CoalTech 2020

Task 4.11.1

Progress Report: Economic evaluation of fine coal beneficiation options

by

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1. INTRODUCTION

The most popular fine coal beneficiation technique used in South Africa today is spiral beneficiation. Spirals have been used for the last 15 years and have proved to be effective in terms of recovery as well as from an economic point of view.

In recent years changes in the coal market have increased the pressure to produce coal of a better quality and at the same time to produce such coal more consistently.

In order to satisfy the demands that market requirements place upon coal processing plants, it is necessary to review the techniques employed for fine coal beneficiation. Spirals, although very capable of producing the required quality of coal when the market demand was for a 27 MJ/kg product, cannot readily produce a product of 28 MJ/kg. They are also difficult to control and the product quality tends to vary with the feed quality.

Dense-medium cyclones (DMCs) can be used to beneficiate fine coal and have the potential to maintain accurate control over the quality of the delivered product. The process is, however, not yet proven and it is also more expensive than spiral beneficiation, in terms of both capital and operating cost.

This report presents the results of a techno-economic evaluation carried out in order to ascertain whether dense-medium cyclone beneficiation of fine coal could prove more viable than spiral processing.

2. METHODOLOGY

To enable a comparison to be drawn between the technical and economic viability of the two process options, the following procedure was employed.

- A hypothetical colliery with a production rate of 417 000 ROM tons (air dried) per month or 5 000 000 tons per annum was used to evaluate different fine coal processing options.
- The colliery produces steam coal for the export market by processing the coal in a single stage plant.
- The plant employs an 800 mm dense-medium cyclone to process the 50 x 1 mm size fraction.
- The cyclone product is dewatered through a basket centrifuge. The superficial moisture content of the coarse coal is taken to be 6 % after centrifuging.

- For the exercise, three product qualities, namely 6 000 kcal/kg, 6 100 kcal/kg and 6 200 kcal/kg, are considered.

- The price paid for the coal is US$ 21 per ton F.O.B. Richards Bay, based on a 6 000 kcal / kg product. The price is adjusted on a linear scale for higher quality coal. The price for 6 100 kcal/kg coal is thus US$ 21,50 and for 6 200 kcal/kg coal, US$ 22.

- Railage is paid by the colliery on the tonnage of coal railed at a rate of R45/ton.

- A port fee of R10 per ton of coal offloaded at Richards Bay Coal Terminal (RBCT) is payable by the mine.

- It is assumed that all coal produced by the colliery can be sold and that no restrictions apply in terms of the size consist of the coal.

Six different options with regard to the fine coal fraction are considered namely:

1. The fine coal is discarded. This forms the base case.
2. The fine coal is added to the final product without any beneficiation.
3. The fine coal is beneficiated using a single-stage spiral. An equivalent cutpoint relative density of 1,80 is assumed.
4. The fine coal is beneficiated using two stages of spirals. The product quality aimed for is 28,0 MJ/kg.
5. The fine coal is beneficiated to 28,0 MJ/kg using a single-stage dense-medium cyclone.
6. The coal is first beneficiated by a single-stage spiral, operating at a cutpoint density of 1,80. The product coal from the spiral is then beneficiated by a dense-medium cyclone to yield a product containing 28,0 MJ/kg.

To evaluate the influence of coal washability on the economic viability of the different processing options, typical washabilities for the No. 2 Seam, No. 4 Seam, No. 5 Seam and coal from the Waterberg coalfield were used. The washability data are shown in Appendix A.

Computer models capable of simulating spiral separators and a 200 mm dense-medium cyclone were used to derive the yield and quality of fine coal when “processed” by the different processes. A model capable of simulating the processing of the coarse coal via an 800 mm dense-medium cyclone was used to “beneficiate” the coarse coal. The quality of this coal was adjusted so as to obtain a final product, inclusive of the fine coal, of the required quality.

The yields and qualities of coal obtained from the simulations were used to calculate the comparative Net Present Values (NPV) of the different options. The income arising from the sale of the coal, as well as the railage and port fees, and the capital and operating expenditure, were taken into account for each option. All the results obtained are expressed in comparative terms, with the base case representing the discarding of the fine coal.

The calculations carried out to derive the operating and capital costs of spiral plants, as well as those for dense-medium processing of the fine coal, are detailed in Appendix B.

The calculations performed to derive the NPV values are given in Appendix C.

3. RESULTS OBTAINED

Table 1 below summarises the NPVs (after 10 years at 17 % interest) obtained for the different fine coal processing options evaluated in accordance with the various washability data sets.

Table 1: Summary of NPVs versus fine coal processing options

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1,80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
No. 2 Seam						
6 000kcal/kg	R0	R54,343,743	R59,451,190	R44,511,758	R55,108,567	R54,034,133
6 100 kcal/kg	R0	R30,264,504	R46,889,981	R37,350,127	R46,237,171	R45,195,985
6 200 kcal/kg	R0	-R30,365,600	R22,333,694	R26,804,957	R30,894,317	R29,772,040
No. 4 Seam						
6 000 kcal/kg	R0		-R59,349,362	R3,443,025	R3,339,939	R6,976,509
6 100 kcal/kg	R0			-R10,369,706	-R17,973,495	-R12,993,401
6 200 kcal/kg	R0			-R24,903,370	-R44,911,251	-R39,394,188
No. 5 Seam						
6 000 kcal/kg	R0	R31,996,185	R47,806,790	R48,138,672	R46,169,829	R45,664,514
6 100 kcal/kg	R0	R11,054,535	R47,049,644	R48,110,834	R45,872,881	R45,465,104
6 200 kcal/kg	R0		R43,527,515	R46,447,901	R44,010,344	R43,926,979
Waterberg						
6 000 kcal/kg	R0			R6,509,350	R4,248,939	R5,340,202
6 100 kcal/kg	R0			-R6,230,647	-R13,070,370	-R14,273,262
6 200 kcal/kg	R0			-R14,932,353	-R32,817,370	-R36,593,611

4. DISCUSSION

It is evident from Table 1 that the interpretation of the results is not really straightforward and that no single “best” processing option is identifiable.

For the No. 2 Seam, when producing a 6 000 kcal/kg product, dense-medium processing of the fine coal is the most economically viable option. However, when a 6 100 kcal/kg product

is the target, single-stage spiral processing seems the most viable. At 6 200 kcal/kg, dense-medium once again appears to be the most viable option.

The difference between the options is not very large. However, as the target quality increases, the option of adding raw fines to the final product becomes markedly less attractive, to the extent that at 6 200 kcal/kg, it becomes very unfavourable.

For the No. 4 Seam, as for the Waterberg coal, it is most viable to discard the fine coal. The only exception is in producing a 6 000 kcal/kg product, when it proves viable to employ almost any of the more advanced techniques to beneficiate the fine coal. With both of these seams, It is not possible to obtain the required product quality if the fine coal is added to the final product in an un-beneficiated state, even by “overwashing” of the coarse coal. This is largely due to the low yield obtainable from the coarse coal. There is simply not enough good-quality coarse coal available to compensate for the poor-quality fine coal.
It is of interest to note that the wrong choice of beneficiation option can result in very large financial penalties.

The 5 Seam coal is an “easier” coal to process than any of the coals already considered. In this case, all the fine coal processing options considered result in a relatively large financial benefit. Only when a 6 200 kcal/kg product has to be produced would it not be viable to add the raw fines back to product.

Double-stage spiral processing appears to be the most viable option for all three quality levels considered. The differences between the various processing options are relatively small – almost indicating that any beneficiation option will be acceptable.

The above results do not appear to make a conclusive case for the introduction of fine coal beneficiation by dense-medium processing. One should, however, consider that the analysis carried out does not take into account practical factors such as ease of operation, degree of control of product quality, tolerance to oversize material and other factors that are currently associated with the operation of spirals. Also, one should keep in mind that dense-medium processing is as yet largely unproven in South Africa.

One of the aspects that to be borne in mind is the fact that, when simulated by computer and using washability data derived from samples de-slimed at 100 micron, spirals appear to be capable of producing a 28 MJ/kg product. In practice, this is not always the case. The effect of ultra-fine coal reporting with the spiral product may be at least partly to blame. However, there may be other contributing factors, such as the fact that spirals operate in “banks”, comprising a large number of spirals, which makes control difficult. Intolerance to oversized material may also play a part.

Although dense-medium cyclones should be easier to operate and control, by virtue of the fact that a smaller number of units may be employed, and in view of the ability to accurately control the operating density of the cyclones, ultra fine “slimes” may still be a problem. In fact, in the case of the dense-medium cyclone, slimes would be an even bigger problem in that they could contaminate the magnetite medium, thus reducing the efficiency of operation.

Practical testing of dense-medium cyclone beneficiation, under plant conditions, is the only means of obtaining the answers to these potential problems.

The removal of ultra fine “slimes” ahead of processing of the fine coal need to be investigated. Effective de-sliming may also yield better-quality product coal also from existing spiral installations.

5. CONCLUSION

The analysis carried out has shown that the economic viability of differing processing options depends on a large number of parameters which are site-specific.

The effect of washabilty characteristics and the specification of the product coal, for example, will have a large influence on the choice of fine coal beneficiation technique to be adopted. Other factors, such as the dewatering option, product price, railage tariffs, etc., also need to be considered for each specific mine. This makes the choice of processing route unique for each colliery.

