



**Department of Water Affairs  
Directorate: Options Analysis**

**PRE-FEASIBILITY AND FEASIBILITY STUDIES FOR AUGMENTATION  
OF THE WESTERN CAPE WATER SUPPLY SYSTEM BY MEANS OF  
FURTHER SURFACE WATER DEVELOPMENTS**

**REPORT No.3 – VOLUME 2  
Breede-Berg (Michell's Pass) Water Transfer Scheme**

**APPENDIX No.12**

**Cost Estimates for the Berg River-Voëlvllei Augmentation Scheme, and  
the Breede-Berg (Michell's Pass) Water Transfer Scheme**



**December 2012**

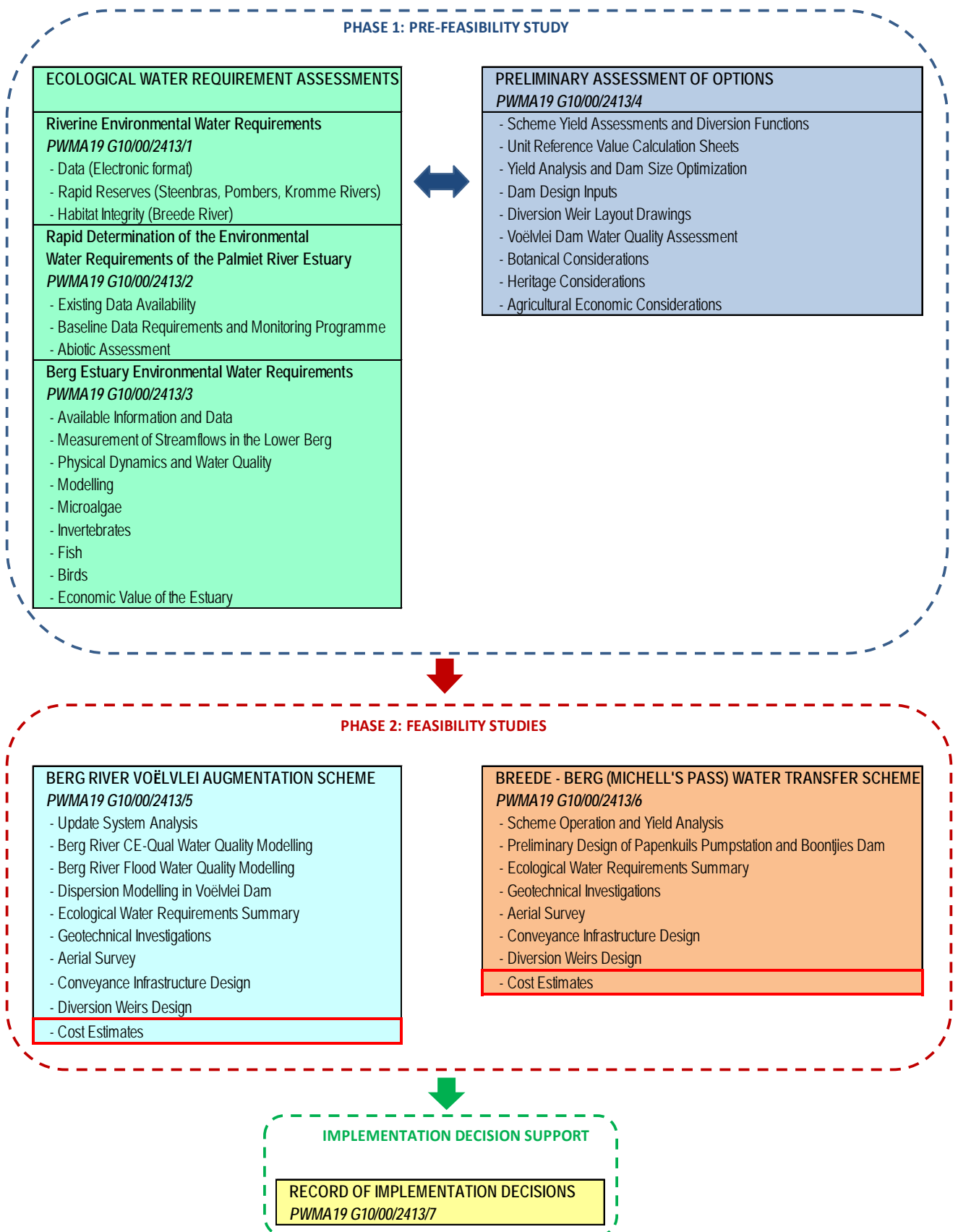
## STUDY REPORT LIST

REPORT No	REPORT TITLE	VOLUME No.	DWA REPORT No.	VOLUME TITLE
1	ECOLOGICAL WATER REQUIREMENT ASSESSMENTS	Vol 1	PWMA19 G10/00/2413/1	<b>Riverine Environmental Water Requirements</b>
				Appendix 1: EWR data for the Breede River
				Appendix 2: EWR data for the Palmiet River
				Appendix 3: EWR data for the Berg River
				Appendix 4: Task 3.1: Rapid Reserve assessments (quantity) for the Steenbras, Pombers and Kromme Rivers
				Appendix 5: Habitat Integrity Report – Breede River
		Vol 2	PWMA19 G10/00/2413/2	<b>Rapid Determination of the Environmental Water Requirements of the Palmiet River Estuary</b>
				Appendix A: Summary of data available for the RDM investigations undertaken during 2007 and 2008
				Appendix B: Summary of baseline data requirements and the long-term monitoring programme
				Appendix C: Abiotic Specialist Report
		Vol 3	PWMA19 G10/00/2413/3	<b>Berg Estuary Environmental Water Requirements</b>
				Appendix A: Available information and data
				Appendix B: Measurement of streamflows in the Lower Berg downstream of Misverstand Dam
				Appendix C: Specialist Report – Physical dynamics and water quality
				Appendix D: Specialist Report – Modelling
				Appendix E: Specialist Report – Microalgae
				Appendix F: Specialist Report – Invertebrates
				Appendix G: Specialist Report – Fish
Appendix H: Specialist Report – Birds				
Appendix I: Specialist Report – The economic value of the Berg River Estuary				
2	PRELIMINARY ASSESSMENT OF OPTIONS		PWMA19 G10/00/2413/4	Appendix 1: Scheme Yield Assessments and Diversion Functions
				Appendix 2: Unit Reference Value Calculation Sheets
				Appendix 3: Yield Analysis and Dam Size Optimization
				Appendix 4: Dam Design Inputs
