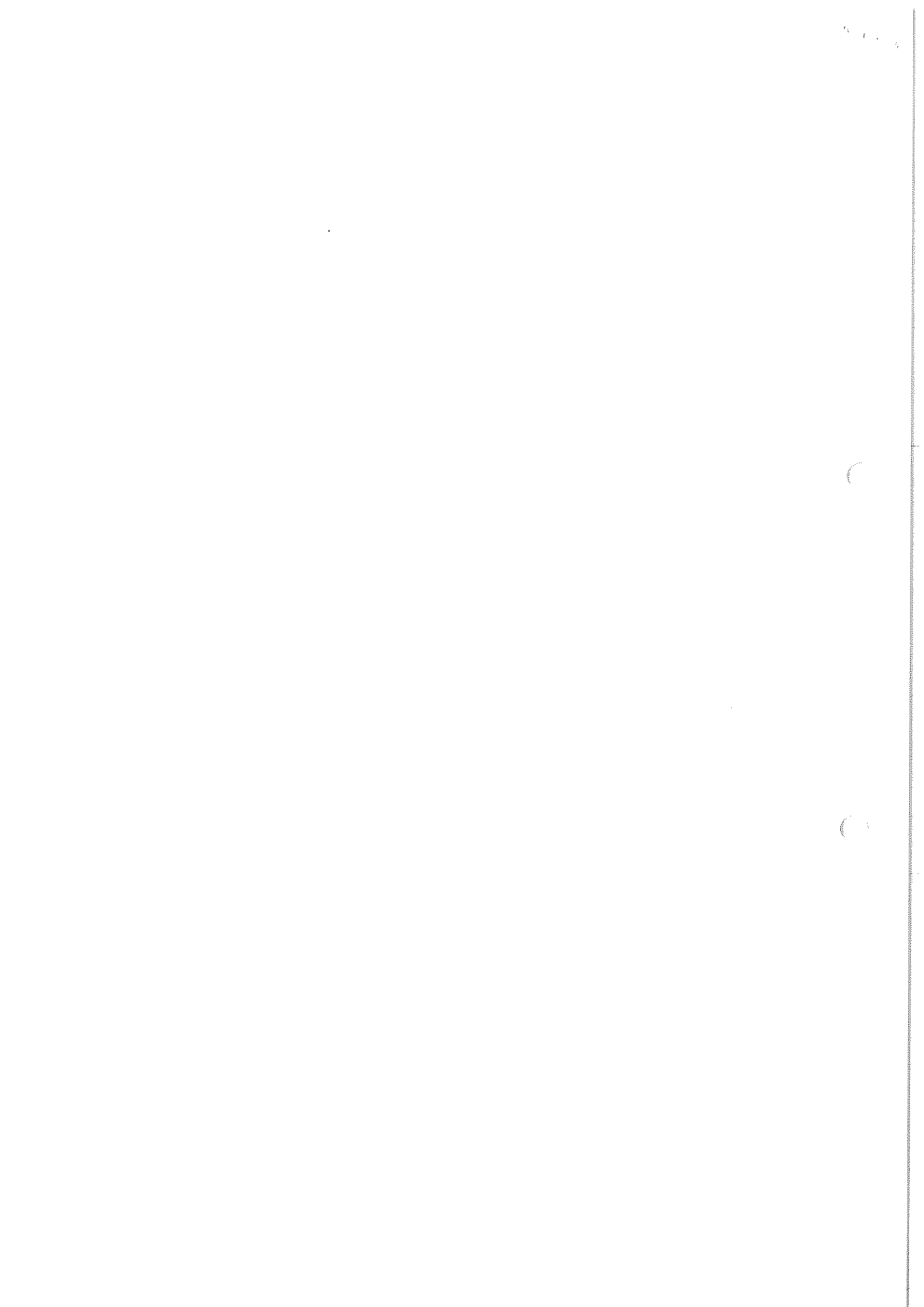
CONSULTING FEES				
Resources Name	E&Pm Level	Estimated Hrs	Rate/Hr	Total Cost ZAR
	Expert	400	R 2 021.38	R 808 550.80
	Expert	400	R 2 021.38	R 808 550.80
	Expert	400	R 2 021.38	R 808 550.80
	Senior	370	R 1 301.12	R 481 415.10
	Senior	370	R 1 301.12	R 481 415.10
	Senior	185	R 1 301.12	R 240 707.55
	Senior	370	R 1 301.12	R 481 415.10
	Senior	370	R 1 301.12	R 481 415.10
	Senior	185	R 1 301.12	R 240 707.55
	Senior	185	R 1 301.12	R 240 707.55
	Senior	185	R 1 301.12	R 240 707.55
	Senior	185	R 1 301.12	R 240 707.55
	Senior	370	R 1 301.12	R 481 415.10
	Senior	185	R 1 301.12	R 240 707.55
	Senior	370	R 1 301.12	R 481 415.10
	Senior	370	R 1 301.12	R 481 415.10
Total Consulting Fees for this Task Order (Excl VAT)				R 7 239 803.37

ACCOMMODATION, TRAVEL AND EXPENSES				
Item	Quantity	Months	Rate	Total
Travelling @R3.18	1000	4	R 3.18	R 12 720.00
Accommodation 3 star	6	4	R 900	R 18 000.00
Total Accommodation, Travel and Expenses for this Task Order (Excl VAT)				R 30 720.00

TOTAL COSTS FOR THIS TASK ORDER (Excl VAT)				R 7 270 523.37
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The Consultant to submit a detailed breakdown with each invoice.

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The submitted CVs for the listed resources form part of the Task Order.

5. ACCESS (25.2)

The *Employer* will provide access to the relevant Eskom Sites and Offices as per Eskom security requirements.

6. PROGRAMME (31.1 and 32.2)

The *Consultant* is to submit a first programme to the *Employer* for acceptance within 15 calendar days of Task Order

7. QUALITY (40.2)

The *Consultant* is to submit a Quality Policy Statement and a Quality Plan within 15 calendar days of Task Order signing.

8. DELAY DAMAGES (X7.1 AND Z11)

Not applicable

9. TRANSFER OF RIGHTS (X9)

Reference to "As per Task Order" not Applicable

10. KEY PERFORMANCE INDICATORS (X20)

Not applicable.

11. SUPPLIER DEVELOPMENT AND LOCALISATION (SD&L)

The Consultant will be obligated to train 1 (one) candidate for every R3 500 000.00 (three million five hundred Rands) cumulated through task orders awarded to them; this obligation will be for the entire duration of the enabling contract. The duration of the task order will not be linked with the Consultant's obligation to train; therefore the Consultant will have to ensure that the skills committed are successfully achieved by the end of the contract period. Skills candidates shall be sourced from previously disadvantage groups in South Africa. The candidates should be currently unemployed Civil, Mechanical and Electrical Engineering graduates from Further Education and Training Colleges, disadvantaged universities and/or unemployed matriculants.

SD&L Deliverables:

The Consultant shall:

- a) Within 30 (thirty) calendar days of the Task Order signing, develop a comprehensive Skills Development Plan that will include the identification of the unemployed resources; and
- b) Develop a formal Assessment Plan for the relevant resources
- c) Provide a report to SD&L.

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