Dense-medium beneficiation of fine coal, although not the most viable option in all cases, does compare favourably with spiral processing, even though it is a more expensive process.

Appendix A

Washability Analysis : **Witbank / Middelburg**
No. 2 Seam
50 x 1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	9.88	4.9	30.40	0.71	53.7	38.4	3.0	9.88	4.9	30.40	0.71	53.7	38.4	3.0
F @ 1.35	15.71	6.9	29.84	0.64	54.2	36.0	3.0	25.59	6.1	30.06	0.67	54.0	36.9	3.0
F @ 1.40	16.65	9.7	29.04	0.63	56.4	31.3	2.7	42.24	7.5	29.66	0.65	55.0	34.7	2.9
F @ 1.45	13.72	14.8	27.58	0.66	55.7	27.1	2.5	55.96	9.3	29.15	0.65	55.1	32.8	2.8
F @ 1.50	10.49	18.8	26.42	0.80	54.1	24.2	2.9	66.45	10.8	28.72	0.68	55.0	31.5	2.8
F @ 1.55	7.47	22.9	25.24	0.76	50.7	23.4	3.0	73.92	12.0	28.36	0.69	54.5	30.6	2.8
F @ 1.60	5.66	29.0	23.51	1.22	45.2	22.6	3.3	79.58	13.2	28.02	0.72	53.9	30.1	2.9
F @ 1.65	3.66	36.6	21.31	1.62	38.5	21.6	3.2	83.24	14.3	27.72	0.76	53.2	29.7	2.9
F @ 1.70	2.77	40.6	20.18	2.13	35.1	21.4	3.0	86.01	15.1	27.48	0.81	52.6	29.4	2.9
F @ 1.75	2.46	45.3	18.83	2.79	31.7	20.3	2.8	88.47	16.0	27.24	0.86	52.0	29.2	2.9
F @ 1.80	2.85	48.9	17.79	2.12	29.3	19.2	2.6	91.32	17.0	26.95	0.90	51.3	28.9	2.9
F @ 1.85	1.19	51.4	17.08	1.79	27.4	18.6	2.6	92.51	17.4	26.82	0.91	51.0	28.7	2.9
F @ 1.90	0.5	53.3	16.54	2.86	26.3	18.0	2.5	93.00	17.6	26.77	0.92	50.9	28.7	2.9
F @ 1.95	0.8	57.9	15.21	1.92	21.7	17.7	2.6	93.80	18.0	26.67	0.93	50.6	28.6	2.9
F @ 2.00	0.5	63.9	13.50	2.89	18.6	15.2	2.3	94.32	18.2	26.59	0.94	50.5	28.5	2.9
S @ 2.00	5.7	79.1	9.14	3.03	8.1	10.7	2.1	100.00	21.7	25.60	1.06	48.1	27.5	2.8
Whole Coal	100.0	21.7	25.6	1.1	48.1	27.5	2.8	100.0	21.7	25.60	1.06	48.1	27.5	2.8

Washability Analysis : **Witbank / Middelburg**
No. 2 Seam
1 x 0.1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	4.30	2.4	31.10					4.30	2.4	31.10	0.00	0.0	0.0	0.0
F @ 1.35	8.30	3.9	30.60					12.60	3.4	30.77	0.00	0.0	0.0	0.0
F @ 1.40	11.10	6.2	29.80					23.70	4.7	30.32	0.00	0.0	0.0	0.0
F @ 1.45	15.40	9.1	28.80					39.10	6.4	29.72	0.00	0.0	0.0	0.0
F @ 1.50	15.50	12.4	27.60					54.60	8.1	29.12	0.00	0.0	0.0	0.0
F @ 1.55	11.00	17.2	25.90					65.60	9.7	28.58	0.00	0.0	0.0	0.0
F @ 1.60	7.70	21.2	25.50					73.30	10.9	28.25	0.00	0.0	0.0	0.0
F @ 1.65	6.30	24.4	23.40					79.60	11.9	27.87	0.00	0.0	0.0	0.0
F @ 1.70	4.80	31.1	21.00					84.40	13.0	27.48	0.00	0.0	0.0	0.0
F @ 1.75	3.00	34.8	19.70					87.40	13.8	27.21	0.00	0.0	0.0	0.0
F @ 1.80	1.60	39.0	18.30					89.00	14.2	27.05	0.00	0.0	0.0	0.0
F @ 1.85	1.00	43.4	16.70					90.00	14.5	26.94	0.00	0.0	0.0	0.0
F @ 1.90	0.8	45.3	16.10					90.80	14.8	26.84	0.00	0.0	0.0	0.0
F @ 1.95	0.7	47.7	15.30					91.50	15.1	26.75	0.00	0.0	0.0	0.0
F @ 2.00	0.5	55.3	13.70					92.00	15.3	26.68	0.00	0.0	0.0	0.0
S @ 2.00	8.0	73.7	7.50					100.00	20.0	25.15	0.00	0.0	0.0	0.0
Whole Coal	100.0	20.0	25.1	0.0	0.0	0.0	0.0	100.0	20.0	25.15	0.00	0.0	0.0	0.0

Washability Analysis : **Witbank / Middelburg**
No. 4 Seam
50 x 1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	0.40	6.7	30.70					0.40	6.7	30.70	0.00	0.0	0.0	0.0
F @ 1.35	3.20	7.3	30.40					3.60	7.2	30.43	0.00	0.0	0.0	0.0
F @ 1.40	10.80	9.8	29.30					14.40	9.2	29.58	0.00	0.0	0.0	0.0
F @ 1.45	12.80	13.5	27.70					27.20	11.2	28.70	0.00	0.0	0.0	0.0
F @ 1.50	14.20	16.9	26.20					41.40	13.2	27.84	0.00	0.0	0.0	0.0
F @ 1.55	9.30	21.3	24.30					50.70	14.6	27.19	0.00	0.0	0.0	0.0
F @ 1.60	6.70	27.1	22.00					57.40	16.1	26.59	0.00	0.0	0.0	0.0
F @ 1.65	3.90	31.0	20.00					61.30	17.1	26.17	0.00	0.0	0.0	0.0
F @ 1.70	3.30	33.3	19.10					64.60	17.9	25.81	0.00	0.0	0.0	0.0
F @ 1.75	2.10	38.2	16.90					66.70	18.5	25.52	0.00	0.0	0.0	0.0
F @ 1.80	1.60	47.9	12.70					68.30	19.2	25.22	0.00	0.0	0.0	0.0
F @ 1.85	4.00	58.0	8.00					72.30	21.4	24.27	0.00	0.0	0.0	0.0
F @ 1.90	6.0	62.0	6.50					78.30	24.5	22.91	0.00	0.0	0.0	0.0
F @ 1.95	7.0	74.0	4.00					85.30	28.5	21.36	0.00	0.0	0.0	0.0
F @ 2.00	3.0	76.0	3.00					88.30	30.1	20.73	0.00	0.0	0.0	0.0
S @ 2.00	11.7	78.0	2.00					100.00	35.7	18.54	0.00	0.0	0.0	0.0
Whole Coal	100.0	35.7	18.5	0.0	0.0	0.0	0.0	100.0	35.7	18.54	0.00	0.0	0.0	0.0

Washability Analysis : **Witbank / Middelburg**
No. 4 Seam
1 x 0.1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	3.30	3.0	31.70					3.30	3.0	31.70	0.00	0.0	0.0	0.0
F @ 1.35	12.70	4.6	29.50					16.00	4.3	29.95	0.00	0.0	0.0	0.0
F @ 1.40	7.60	6.6	28.50					23.60	5.0	29.49	0.00	0.0	0.0	0.0
F @ 1.45	15.70	9.0	27.10					39.30	6.6	28.53	0.00	0.0	0.0	0.0
F @ 1.50	9.80	10.8	26.30					49.10	7.4	28.09	0.00	0.0	0.0	0.0
F @ 1.55	11.60	16.0	24.40					60.70	9.1	27.38	0.00	0.0	0.0	0.0
F @ 1.60	7.90	18.4	23.10					68.60	10.2	26.89	0.00	0.0	0.0	0.0
F @ 1.65	6.50	24.2	20.70					75.10	11.4	26.35	0.00	0.0	0.0	0.0
F @ 1.70	2.80	29.2	19.10					77.90	12.0	26.09	0.00	0.0	0.0	0.0
F @ 1.75	2.60	33.8	18.10					80.50	12.7	25.83	0.00	0.0	0.0	0.0
F @ 1.80	2.60	39.3	15.70					83.10	13.5	25.52	0.00	0.0	0.0	0.0
F @ 1.85	0.70	42.3	14.00					83.80	13.8	25.42	0.00	0.0	0.0	0.0
F @ 1.90	0.9	46.3	13.60					84.70	14.1	25.30	0.00	0.0	0.0	0.0
F @ 1.95	1.0	52.3	11.20					85.70	14.6	25.13	0.00	0.0	0.0	0.0
F @ 2.00	2.8	75.7	3.40					88.50	16.5	24.44	0.00	0.0	0.0	0.0
S @ 2.00	11.5	78.8	2.60					100.00	23.7	21.93	0.00	0.0	0.0	0.0
Whole Coal	100.0	23.7	21.9	0.0	0.0	0.0	0.0	100.0	23.7	21.93	0.00	0.0	0.0	0.0