				Appendix 5: Diversion Weir Layout Drawings
				Appendix 6: Voëlvlei Dam Water Quality Assessment
				Appendix 7: Botanical Considerations
				Appendix 8: Heritage Considerations
				Appendix 9: Agricultural Economic Considerations

**STUDY REPORT LIST (cntd)**

REPORT No	REPORT TITLE	VOLUME No.	DWA REPORT No.	VOLUME TITLE
3	<b>FEASIBILITY STUDIES</b>	Vol 1	PWMA19 G10/00/2413/5	<b>Berg River-Voëlvlei Augmentation Scheme</b>
				Appendix 1: Updating of the Western Cape Water Supply System Analysis for the Berg River-Voëlvlei Augmentation Scheme
				Appendix 2: Configuration, Calibration and Application of the CE-QUAL-W2 model to Voëlvlei Dam for the Berg River-Voëlvlei Augmentation Scheme
				Appendix 3: Monitoring Water Quality During Flood Events in the Middle Berg River (Winter 2011), for the Berg River-Voëlvlei Augmentation Scheme
				Appendix 4: Dispersion Modelling in Voëlvlei Dam from Berg River Water Transfers for the Berg River-Voëlvlei Augmentation Scheme
				Appendix 7 - 12: See list under Volume 2 below
		Vol 2	PWMA19 G10/00/2413/6	<b>Breede-Berg (Michell's Pass) Water Transfer Scheme</b>
				Appendix 5: Scheme Operation and Yield Analyses with Ecological Flow Requirements for the Breede-Berg (Michell's Pass) Water Transfer Scheme
				Appendix 6: Preliminary Design of Papenkuils Pump Station Upgrade and Pre-Feasibility Design of the Boontjies Dam, for the Breede-Berg (Michell's Pass) Water Transfer Scheme
				Appendix 7: Ecological Water Requirements Assessment Summary for the Berg River-Voëlvlei Augmentation Scheme, and the Breede Berg (Michell's Pass) Water Transfer Scheme
				Appendix 8: Geotechnical Investigations for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
				Appendix 9: LiDAR Aerial Survey, for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
				Appendix 10: Conveyance Infrastructure Design Report, for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
				Appendix 11: Diversion Weirs Design for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme
Appendix 12: Cost Estimates for the Berg River-Voëlvlei Augmentation Scheme, and the Breede-Berg (Michell's Pass) Water Transfer Scheme				
4	<b>RECORD OF IMPLEMENTATION DECISIONS</b>		PWMA19 G10/00/2413/7	