Washability Analysis : **Witbank / Middelburg**
No. 5 Seam
50 x 1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	9.70	4.7	30.20					9.70	4.7	30.20	0.00	0.0	0.0	0.0
F @ 1.35	30.40	7.2	29.40					40.10	6.6	29.59	0.00	0.0	0.0	0.0
F @ 1.40	15.90	10.8	28.40					56.00	7.8	29.25	0.00	0.0	0.0	0.0
F @ 1.45	6.50	17.2	26.50					62.50	8.8	28.97	0.00	0.0	0.0	0.0
F @ 1.50	3.10	20.6	25.50					65.60	9.3	28.80	0.00	0.0	0.0	0.0
F @ 1.55	1.40	24.9	24.20					67.00	9.7	28.71	0.00	0.0	0.0	0.0
F @ 1.60	1.20	31.1	22.40					68.20	10.0	28.60	0.00	0.0	0.0	0.0
F @ 1.65	1.00	37.8	20.50					69.20	10.4	28.48	0.00	0.0	0.0	0.0
F @ 1.70	1.00	42.3	19.10					70.20	10.9	28.35	0.00	0.0	0.0	0.0
F @ 1.75	1.20	47.0	17.80					71.40	11.5	28.17	0.00	0.0	0.0	0.0
F @ 1.80	1.10	53.7	15.80					72.50	12.1	27.98	0.00	0.0	0.0	0.0
F @ 1.85	1.30	58.7	14.30					73.80	13.0	27.74	0.00	0.0	0.0	0.0
F @ 1.90	1.5	61.0	13.70					75.30	13.9	27.46	0.00	0.0	0.0	0.0
F @ 1.95	2.3	65.0	12.50					77.60	15.4	27.02	0.00	0.0	0.0	0.0
F @ 2.00	2.4	70.0	11.00					80.00	17.1	26.54	0.00	0.0	0.0	0.0
S @ 2.00	20.0	77.0	9.00					100.00	29.0	23.03	0.00	0.0	0.0	0.0
Whole Coal	100.0	29.0	23.0	0.0	0.0	0.0	0.0	100.0	29.0	23.03	0.00	0.0	0.0	0.0

Washability Analysis : **Witbank / Middelburg**
No. 5 Seam
1 x 0.1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	9.10	2.1	30.90					9.10	2.1	30.90	0.00	0.0	0.0	0.0
F @ 1.35	15.30	3.9	30.40					24.40	3.2	30.59	0.00	0.0	0.0	0.0
F @ 1.40	11.80	6.9	29.50					36.20	4.4	30.23	0.00	0.0	0.0	0.0
F @ 1.45	6.10	12.0	28.00					42.30	5.5	29.91	0.00	0.0	0.0	0.0
F @ 1.50	2.70	15.3	27.00					45.00	6.1	29.74	0.00	0.0	0.0	0.0
F @ 1.55	2.00	19.8	25.70					47.00	6.7	29.56	0.00	0.0	0.0	0.0
F @ 1.60	1.60	23.9	24.50					48.60	7.3	29.40	0.00	0.0	0.0	0.0
F @ 1.65	1.00	31.2	22.40					49.60	7.7	29.26	0.00	0.0	0.0	0.0
F @ 1.70	0.60	36.7	20.80					50.20	8.1	29.16	0.00	0.0	0.0	0.0
F @ 1.75	0.70	42.1	19.20					50.90	8.6	29.02	0.00	0.0	0.0	0.0
F @ 1.80	0.80	46.9	17.80					51.70	9.1	28.84	0.00	0.0	0.0	0.0
F @ 1.85	0.90	50.9	16.60					52.60	9.9	28.64	0.00	0.0	0.0	0.0
F @ 1.90	0.9	54.1	15.70					53.50	10.6	28.42	0.00	0.0	0.0	0.0
F @ 1.95	0.8	56.6	14.90					54.30	11.3	28.22	0.00	0.0	0.0	0.0
F @ 2.00	1.2	59.2	14.20					55.50	12.3	27.92	0.00	0.0	0.0	0.0
S @ 2.00	44.5	80.8	7.80					100.00	42.8	18.96	0.00	0.0	0.0	0.0
Whole Coal	100.0	42.8	19.0	0.0	0.0	0.0	0.0	100.0	42.8	18.96	0.00	0.0	0.0	0.0

Washability Analysis : **Waterberg**

50 x 1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	1.65	3.6	31.11	0.75	56.9	35.9	3.6	1.65	3.6	31.11	0.75	56.9	35.9	3.6
F @ 1.35	6.09	5.6	30.40	0.77	55.0	35.8	3.5	7.74	5.2	30.55	0.77	55.4	35.8	3.5
F @ 1.40	6.34	14.1	27.72	0.94	47.5	35.5	2.9	14.08	9.2	29.28	0.84	51.8	35.7	3.2
F @ 1.45	7.01	19.6	25.64	0.98	44.2	33.3	2.8	21.09	12.7	28.07	0.89	49.3	34.9	3.1
F @ 1.50	5.80	23.9	24.12	0.99	41.8	31.7	2.6	26.89	15.1	27.22	0.91	47.7	34.2	3.0
F @ 1.55	4.82	28.0	22.64	1.10	39.6	29.9	2.5	31.71	17.0	26.52	0.94	46.5	33.5	2.9
F @ 1.60	3.73	31.9	21.19	1.06	37.5	28.2	2.4	35.44	18.6	25.96	0.95	45.5	33.0	2.9
F @ 1.65	3.29	35.3	19.94	1.10	35.2	27.2	2.3	38.73	20.0	25.45	0.96	44.6	32.5	2.8
F @ 1.70	2.77	37.3	19.12	1.11	33.4	27.0	2.3	41.50	21.2	25.03	0.97	43.9	32.1	2.8
F @ 1.75	2.04	41.2	17.80	1.11	32.1	24.5	2.2	43.54	22.1	24.69	0.98	43.3	31.8	2.8
F @ 1.80	1.94	43.6	16.94	1.12	30.8	23.4	2.2	45.48	23.0	24.36	0.99	42.8	31.4	2.7
F @ 1.85	3.13	48.8	14.91	1.27	27.2	21.9	2.1	48.61	24.7	23.75	1.01	41.8	30.8	2.7
F @ 1.90	1.4	54.3	12.93	1.20	22.9	20.9	1.9	50.01	25.5	23.45	1.01	41.3	30.5	2.7
F @ 1.95	1.5	57.5	11.79	1.35	22.1	18.6	1.8	51.51	26.5	23.11	1.02	40.7	30.2	2.6
F @ 2.00	1.8	60.6	10.60	0.94	20.2	17.4	1.7	53.31	27.6	22.68	1.02	40.0	29.7	2.6
S @ 2.00	46.7	81.9	2.66	0.92	6.5	10.2	1.4	100.01	53.0	13.33	0.97	24.4	20.6	2.0
Whole Coal	100.0	53.0	13.3	1.0	24.4	20.6	2.0	100.0	53.0	13.33	0.97	24.4	20.6	2.0

Washability Analysis : **Waterberg**

1 x 0.1 mm size fraction

Rel.Dens.	FRACTIONAL							CUMULATIVE						
	Yield	Ash	CV	Sulph	F/C	Vols	I Moist	Yield	Ash	CV	Sulph	F/C	Vols	I Moist
F @ 1.30	14.80	3.2	31.00	0.66	58.1	35.2	3.5	14.80	3.2	31.00	0.66	58.1	35.2	3.5
F @ 1.35	12.50	6.1	30.40	0.57	56.7	33.9	3.3	27.30	4.5	30.73	0.62	57.5	34.6	3.4
F @ 1.40	6.10	11.3	28.10	0.58	52.2	33.4	3.1	33.40	5.8	30.25	0.61	56.5	34.4	3.4
F @ 1.45	4.20	18.0	26.10	0.56	48.5	30.6	2.9	37.60	7.1	29.78	0.61	55.6	34.0	3.3
F @ 1.50	4.50	21.7	24.80	0.55	45.6	29.9	2.8	42.10	8.7	29.25	0.60	54.5	33.5	3.2
F @ 1.55	2.80	27.5	22.50	0.54	42.4	27.2	2.9	44.90	9.9	28.83	0.60	53.8	33.1	3.2
F @ 1.60	5.00	30.0	20.80	0.55	41.2	26.2	2.6	49.90	11.9	28.02	0.59	52.5	32.4	3.2
F @ 1.65	3.30	31.6	17.30	0.53	40.2	25.1	3.1	53.20	13.1	27.36	0.59	51.8	32.0	3.2
F @ 1.70	6.70	40.0	16.40	0.54	33.1	23.1	3.8	59.90	16.1	26.13	0.58	49.7	31.0	3.2
F @ 1.75	2.50	43.5	16.20	0.56	31.2	21.8	3.5	62.40	17.2	25.74	0.58	48.9	30.6	3.2
F @ 1.80	1.70	46.4	15.20	0.53	29.3	21.2	3.1	64.10	18.0	25.46	0.58	48.4	30.4	3.2
F @ 1.85	2.20	50.1	13.00	0.52	24.7	21.1	4.1	66.30	19.0	25.04	0.58	47.6	30.1	3.3
F @ 1.90	1.4	53.9	11.53	0.46	21.7	19.4	5.0	67.70	19.8	24.76	0.58	47.1	29.8	3.3
F @ 1.95	3.1	64.2	7.51	0.34	15.8	15.6	4.4	70.80	21.7	24.01	0.57	45.7	29.2	3.4
F @ 2.00	2.8	66.5	6.62	0.27	15.2	15.1	3.2	73.60	23.4	23.35	0.55	44.6	28.7	3.3
S @ 2.00	26.4	77.4	2.36	0.77	7.3	12.5	2.8	100.00	37.7	17.81	0.61	34.7	24.4	3.2
Whole Coal	100.0	37.7	17.8	0.6	34.7	24.4	3.2	100.0	37.7	17.81	0.61	34.7	24.4	3.2

Appendix B

Cost Estimate - Spiral Plant (Single Stage)

Item	Cost
Primary Cyclone cluster D4/35	R133,000
Primary spirals 1 x 12 triple starts	R299,000
Launders	R35,000
Pump - product (8/6)	R64,000
Pump - discard (6/4)	R39,000
Product dewatering cyclone cluster D4/35	R133,000
Discard dewatering cyclone cluster D4/25	R100,000
Equipment cost = 1	R803,000

Item	Factor	
Erection	0.11	R88,330
Structures	0.26	R208,780
Civils	0.17	R136,510
Piping	0.14	R112,420
Electrical	0.26	R208,780
Instrumentation	0.10	R80,300
Installed plant		R1,638,120
GST @14 %	0.14	R229,337
Site prep @ 5 %	0.05	R81,906
Cons. Man 15 %	0.15	R245,718
Contingency 15 %	0.15	R245,718
Cost of Fixed Capital		R2,440,799
Cost R/ton/hour		R24,408

Item			Cost per year
Labour	1 x operator x 25 % of time		R6,000
Electricity:			
	1 x 55 kW		R62,370
	1 x 110 kW		R124,740
	1 x 110 kW		R124,740
Spiral plant maintenance:			
Piping replacements (2 year life)			
45 m x 75 mm piping		1400	
20 m x 160 mm piping		1568	
Orifices 20 x R41 each		1000	
Elbows 20 x R48 each		1000	
Total over 10 years		24840	
Average per year			R2,484
Renewal of spirals (5 year life)			
36 way distributor		29000	
12 triple start spirals		225600	
Total over 10 year life		254600	
Average per year			R25,460
Renewal of cyclones (2 year life)			
V350 x 6		84000	
V250 x 4		32400	
Total over 10 years		582000	
Average per year			R58,200
Maintenance on pumps @ 10 % of purchase cost/year			
			R6,400
			R3,900
Total per year			**R414,294**

Total cents per ton processed **76.72**

Running hours per yea	5400
Capacity = 100 tph	
Capacity per year	540000

Cost Estimate - Double Stage Spiral Plant

Item	Cost
Primary Cyclone cluster D4/35	R133,000
Primary spirals 1 x 12 triple starts	R299,000
Launders	R35,000
Secondary spirals 1 x 10 triple starts	R248,000
Launders	R29,000
Pump - product (8/6)	R64,000
Pump - discard (6/4)	R39,000
Product dewatering cyclone cluster D4/35	R133,000
Discard dewatering cyclone cluster D4/25	R100,000
Equipment cost = 1	R1,080,000

Item	Factor	
Erection	0.11	R118,800
Structures	0.26	R280,800
Civils	0.17	R183,600
Piping	0.14	R151,200
Electrical	0.26	R280,800
Instrumentation	0.10	R108,000
Installed plant		R2,203,200
GST @14 %	0.14	R308,448
Site prep @ 5 %	0.05	R110,160
Cons. Man 15 %	0.15	R330,480
Contingency 15 %	0.15	R330,480
Cost of Fixed Capital		R3,282,768
Cost R/ton/hour		R32,828

Item			Cost per year
Labour	1 x operator x 25 % of time		R6,000
Electricity:			
	1 x 55 kW		R62,370
	1 x 110 kW		R124,740
	1 x 110 kW		R124,740
Spiral plant maintenance:			
Piping replacements (2 year life)			
96 m x 75 mm piping		2400	
24 m x 160 mm piping		2568	
Orifices 36 x R41 each		1476	
Elbows 30 x R48 each		1440	
Total over 10 years		39420	
Average per year			R3,942
Renewal of spirals (5 year life)			
30 way distributor		19400	
36 way distributor		29000	
22 triple start spirals		413600	
Total over 10 year life		462000	
Average per year			R46,200
Renewal of cyclones (2 year life)			
V350 x 6		84000	
V250 x 4		32400	
Total over 10 years		582000	
Average per year			R58,200
Maintenance on pumps @ 10 % of purchase cost/year			
			R6,400
			R3,900
Total per year			**R436,492**

Total cents per ton processed **80.83**

Running hours per year	5400
Capacity = 100 tph	
Capacity per year	540000

Cost Estimate - DM Cyclone Plant

Item	Cost
Primary Cyclone cluster D4/35	R133,000
DM Cyclone (4 x 400 mm)	R62,000
CD tank	R50,000
Mixing tank	R50,000
Feed distributor & Feed piping	R75,000
Discard dilute tank	R50,000
Product dilute tank	R50,000
Primary magnetic separators (4 x 2.135m x 900mm)	R445,164
Secondary magnetic separators (4 x 2.135m x 900mm)	R445,164
Correct density pump (10/8)	R90,000
Cyclone feed pump (10/8)	R90,000
Pump - product (8/6)	R64,000
Pump - discard (6/4)	R39,000
Product dewatering cyclone cluster D4/35	R133,000
Discard dewatering cyclone cluster D4/25	R100,000
Equipment cost = 1	R1,876,328

Item	Factor	
Erection	0.11	R206,396
Structures	0.26	R487,845
Civils	0.17	R318,976
Piping	0.14	R262,686
Electrical	0.26	R487,845
Instrumentation	0.10	R187,633
Installed plant		R3,827,709
GST @14 %	0.14	R535,879
Site prep @ 5 %	0.05	R191,385
Cons. Man 15 %	0.15	R574,156
Contingency 15 %	0.15	R574,156
Cost of Fixed Capital		R5,703,287
Cost R/ton/hour		R57,033

Item			Cost per year
Labour	1 x operators x 100 % of time		R24,000
Electricity:			
	1 x 55 kW		R62,370
	1 x 110 kW		R124,740
	1 x 110 kW		R124,740
	1 x 220 kW		R249,480
	1 x 220 kW		R249,480
Magnetite	3 kg/ton superfine grade	1620	R477,900
Plant maintenance:			
Pumps, cyclones etc @ 10 % p.a.of equipment cost		187633	
Total over 10 years		1876328	
Average per year			R187,633
Total per year			**R1,500,343**

Total cents per ton processed **277.84**

Running hours per yea	5400
Capacity = 100 tph	
Capacity per year	540000

Fine Coal Beneficiation - Evaluation of Options

No. 2 Seam
Product Specification = 6000 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	83.90	79.84	81.72	82.95	82.54	82.55
Tons fines	0.00	6.00	4.76	3.04	4.08	4.07
Total	83.90	85.84	86.48	85.99	86.62	86.62
CV ex Cyclone	26.72	27.21	27.00	26.85	26.90	26.90
CV Fines	0.00	25.15	26.92	28.00	28.00	28.00
Combined MJ/kg AD	26.72	27.07	26.99	26.89	26.95	26.95
Moist ex Cyclone	8.69	8.70	8.70	8.69	8.69	8.69
Moist ex Fines	0.00	25.21	25.21	25.21	25.21	25.21
Combined	8.69	9.85	9.61	9.27	9.47	9.47
Combined - inherent moist	2.86	2.87	2.87	2.86	2.87	2.87
CV Kcals GAR	6000	6000	6000	6000	6000	6000
FOB Price (R/t GAR)	R 126.00	R 126.00	R 126.00	R 126.00	R 126.00	R 126.00
Tons railed per annum	4462951	4624520	4646411	4603514	4647050	4646739
Railage + Port fees per annum	R 245,462,280	R 254,348,609	R 255,552,587	R 253,193,261	R 255,587,751	R 255,570,667
Revenue per annum	R 562,331,768	R 582,689,540	R 585,447,745	R 580,042,744	R 585,528,303	R 585,489,163
Contribution per annum	**R 316,869,488**	**R 328,340,931**	**R 329,895,158**	**R 326,849,483**	**R 329,940,552**	**R 329,918,497**
Variance from Base Case	**R 0**	**R 11,471,443**	**R 13,025,669**	**R 9,979,994**	**R 13,071,063**	**R 13,049,008**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0	300,000	238,000	152,000	204,000	203,500
Feed to Primary Spiral plant	0	0	300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0	0	0	201,690	0	
Feed to DMC plant	0	0	0	0	300,000	237,810
Discards	804,900	708,000	675,950	700,450	668,850	669,050
Tons per hour :						
Fines Product	0.0	55.6	44.1	28.1	37.8	37.7
Feed to Primary Spiral Plant	0.0	0.0	55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0	0.0	0.0	37.4	0.0	0.0
Feed to DMC Plant	0.0	0.0	0.0	0.0	55.6	44.0
Operating cost :						
Spiral beneficiation	R 0	R 0	R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0	R 0	R 0	R 0	R 834,000	R 661,112
Discard Disposal	R1,609,800	R1,416,000	R1,351,900	R1,400,900	R1,337,700	R1,338,100
Total	R1,609,800	R1,416,000	R1,582,900	R1,643,900	R2,171,700	R2,230,212
Net Contribution	R 315,259,688	R 326,924,931	R 328,312,258	R 325,205,583	R 327,768,852	R 327,688,285
Variance from Base Case	**R 0**	**R 11,665,243**	**R 13,052,569**	**R 9,945,894**	**R 12,509,163**	**R 12,428,597**
Capital cost :						
Spiral plant	R 0	R 0	R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0	R 0	R 0	R 0	R 3,166,667	R 2,510,217
Total	R 0	R 0	R 1,355,556	R 1,822,222	R 3,166,667	R 3,865,772
Net Present Value						
Contribution per annum	**R0**	**R11,665,243**	**R13,052,569**	**R9,945,894**	**R12,509,163**	**R12,428,597**
Capital Cost	**R0**	**R0**	**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,865,772**
Payback Period (years)	0.00	0.00	0.10	0.18	0.25	0.31
Return on Investment %		Err:503	962.89	545.81	395.03	321.50
Net Present Value over 10 yrs	**R0**	**R54,343,743**	**R59,451,190**	**R44,511,758**	**R55,108,567**	**R54,034,133**
NPV Calc interest Rate **17** %						
Year						
1	R0	R9,970,293	R11,156,042	R8,500,765	R10,691,593	R10,622,732
2	R0	R8,521,618	R9,535,079	R7,265,611	R9,138,113	R9,079,258
3	R0	R7,283,434	R8,149,640	R6,209,924	R7,810,353	R7,760,050
4	R0	R6,225,157	R6,965,504	R5,307,627	R6,675,516	R6,632,521
5	R0	R5,320,647	R5,953,422	R4,536,433	R5,705,569	R5,668,822
6	R0	R4,547,562	R5,088,395	R3,877,293	R4,876,555	R4,845,147
7	R0	R3,886,805	R4,349,056	R3,313,926	R4,167,995	R4,141,151
8	R0	R3,322,056	R3,717,142	R2,832,415	R3,562,389	R3,539,445
9	R0	R2,839,364	R3,177,044	R2,420,868	R3,044,777	R3,025,167
10	R0	R2,426,807	R2,715,422	R2,069,118	R2,602,374	R2,585,613
	R0	R54,343,743	R60,806,746	R46,333,980	R58,275,234	R57,899,905
Initial Capital Outlay	R 0	R 0	-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,865,772
Net Present Value	**R0**	**R54,343,743**	**R59,451,190**	**R44,511,758**	**R55,108,567**	**R54,034,133**