## STUDY REPORT MATRIX DIAGRAM



## COST ESTIMATE SUMMARY : BRVA SCHEME - 4 m<sup>3</sup>/s

December 2012

DESCRIPTION	UNIT	QTE	RATE	ESTIMATED COST (R)
<b>A: Estimated Construction Cost - Berg River Weir Structure</b>				
Preliminary & General	5%			R 1,672,500.00
Berg River Weir Structure <sup>A)</sup>	Sum	1	33,450,000.00	R 33,450,000.00
<b>Subtotal A</b>				<b>R 35,122,500.00</b>
<b>B: Estimated Construction Cost - Mechanical/Electrical</b>				
Preliminary & General	5%			R 1,825,000.00
Berg River Pump Station (Mechanical/Electrical) <sup>B)</sup>	Sum	1	36,500,000.00	R 36,500,000.00
<b>Subtotal B</b>				<b>R 38,325,000.00</b>
<b>C: Estimated Construction Cost - Civil</b>				
Preliminary & General	25%			R 25,437,500.00
Berg River Pump Station (Civil)	Sum	1	5,000,000.00	R 5,000,000.00
Voëlvlei Rising Main <sup>C)</sup>	Sum	1	96,750,000.00	R 96,750,000.00
<b>Subtotal C</b>				<b>R 127,187,500.00</b>
<b>D: Estimated Construction Cost - River Protection</b>				
Preliminary & General	5%			R 7,500.00
Voëlvlei Outlet Structure	Sum	1	50,000.00	R 50,000.00
Berg River Protection	Sum	1	100,000.00	R 100,000.00
<b>Subtotal D</b>				<b>R 157,500.00</b>
<b>SUBTOTAL 1</b>				<b>R 200,792,500.00</b>
Contingencies	10%			R 20,079,250.00
Escalation	0%			R 0.00
<b>SUBTOTAL 2</b>				<b>R 20,079,250.00</b>
<b>TOTAL CONSTRUCTION COST (Excl VAT)</b>				<b>R 220,871,750.00</b>

<b>Estimated Professional Fees</b>	
Professional Fees	R 13,331,446.25
Recoverable Expenditures	R 3,350,000.00
Supervision	R 360,000.00
Site and Occupational Health & Safety Supervision	R 156,000.00
<b>TOTAL PROFESSIONAL FEES (Excl VAT)</b>	<b>R 17,197,446.25</b>

<b>Estimated Other Fees</b>	
Servitude and Property Cost	R 5,040,000.00
<b>TOTAL OTHER FEES (Excl VAT)</b>	<b>R 5,040,000.00</b>

<b>TOTAL PROJECT COST (Excl VAT)</b>	<b>R 243,109,196.25</b>
<b>VAT (14 %)</b>	<b>R 34,035,287.48</b>
<b>TOTAL PROJECT COST (Incl VAT)</b>	<b>R 277,144,483.73</b>

\*Power supply to be finalized with ESKOM when design is finalized

A) Assumed to be equal to that of the 6m<sup>3</sup>/s weir (Appendix 7.1)

B) Refer to Appendix 7.2

C) Refer to Appendix 7.3

# COST ESTIMATE SUMMARY : BRVA SCHEME - 6 m<sup>3</sup>/s

December 2012

DESCRIPTION	UNIT	QTE	RATE	ESTIMATED COST (R)
<b>A: Estimated Construction Cost - Berg River Weir Structure</b>				
Preliminary & General	5%			R 1,672,500.00
Berg River Weir Structure <sup>A)</sup>	Sum	1	33,450,000.00	R 33,450,000.00
<b>Subtotal A</b>				<b>R 35,122,500.00</b>
<b>B: Estimated Construction Cost - Mechanical/Electrical</b>				
Preliminary & General	5%			R 2,290,000.00
Berg River Pump Station (Mechanical/Electrical) <sup>B)</sup>	Sum	1	45,800,000.00	R 45,800,000.00
<b>Subtotal B</b>				<b>R 48,090,000.00</b>
<b>C: Estimated Construction Cost - Civil</b>				
Preliminary & General	25%			R 28,750,000.00
Berg River Pump Station (Civil)	Sum	1	5,000,000.00	R 5,000,000.00
Voëlvlei Rising Main <sup>C)</sup>	Sum	1	110,000,000.00	R 110,000,000.00
<b>Subtotal C</b>				<b>R 143,750,000.00</b>
<b>D: Estimated Construction Cost - River Protection</b>				
Preliminary & General	5%			R 7,500.00
Voëlvlei Outlet Structure	Sum	1	50,000.00	R 50,000.00
Berg River Protection	Sum	1	100,000.00	R 100,000.00
<b>Subtotal D</b>				<b>R 157,500.00</b>
<b>SUBTOTAL 1</b>				<b>R 227,120,000.00</b>
Contingencies	10%			R 22,712,000.00
Escalation	0%			R 0.00
<b>SUBTOTAL 2</b>				<b>R 22,712,000.00</b>
<b>TOTAL CONSTRUCTION COST (Excl VAT)</b>				<b>R 249,832,000.00</b>