Fine Coal Beneficiation - Evaluation of Options

No. 2 Seam
Product Specification = 6100 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	80.20	74.74	77.22	78.77	78.23	78.24
Tons fines	0.00	6.00	4.76	3.04	4.08	4.07
Total	80.20	80.74	81.98	81.81	82.31	82.31
CV ex Cyclone	27.17	27.73	27.49	27.33	27.39	27.38
CV Fines	0.00	25.15	26.92	28.00	28.00	28.00
Combined MJ/kg AD	27.17	27.54	27.46	27.35	27.42	27.41
Moist ex Cyclone	8.70	8.70	8.70	8.70	8.70	8.70
Moist ex Fines	0.00	25.21	25.21	25.21	25.21	25.21
Combined	8.70	9.93	9.66	9.31	9.52	9.52
Combined - inherent moist	2.87	2.87	2.88	2.88	2.88	2.88
CV Kcals GAR	6100	6100	6100	6100	6100	6100
FOB Price (R/t GAR)	R 129.00	R 129.00	R 129.00	R 129.00	R 129.00	R 129.00
Tons railed per annum	4266113	4353178	4406775	4380849	4417837	4417633
Railage + Port fees per annum	R 234,636,239	R 239,424,788	R 242,372,600	R 240,946,674	R 242,981,047	R 242,969,810
Revenue per annum	R 550,328,633	R 561,559,958	R 568,473,917	R 565,129,471	R 569,901,001	R 569,874,646
Contribution per annum	**R 315,692,394**	**R 322,135,170**	**R 326,101,317**	**R 324,182,797**	**R 326,919,954**	**R 326,904,836**
Variance from Base Case	**R 0**	**R 6,442,775**	**R 10,408,923**	**R 8,490,403**	**R 11,227,560**	**R 11,212,442**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0	300,000	238,000	152,000	204,000	203,500
Feed to Primary Spiral plant	0	0	300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0	0	0	201,690	0	
Feed to DMC plant	0	0	0	0	300,000	237,810
Discards	989,950	963,100	900,800	909,350	884,300	884,400
Tons per hour :						
Fines Product	0.0	55.6	44.1	28.1	37.8	37.7
Feed to Primary Spiral Plant	0.0	0.0	55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0	0.0	0.0	37.4	0.0	0.0
Feed to DMC Plant	0.0	0.0	0.0	0.0	55.6	44.0
Operating cost :						
Spiral beneficiation	R 0	R 0	R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0	R 0	R 0	R 0	R 834,000	R 661,112
Discard Disposal	R1,979,900	R1,926,200	R1,801,600	R1,818,700	R1,768,600	R1,768,800
Total	R1,979,900	R1,926,200	R2,032,600	R2,061,700	R2,602,600	R2,660,912
Net Contribution	R 313,712,494	R 320,208,970	R 324,068,717	R 322,121,097	R 324,317,354	R 324,243,924
Variance from Base Case	**R 0**	**R 6,496,475**	**R 10,356,223**	**R 8,408,603**	**R 10,604,860**	**R 10,531,430**
Capital cost :						
Spiral plant	R 0	R 0	R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0	R 0	R 0	R 0	R 3,166,667	R 2,510,217
Total	R 0	R 0	R 1,355,556	R 1,822,222	R 3,166,667	R 3,865,772
Net Present Value						
Contribution per annum	**R0**	**R6,496,475**	**R10,356,223**	**R8,408,603**	**R10,604,860**	**R10,531,430**
Capital Cost	**R0**	**R0**	**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,865,772**
Payback Period (years)	0.00	0.00	0.13	0.22	0.30	0.37
Return on Investment %		Err:503	763.98	461.45	334.89	272.43
Net Present Value over 10 yrs	**R0**	**R30,264,504**	**R46,889,981**	**R37,350,127**	**R46,237,171**	**R45,195,985**
NPV Calc interest Rate **17** %						
Year						
1	R0	R5,552,543	R8,851,472	R7,186,840	R9,063,983	R9,001,222
2	R0	R4,745,763	R7,565,361	R6,142,599	R7,746,994	R7,693,352
3	R0	R4,056,208	R6,466,121	R5,250,084	R6,621,362	R6,575,515
4	R0	R3,466,844	R5,526,599	R4,487,251	R5,659,284	R5,620,098
5	R0	R2,963,115	R4,723,589	R3,835,258	R4,836,995	R4,803,503
6	R0	R2,532,577	R4,037,255	R3,277,998	R4,134,184	R4,105,558
7	R0	R2,164,596	R3,450,646	R2,801,708	R3,533,490	R3,509,024
8	R0	R1,850,082	R2,949,270	R2,394,622	R3,020,077	R2,999,166
9	R0	R1,581,266	R2,520,743	R2,046,685	R2,581,263	R2,563,389
10	R0	R1,351,510	R2,154,481	R1,749,304	R2,206,207	R2,190,931
	R0	R30,264,504	R48,245,536	R39,172,349	R49,403,838	R49,061,757
Initial Capital Outlay	R 0	R 0	-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,865,772
Net Present Value	**R0**	**R30,264,504**	**R46,889,981**	**R37,350,127**	**R46,237,171**	**R45,195,985**

Fine Coal Beneficiation - Evaluation of Options

No. 2 Seam
Product Specification = 6200 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	75.96	67.33	71.61	73.90	73.10	73.10
Tons fines	0.00	6.00	4.76	3.04	4.08	4.07
Total	75.96	73.33	76.37	76.94	77.18	77.17
CV ex Cyclone	27.62	28.29	28.00	27.81	27.87	27.87
CV Fines	0.00	25.15	26.92	28.00	28.00	28.00
Combined MJ/kg AD	27.62	28.03	27.93	27.81	27.88	27.88
Moist ex Cyclone	8.70	8.66	8.69	8.70	8.69	8.69
Moist ex Fines	0.00	25.18	25.20	25.21	25.21	25.21
Combined	8.70	10.01	9.72	9.35	9.56	9.56
Combined - inherent moist	2.88	2.83	2.86	2.87	2.87	2.87
CV Kcals GAR	6200	6200	6200	6200	6200	6200
FOB Price (R/t GAR)	R 132.00	R 132.00	R 132.00	R 132.00	R 132.00	R 132.00
Tons railed per annum	4040403	3959162	4108905	4122093	4144609	4144192
Railage + Port fees per annum	R 222,222,187	R 217,753,918	R 225,989,797	R 226,715,125	R 227,953,484	R 227,930,537
Revenue per annum	R 533,333,249	R 522,609,404	R 542,375,513	R 544,116,300	R 547,088,361	R 547,033,290
Contribution per annum	**R 311,111,062**	**R 304,855,486**	**R 316,385,716**	**R 317,401,175**	**R 319,134,877**	**R 319,102,752**
Variance from Base Case	**R 0**	**-R 6,255,576**	**R 5,274,654**	**R 6,290,113**	**R 8,023,815**	**R 7,991,690**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0	300,000	238,000	152,000	204,000	203,500
Feed to Primary Spiral plant	0	0	300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0	0	0	201,690	0	
Feed to DMC plant	0	0	0	0	300,000	237,810
Discards	1,202,000	1,333,300	1,181,300	1,153,050	1,141,200	1,141,500
Tons per hour :						
Fines Product	0.0	55.6	44.1	28.1	37.8	37.7
Feed to Primary Spiral Plant	0.0	0.0	55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0	0.0	0.0	37.4	0.0	0.0
Feed to DMC Plant	0.0	0.0	0.0	0.0	55.6	44.0
Operating cost :						
Spiral beneficiation	R 0	R 0	R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0	R 0	R 0	R 0	R 834,000	R 661,112
Discard Disposal	R2,404,000	R2,666,600	R2,362,600	R2,306,100	R2,282,400	R2,283,000
Total	R2,404,000	R2,666,600	R2,593,600	R2,549,100	R3,116,400	R3,175,112
Net Contribution	R 308,707,062	R 302,188,886	R 313,792,116	R 314,852,075	R 316,018,477	R 315,927,640
Variance from Base Case	**R 0**	**-R 6,518,176**	**R 5,085,054**	**R 6,145,013**	**R 7,311,415**	**R 7,220,578**
Capital cost :						
Spiral plant	R 0	R 0	R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0	R 0	R 0	R 0	R 3,166,667	R 2,510,217
Total	R 0	R 0	R 1,355,556	R 1,822,222	R 3,166,667	R 3,865,772
Net Present Value						
Contribution per annum	**R0**	**(R6,518,176)**	**R5,085,054**	**R6,145,013**	**R7,311,415**	**R7,220,578**
Capital Cost	**R0**	**R0**	**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,865,772**
Payback Period (years)	0.00	0.00	0.27	0.30	0.43	0.54
Return on Investment %		Err:503	375.13	337.23	230.89	186.78
Net Present Value over 10 yrs	**R0**	**(R30,365,600)**	**R22,333,694**	**R26,804,957**	**R30,894,317**	**R29,772,040**
NPV Calc interest Rate **17** %						
Year						
1	R0	(R5,571,091)	R4,346,200	R5,252,148	R6,249,073	R6,171,434
2	R0	(R4,761,616)	R3,714,701	R4,489,015	R5,341,088	R5,274,730
3	R0	(R4,069,757)	R3,174,958	R3,836,765	R4,565,032	R4,508,316
4	R0	(R3,478,425)	R2,713,639	R3,279,286	R3,901,737	R3,853,262
5	R0	(R2,973,013)	R2,319,350	R2,802,809	R3,334,818	R3,293,386
6	R0	(R2,541,037)	R1,982,350	R2,395,563	R2,850,272	R2,814,860
7	R0	(R2,171,826)	R1,694,316	R2,047,490	R2,436,130	R2,405,863
8	R0	(R1,856,262)	R1,448,134	R1,749,991	R2,082,162	R2,056,293
9	R0	(R1,586,548)	R1,237,721	R1,495,719	R1,779,626	R1,757,516
10	R0	(R1,356,024)	R1,057,881	R1,278,392	R1,521,048	R1,502,150
	R0	(R30,365,600)	R23,689,249	R28,627,179	R34,060,984	R33,637,812
Initial Capital Outlay	R 0	R 0	-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,865,772
Net Present Value	**R0**	**(R30,365,600)**	**R22,333,694**	**R26,804,957**	**R30,894,317**	**R29,772,040**

Fine Coal Beneficiation - Evaluation of Options

No. 4 Seam
Product Specification = 6000 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
		Cannot achieve				
Tons ex Cyclone	49.91	Quality	41.45	48.80	48.22	48.36
Tons fines	0.00		4.50	1.25	1.93	2.01
Total	49.91		45.95	50.05	50.15	50.37
CV ex Cyclone	26.72		27.44	26.83	26.88	26.87
CV Fines	0.00		25.08	27.31	27.56	28.00
Combined MJ/kg AD	26.72		27.21	26.84	26.91	26.92
Moist ex Cyclone	9.38		9.38	9.38	9.38	9.38
Moist ex Fines	0.00		25.77	25.77	25.77	25.77
Combined	9.38		10.99	9.79	10.01	10.03
Combined - inherent moist	3.60		3.60	3.60	3.60	3.60
CV Kcals GAR	6000		6000	5999	6000	6000
FOB Price (R/t GAR)	R 126.00		R 126.00	R 126.00	R 126.00	R 126.00
Tons railed per annum	2654776		2488271	2673930	2685866	2698561
Railage + Port fees per annum	R 146,012,704		R 136,854,930	R 147,066,163	R 147,722,650	R 148,420,842
Revenue per annum	R 334,501,830		R 313,522,203	R 336,915,209	R 338,419,163	R 340,018,657
Contribution per annum	**R 188,489,126**		**R 176,667,273**	**R 189,849,047**	**R 190,696,512**	**R 191,597,814**
Variance from Base Case	**R 0**		**-R 11,821,853**	**R 1,359,920**	**R 2,207,386**	**R 3,108,688**

Case No :	1		3	4	5	6
	Base Case Fines discarded		Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0		225,000	62,500	96,500	100,500
Feed to Primary Spiral plant	0		300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0		0	224,910	0	
Feed to DMC plant	0		0	0	300,000	224,910
Discards	2,504,400		2,702,350	2,497,750	2,492,750	2,481,550
Tons per hour :						
Fines Product	0.0		41.7	11.6	17.9	18.6
Feed to Primary Spiral Plant	0.0		55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0		0.0	41.7	0.0	0.0
Feed to DMC Plant	0.0		0.0	0.0	55.6	41.7
Operating cost :						
Spiral beneficiation	R 0		R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0		R 0	R 0	R 834,000	R 625,250
Discard Disposal	R5,008,800		R5,404,700	R4,995,500	R4,985,500	R4,963,100
Total	R5,008,800		R5,635,700	R5,238,500	R5,819,500	R5,819,350
Net Contribution	R 183,480,326		R 171,031,573	R 184,610,547	R 184,877,012	R 185,778,465
Variance from Base Case	**R 0**		**-R 12,448,753**	**R 1,130,220**	**R 1,396,686**	**R 2,298,138**
Capital cost :						
Spiral plant	R 0		R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0		R 0	R 0	R 3,166,667	R 2,374,050
Total	R 0		R 1,355,556	R 1,822,222	R 3,166,667	R 3,729,606
Net Present Value						
Contribution per annum	**R0**		**(R12,448,753)**	**R1,130,220**	**R1,396,686**	**R2,298,138**
Capital Cost	**R0**		**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,729,606**
Payback Period (years)	0.00		-0.11	1.61	2.27	1.62
Return on Investment %			-918.35	62.02	44.11	61.62
Net Present Value over 10 yrs	**R0**		**(R59,349,362)**	**R3,443,025**	**R3,339,939**	**R6,976,509**
NPV Calc interest Rate **17** %						
Year						
1	R0		(R10,639,960)	R966,000	R1,193,749	R1,964,221
2	R0		(R9,093,983)	R825,641	R1,020,298	R1,678,821
3	R0		(R7,772,635)	R705,676	R872,050	R1,434,890
4	R0		(R6,643,278)	R603,142	R745,342	R1,226,402
5	R0		(R5,678,015)	R515,506	R637,044	R1,048,206
6	R0		(R4,853,004)	R440,603	R544,482	R895,903
7	R0		(R4,147,867)	R376,584	R465,369	R765,729
8	R0		(R3,545,185)	R321,867	R397,752	R654,469
9	R0		(R3,030,073)	R275,100	R339,959	R559,375
10	R0		(R2,589,806)	R235,128	R290,563	R478,099
	R0		(R57,993,807)	R5,265,247	R6,506,606	R10,706,115
Initial Capital Outlay	R 0		-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,729,606
Net Present Value	**R0**		**(R59,349,362)**	**R3,443,025**	**R3,339,939**	**R6,976,509**

Fine Coal Beneficiation - Evaluation of Options

No. 4 Seam
Product Specification = 6100 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	45.11	Cannot achieve Quality	Cannot achieve Quality	43.25	42.26	42.46
Tons fines	0.00			1.25	1.93	2.01
Total	45.11			44.50	44.19	44.47
CV ex Cyclone	27.17			27.31	27.38	27.36
CV Fines	0.00			27.31	27.56	28.00
Combined MJ/kg AD	27.17			27.31	27.38	27.39
Moist ex Cyclone	9.38			9.38	9.38	9.38
Moist ex Fines	0.00			25.77	25.77	25.77
Combined	9.38			9.84	10.10	10.12
Combined - inherent moist	3.60			3.60	3.60	3.60
CV Kcals GAR	6100			6100	6100	6100
FOB Price (R/t GAR)	R 129.00			R 129.00	R 129.00	R 129.00
Tons railed per annum	2399469			2378791	2369036	2385030
Railage + Port fees per annum	R 131,970,770			R 130,833,479	R 130,296,999	R 131,176,626
Revenue per annum	R 309,531,443			R 306,863,978	R 305,605,688	R 307,668,814
Contribution per annum	**R 177,560,673**			**R 176,030,499**	**R 175,308,689**	**R 176,492,188**
Variance from Base Case	**R 0**			**-R 1,530,174**	**-R 2,251,983**	**-R 1,068,485**