<b>Estimated Professional Fees</b>	
Professional Fees	R 14,924,260.00
Recoverable Expenditures	R 3,750,000.00
Supervision	R 360,000.00
Site and Occupational Health & Safety Supervision	R 156,000.00
<b>TOTAL PROFESSIONAL FEES (Excl VAT)</b>	<b>R 19,190,260.00</b>

<b>Estimated Other Fees</b>	
Servitude and Property Cost	R 5,040,000.00
<b>TOTAL OTHER FEES (Excl VAT)</b>	<b>R 5,040,000.00</b>

<b>TOTAL PROJECT COST (Excl VAT)</b>	<b>R 274,062,260.00</b>
<b>VAT (14 %)</b>	<b>R 38,368,716.40</b>
<b>TOTAL PROJECT COST (Incl VAT)</b>	<b>R 312,430,976.40</b>

\*Power supply to be finalized with ESKOM when design is finalized

A) Refer to Appendix 7.1

B) Refer to Appendix 7.2

C) Refer to Appendix 7.3

**COST ESTIMATE SUMMARY : Michell's Pass Scheme - Alternative A  
(without provision for summer EWR pumping scheme)**

December 2012

DESCRIPTION	UNIT	QTE	RATE	ESTIMATED COST (R)
<b>A: Estimated Construction Cost - Michells Pass Weir Structure</b>				
Preliminary & General	5%			R 2,383,750.00
Michells Pass Weir Structure <sup>A)</sup>	Sum	1	47,675,000.00	R 47,675,000.00
<b>Subtotal A</b>				<b>R 50,058,750.00</b>
<b>B: Estimated Construction Cost - Civil</b>				
Preliminary & General	25%			R 35,562,500.00
Gravity Main (Breede Weir to Balancing Tank) <sup>B)</sup>	Sum	1	138,500,000.00	R 138,500,000.00
Balancing Tank <sup>C)</sup>	Sum	1	3,750,000.00	R 3,750,000.00
<b>Subtotal B</b>				<b>R 177,812,500.00</b>
<b>C: Estimated Construction Cost - Chutes and River Protection</b>				
Preliminary & General	5%			R 3,275,000.00
Blousloot Closed Chute <sup>C)</sup>	Sum	1	15,500,000.00	R 15,500,000.00
Blousloot and Boontjies River Protection <sup>C)</sup>	Sum	1	50,000,000.00	R 50,000,000.00
<b>Subtotal C</b>				<b>R 68,775,000.00</b>
<b>D: Estimated Construction Cost - Papenkuils Pump Station</b>				
Preliminary & General (Civil)	25%			R 2,375,000.00
Pump Station Upgrade (Civil)	Sum	1	9,500,000.00	R 9,500,000.00
Preliminary & General (Mechanical/Electrical)	15%			R 10,200,000.00
Pump Station Upgrade (Mechanical/Electrical)	Sum	1	68,000,000.00	R 68,000,000.00
<b>Subtotal D</b>				<b>R 90,075,000.00</b>
<b>SUBTOTAL 1</b>				<b>R 386,721,250.00</b>
Contingencies	10%			R 38,672,125.00
Escalation	0%			R 0.00
<b>SUBTOTAL 2</b>				<b>R 38,672,125.00</b>
<b>TOTAL CONSTRUCTION COST (Excl VAT)</b>				<b>R 425,393,375.00</b>

<b>Estimated Professional Fees</b>	
Professional Fees	R 24,380,668.75
Recoverable Expenditures	R 7,676,529.38
Supervision	R 360,000.00
Site and Occupational Health & Safety Supervision	R 156,000.00
<b>TOTAL PROFESSIONAL FEES (VAT excl)</b>	<b>R 32,573,198.13</b>

<b>Estimated Other Fees</b>	
Servitude and Property Cost	R 6,080,000.00
<b>TOTAL OTHER FEES (Excl VAT)</b>	<b>R 6,080,000.00</b>

<b>TOTAL PROJECT COST (Excl VAT)</b>	<b>R 464,046,573.13</b>
<b>VAT (14 %)</b>	<b>R 64,966,520.24</b>
<b>TOTAL PROJECT COST (Incl VAT)</b>	<b>R 529,013,093.36</b>