Case No :	1			4	5	6
	Base Case Fines discarded			Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0			62,500	96,500	100,500
Feed to Primary Spiral plant	0			300,000	0	300,000
Feed to Secondary Spiral plant	0			224,910	0	
Feed to DMC plant	0			0	300,000	224,910
Discards	2,744,400			2,775,200	2,790,600	2,776,300
Tons per hour :						
Fines Product	0.0			11.6	17.9	18.6
Feed to Primary Spiral Plant	0.0			55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0			41.7	0.0	0.0
Feed to DMC Plant	0.0			0.0	55.6	41.7
Operating cost :						
Spiral beneficiation	R 0			R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0			R 0	R 834,000	R 625,250
Discard Disposal	R5,488,800			R5,550,400	R5,581,200	R5,552,600
Total	R5,488,800			R5,793,400	R6,415,200	R6,408,850
Net Contribution	R 172,071,873			R 170,237,099	R 168,893,489	R 170,083,338
Variance from Base Case	**R 0**			**-R 1,834,774**	**-R 3,178,383**	**-R 1,988,535**
Capital cost :						
Spiral plant	R 0			R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0			R 0	R 3,166,667	R 2,374,050
Total	R 0			R 1,822,222	R 3,166,667	R 3,729,606
Net Present Value						
Contribution per annum	**R0**			**(R1,834,774)**	**(R3,178,383)**	**(R1,988,535)**
Capital Cost	**R0**			**R1,822,222**	**R3,166,667**	**R3,729,606**
Payback Period (years)	0.00			-0.99	-1.00	-1.88
Return on Investment %				-100.69	-100.37	-53.32
Net Present Value over 10 yrs	**R0**			**(R10,369,706)**	**(R17,973,495)**	**(R12,993,401)**
NPV Calc interest Rate 17 %						
Year						
1	R0			(R1,568,183)	(R2,716,567)	(R1,699,602)
2	R0			(R1,340,327)	(R2,321,852)	(R1,452,652)
3	R0			(R1,145,579)	(R1,984,489)	(R1,241,583)
4	R0			(R979,127)	(R1,696,144)	(R1,061,182)
5	R0			(R836,861)	(R1,449,696)	(R906,993)
6	R0			(R715,266)	(R1,239,057)	(R775,208)
7	R0			(R611,338)	(R1,059,023)	(R662,571)
8	R0			(R522,511)	(R905,148)	(R566,300)
9	R0			(R446,591)	(R773,630)	(R484,017)
10	R0			(R381,702)	(R661,223)	(R413,690)
	R0			(R8,547,483)	(R14,806,829)	(R9,263,795)
Initial Capital Outlay	R 0			-R 1,822,222	-R 3,166,667	-R 3,729,606
Net Present Value	**R0**			**(R10,369,706)**	**(R17,973,495)**	**(R12,993,401)**

Fine Coal Beneficiation - Evaluation of Options

No. 4 Seam
Product Specification = 6200 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	39.07	Cannot achieve Quality	Cannot achieve Quality	36.48	34.86	35.09
Tons fines	0.00			1.25	1.93	2.01
Total	39.07			37.73	36.79	37.10
CV ex Cyclone	27.62			27.80	27.90	27.88
CV Fines	0.00			27.31	27.56	28.00
Combined MJ/kg AD	27.62			27.78	27.88	27.88
Moist ex Cyclone	9.38			9.38	9.38	9.38
Moist ex Fines	0.00			25.77	25.77	25.77
Combined	9.38			9.92	10.24	10.27
Combined - inherent moist	3.60			3.60	3.60	3.60
CV Kcals GAR	6200			6200	6200	6200
FOB Price (R/t GAR)	R 132.00			R 132.00	R 132.00	R 132.00
Tons railed per annum	2078313			2018871	1975733	1992579
Railage + Port fees per annum	R 114,307,188			R 111,037,888	R 108,665,295	R 109,591,840
Revenue per annum	R 274,337,252			R 266,490,931	R 260,796,708	R 263,020,415
Contribution per annum	**R 160,030,064**			**R 155,453,043**	**R 152,131,413**	**R 153,428,576**
Variance from Base Case	**R 0**			**-R 4,577,021**	**-R 7,898,650**	**-R 6,601,488**

Case No :	1			4	5	6
	Base Case Fines discarded			Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0			62,500	96,500	100,500
Feed to Primary Spiral plant	0			300,000	0	300,000
Feed to Secondary Spiral plant	0			224,910	0	
Feed to DMC plant	0			0	300,000	224,910
Discards	3,046,300			3,113,550	3,160,350	3,145,250
Tons per hour :						
Fines Product	0.0			11.6	17.9	18.6
Feed to Primary Spiral Plant	0.0			55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0			41.7	0.0	0.0
Feed to DMC Plant	0.0			0.0	55.6	41.7
Operating cost :						
Spiral beneficiation	R 0			R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0			R 0	R 834,000	R 625,250
Discard Disposal	R6,092,600			R6,227,100	R6,320,700	R6,290,500
Total	R6,092,600			R6,470,100	R7,154,700	R7,146,750
Net Contribution	R 153,937,464			R 148,982,943	R 144,976,713	R 146,281,826
Variance from Base Case	**R 0**			**-R 4,954,521**	**-R 8,960,750**	**-R 7,655,638**
Capital cost :						
Spiral plant	R 0			R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0			R 0	R 3,166,667	R 2,374,050
Total	R 0			R 1,822,222	R 3,166,667	R 3,729,606
Net Present Value						
Contribution per annum	**R0**			**(R4,954,521)**	**(R8,960,750)**	**(R7,655,638)**
Capital Cost	**R0**			**R1,822,222**	**R3,166,667**	**R3,729,606**
Payback Period (years)	0.00			-0.37	-0.35	-0.49
Return on Investment %				-271.89	-282.97	-205.27
Net Present Value over 10 yrs	**R0**			**(R24,903,370)**	**(R44,911,251)**	**(R39,394,188)**
NPV Calc interest Rate 17 %						
Year						
1	R0			(R4,234,633)	(R7,658,761)	(R6,543,280)
2	R0			(R3,619,344)	(R6,545,950)	(R5,592,547)
3	R0			(R3,093,457)	(R5,594,829)	(R4,779,955)
4	R0			(R2,643,980)	(R4,781,905)	(R4,085,431)
5	R0			(R2,259,812)	(R4,087,098)	(R3,491,822)
6	R0			(R1,931,463)	(R3,493,246)	(R2,984,463)
7	R0			(R1,650,823)	(R2,985,681)	(R2,550,823)
8	R0			(R1,410,960)	(R2,551,864)	(R2,180,191)
9	R0			(R1,205,949)	(R2,181,080)	(R1,863,411)
10	R0			(R1,030,726)	(R1,864,171)	(R1,592,659)
	R0			(R23,081,148)	(R41,744,584)	(R35,664,582)
Initial Capital Outlay	R 0			-R 1,822,222	-R 3,166,667	-R 3,729,606
Net Present Value	**R0**			**(R24,903,370)**	**(R44,911,251)**	**(R39,394,188)**

Fine Coal Beneficiation - Evaluation of Options

No. 5 Seam
Product Specification = 6000 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	70.88	65.72	69.81	70.21	70.21	70.21
Tons fines	0.00	6.00	3.27	2.97	3.07	3.01
Total	70.88	71.72	73.08	73.18	73.28	73.22
CV ex Cyclone	26.73	27.88	26.97	26.87	26.88	26.88
CV Fines	0.00	18.96	26.31	28.00	28.00	28.00
Combined MJ/kg AD	26.73	27.13	26.94	26.92	26.93	26.92
Moist ex Cyclone	8.82	8.82	8.82	8.82	8.82	8.82
Moist ex Fines	0.00	25.31	25.31	25.31	25.31	25.31
Combined	8.82	10.20	9.56	9.49	9.51	9.50
Combined - inherent moist	3.00	3.00	3.00	3.00	3.00	3.00
CV Kcals GAR	6000	6000	6000	6000	6000	6000
FOB Price (R/t GAR)	R 126.00	R 126.00	R 126.00	R 126.00	R 126.00	R 126.00
Tons railed per annum	3770319	3873233	3919107	3921548	3927843	3924066
Railage + Port fees per annum	R 207,367,553	R 213,027,806	R 215,550,873	R 215,685,130	R 216,031,373	R 215,823,624
Revenue per annum	R 475,060,213	R 488,027,336	R 493,807,454	R 494,115,025	R 494,908,237	R 494,432,303
Contribution per annum	**R 267,692,660**	**R 274,999,531**	**R 278,256,581**	**R 278,429,895**	**R 278,876,864**	**R 278,608,679**
Variance from Base Case	**R 0**	**R 7,306,871**	**R 10,563,922**	**R 10,737,236**	**R 11,184,204**	**R 10,916,019**