\*Power supply to be finalized with ESKOM when design is finalized

A) Refer to Appendix 8.1.1

B) Refer to Appendix 8.1.2

C) Refer to Appendix 8.1.3

**COST ESTIMATE SUMMARY : Michell's Pass Scheme - Alternative B  
(with provision for summer EWR pumping scheme)**

December 2012

DESCRIPTION	UNIT	QTE	RATE	ESTIMATED COST (R)
<b>A: Estimated Construction Cost - Michells Pass Weir Structure</b>				
Preliminary & General	5%			R 2,383,750.00
Michells Pass Weir Structure <sup>A)</sup>	Sum	1	47,675,000.00	R 47,675,000.00
<b>Subtotal A</b>				<b>R 50,058,750.00</b>
<b>B: Estimated Construction Cost - Mechanical/Electrical</b>				
Preliminary & General	5%			R 650,000.00
New Boontjies Dam Pump Station (Mech/Elec) <sup>B)</sup>	Sum	1	13,000,000.00	R 13,000,000.00
<b>Subtotal B</b>				<b>R 13,650,000.00</b>
<b>C: Estimated Construction Cost - Civil</b>				
Preliminary & General	25%			R 50,716,250.00
Gravity Main (Breede Weir to New Boontjies Dam) <sup>C)</sup>	Sum	1	184,115,000.00	R 184,115,000.00
Balancing Tank <sup>D)</sup>	Sum	1	3,750,000.00	R 3,750,000.00
New Boontjies Dam Pump Station (Civil)	Sum	1	3,500,000.00	R 3,500,000.00
New Rising Main (Boontjies PST to Gravity Main) <sup>C)</sup>	Sum	1	11,500,000.00	R 11,500,000.00
<b>Subtotal C</b>				<b>R 253,581,250.00</b>
<b>D: Estimated Construction Cost - Chutes and River Protection</b>				
Preliminary & General	5%			R 2,775,000.00
Boontjies Dam Closed Chute <sup>D)</sup>	Sum	1	15,500,000.00	R 15,500,000.00
Boontjies River Protection <sup>C)</sup>	Sum	1	40,000,000.00	R 40,000,000.00
<b>Subtotal D</b>				<b>R 58,275,000.00</b>
<b>E: Estimated Construction Cost - Boontjies EWR Dam</b>				
Preliminary & General	20%			R 16,300,000.00
Boontjies EWR Dam	Sum	1	81,500,000.00	R 81,500,000.00
<b>Subtotal E</b>				<b>R 97,800,000.00</b>
<b>F: Estimated Construction Cost - Papenkuils Pump Station</b>				
Preliminary & General (Civil)	25%			R 2,375,000.00
Pump Station Upgrade (Civil)	Sum	1	9,500,000.00	R 9,500,000.00
Preliminary & General (Mechanical/Electrical)	15%			R 10,200,000.00
Pump Station Upgrade (Mechanical/Electrical)	Sum	1	68,000,000.00	R 68,000,000.00
<b>Subtotal F</b>				<b>R 90,075,000.00</b>
<b>SUBTOTAL 1</b>				<b>R 563,440,000.00</b>
Contingencies (Boontjies EWR Dam = 15%)	10%			R 61,234,000.00
Escalation	0%			R 0.00
<b>SUBTOTAL 2</b>				<b>R 61,234,000.00</b>
<b>TOTAL CONSTRUCTION COST (Excl VAT)</b>				<b>R 624,674,000.00</b>

<b>Estimated Professional Fees</b>	
Professional Fees	R 34,344,700.00
Recoverable Expenditures	R 10,577,975.00
Supervision	R 450,000.00
Site and Occupational Health & Safety Supervision	R 195,000.00
<b>TOTAL PROFESSIONAL FEES (VAT excl)</b>	<b>R 45,567,675.00</b>

<b>Estimated Other Fees</b>	
Servitude and Property Cost	R 19,532,000.00
<b>TOTAL OTHER FEES (Excl VAT)</b>	<b>R 19,532,000.00</b>

<b>TOTAL PROJECT COST (Excl VAT)</b>	<b>R 689,773,675.00</b>
<b>VAT (14 %)</b>	<b>R 96,568,314.50</b>
<b>TOTAL PROJECT COST (Incl VAT)</b>	<b>R 786,341,989.50</b>

\*Power supply to be finalized with ESKOM when design is finalized

A) Refer to Appendix 8.2.1

B) Refer to Appendix 8.2.2

C) Refer to Appendix 8.2.3

D) Assumed to be equal to that of Alternative A