Case No :	1	3	3	4	5	6
	Base Case Fines discarded	Fines beneficiated single spiral at RD 1.80	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0	300,000	163,500	148,500	153,500	150,500
Feed to Primary Spiral plant	0	300,000	300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0	0	0	180,660	0	
Feed to DMC plant	0	0	0	0	300,000	163,710
Discards	1,455,900	1,414,250	1,345,850	1,340,800	1,335,800	1,338,800
Tons per hour :						
Fines Product	0.0	55.6	30.3	27.5	28.4	27.9
Feed to Primary Spiral Plant	0.0	55.6	55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0	0.0	0.0	33.5	0.0	0.0
Feed to DMC Plant	0.0	0.0	0.0	0.0	55.6	30.3
Operating cost :						
Spiral beneficiation	R 0	R 231,000	R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0	R 0	R 0	R 0	R 834,000	R 455,114
Discard Disposal	R2,911,800	R2,828,500	R2,691,700	R2,681,600	R2,671,600	R2,677,600
Total	R2,911,800	R3,059,500	R2,922,700	R2,924,600	R3,505,600	R3,363,714
Net Contribution	R 264,780,860	R 271,940,031	R 275,333,881	R 275,505,295	R 275,371,264	R 275,244,965
Variance from Base Case	**R 0**	**R 7,159,171**	**R 10,553,022**	**R 10,724,436**	**R 10,590,404**	**R 10,464,105**
Capital cost :						
Spiral plant	R 0	R 1,355,556	R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0	R 0	R 0	R 0	R 3,166,667	R 1,728,050
Total	R 0	R 1,355,556	R 1,355,556	R 1,822,222	R 3,166,667	R 3,083,606
Net Present Value						
Contribution per annum	**R0**	**R7,159,171**	**R10,553,022**	**R10,724,436**	**R10,590,404**	**R10,464,105**
Capital Cost	**R0**	**R1,355,556**	**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,083,606**
Payback Period (years)	0.00	0.19	0.13	0.17	0.30	0.29
Return on Investment %		528.14	778.50	588.54	334.43	339.35
Net Present Value over 10 yrs	**R0**	**R31,996,185**	**R47,806,790**	**R48,138,672**	**R46,169,829**	**R45,664,514**
NPV Calc interest Rate **17** %						
Year						
1	R0	R6,118,950	R9,019,677	R9,166,184	R9,051,628	R8,943,680
2	R0	R5,229,872	R7,709,125	R7,834,346	R7,736,434	R7,644,171
3	R0	R4,469,976	R6,588,996	R6,696,022	R6,612,337	R6,533,479
4	R0	R3,820,492	R5,631,621	R5,723,096	R5,651,570	R5,584,170
5	R0	R3,265,378	R4,813,351	R4,891,535	R4,830,401	R4,772,795
6	R0	R2,790,921	R4,113,975	R4,180,799	R4,128,548	R4,079,312
7	R0	R2,385,403	R3,516,218	R3,573,332	R3,528,674	R3,486,592
8	R0	R2,038,806	R3,005,315	R3,054,130	R3,015,960	R2,979,993
9	R0	R1,742,569	R2,568,645	R2,610,368	R2,577,744	R2,547,002
10	R0	R1,489,375	R2,195,423	R2,231,084	R2,203,200	R2,176,925
	R0	R33,351,741	R49,162,345	R49,960,895	R49,336,496	R48,748,120
Initial Capital Outlay	R 0	-R 1,355,556	-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,083,606
Net Present Value	**R0**	**R31,996,185**	**R47,806,790**	**R48,138,672**	**R46,169,829**	**R45,664,514**

Fine Coal Beneficiation - Evaluation of Options

No. 5 Seam
Product Specification = 6100 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	68.91	62.55	67.69	68.13	68.11	68.12
Tons fines	0.00	6.00	3.27	2.97	3.07	3.01
Total	68.91	68.55	70.96	71.10	71.18	71.13
CV ex Cyclone	27.17	28.44	27.45	27.35	27.35	27.35
CV Fines	0.00	18.96	26.31	28.00	28.00	28.00
Combined MJ/kg AD	27.17	27.61	27.40	27.38	27.38	27.38
Moist ex Cyclone	8.82	8.82	8.82	8.82	8.82	8.82
Moist ex Fines	0.00	25.31	25.31	25.31	25.31	25.31
Combined	8.82	10.26	9.58	9.51	9.53	9.52
Combined - inherent moist	3.00	3.00	3.00	3.00	3.00	3.00
CV Kcals GAR	6100	6100	6100	6100	6100	6100
FOB Price (R/t GAR)	R 129.00	R 129.00	R 129.00	R 129.00	R 129.00	R 129.00
Tons railed per annum	3665532	3705136	3806295	3810703	3815988	3812636
Railage + Port fees per annum	R 201,604,255	R 203,782,484	R 209,346,245	R 209,588,665	R 209,879,349	R 209,694,989
Revenue per annum	R 472,853,617	R 477,962,554	R 491,012,102	R 491,580,686	R 492,262,473	R 491,830,065
Contribution per annum	**R 271,249,362**	**R 274,180,070**	**R 281,665,857**	**R 281,992,022**	**R 282,383,124**	**R 282,135,076**
Variance from Base Case	**R 0**	**R 2,930,708**	**R 10,416,495**	**R 10,742,660**	**R 11,133,762**	**R 10,885,715**

Case No :	1	3	3	4	5	6
	Base Case Fines discarded	Fines beneficiated single spiral at RD 1.80	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0	300,000	163,500	148,500	153,500	150,500
Feed to Primary Spiral plant	0	300,000	300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0	0	0	180,660	0	
Feed to DMC plant	0	0	0	0	300,000	163,710
Discards	1,554,400	1,572,300	1,451,900	1,445,000	1,440,950	1,443,550
Tons per hour :						
Fines Product	0.0	55.6	30.3	27.5	28.4	27.9
Feed to Primary Spiral Plant	0.0	55.6	55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0	0.0	0.0	33.5	0.0	0.0
Feed to DMC Plant	0.0	0.0	0.0	0.0	55.6	30.3
Operating cost :						
Spiral beneficiation	R 0	R 231,000	R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0	R 0	R 0	R 0	R 834,000	R 455,114
Discard Disposal	R3,108,800	R3,144,600	R2,903,800	R2,890,000	R2,881,900	R2,887,100
Total	R3,108,800	R3,375,600	R3,134,800	R3,133,000	R3,715,900	R3,573,214
Net Contribution	R 268,140,562	R 270,804,470	R 278,531,057	R 278,859,022	R 278,667,224	R 278,561,862
Variance from Base Case	**R 0**	**R 2,663,908**	**R 10,390,495**	**R 10,718,460**	**R 10,526,662**	**R 10,421,301**
Capital cost :						
Spiral plant	R 0	R 1,355,556	R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0	R 0	R 0	R 0	R 3,166,667	R 1,728,050
Total	R 0	R 1,355,556	R 1,355,556	R 1,822,222	R 3,166,667	R 3,083,606
Net Present Value						
Contribution per annum	**R0**	**R2,663,908**	**R10,390,495**	**R10,718,460**	**R10,526,662**	**R10,421,301**
Capital Cost	**R0**	**R1,355,556**	**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,083,606**
Payback Period (years)	0.00	0.51	0.13	0.17	0.30	0.30
Return on Investment %		196.52	766.51	588.21	332.42	337.96
Net Present Value over 10 yrs	**R0**	**R11,054,535**	**R47,049,644**	**R48,110,834**	**R45,872,881**	**R45,465,104**
NPV Calc interest Rate **17** %						
Year						
1	R0	R2,276,844	R8,880,765	R9,161,077	R8,997,147	R8,907,095
2	R0	R1,946,021	R7,590,398	R7,829,980	R7,689,870	R7,612,901
3	R0	R1,663,266	R6,487,519	R6,692,291	R6,572,538	R6,506,753
4	R0	R1,421,595	R5,544,888	R5,719,907	R5,617,554	R5,561,328
5	R0	R1,215,038	R4,739,221	R4,888,809	R4,801,328	R4,753,272
6	R0	R1,038,494	R4,050,616	R4,178,469	R4,103,699	R4,062,625
7	R0	R887,602	R3,462,065	R3,571,341	R3,507,435	R3,472,329
8	R0	R758,634	R2,959,030	R3,052,428	R2,997,806	R2,967,803
9	R0	R648,405	R2,529,085	R2,608,913	R2,562,229	R2,536,584
10	R0	R554,192	R2,161,611	R2,229,840	R2,189,939	R2,168,020
	R0	R12,410,091	R48,405,199	R49,933,056	R49,039,548	R48,548,710
Initial Capital Outlay	R 0	-R 1,355,556	-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,083,606
Net Present Value	**R0**	**R11,054,535**	**R47,049,644**	**R48,110,834**	**R45,872,881**	**R45,465,104**

Fine Coal Beneficiation - Evaluation of Options

No. 5 Seam
Product Specification = 6200 kCals

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
		Cannot Achieve				
Tons ex Cyclone	66.96	Quality	65.46	65.99	65.96	65.99
Tons fines	0.00		3.27	2.97	3.07	3.01
Total	66.96		68.73	68.96	69.03	69.00
CV ex Cyclone	27.61		27.93	27.82	27.83	27.83
CV Fines	0.00		26.31	28.00	28.00	28.00
Combined MJ/kg AD	27.61		27.85	27.83	27.84	27.83
Moist ex Cyclone	8.82		8.82	8.82	8.82	8.82
Moist ex Fines	0.00		25.31	25.31	25.31	25.31
Combined	8.82		9.60	9.53	9.55	9.54
Combined - inherent moist	3.00		3.00	3.00	3.00	3.00
CV Kcals GAR	6200		6200	6200	6200	6200
FOB Price (R/t GAR)	R 132.00		R 132.00	R 132.00	R 132.00	R 132.00
Tons railed per annum	3561915		3687740	3697040	3701581	3699239
Railage + Port fees per annum	R 195,905,319		R 202,825,710	R 203,337,177	R 203,586,931	R 203,458,138
Revenue per annum	R 470,172,766		R 486,781,704	R 488,009,224	R 488,608,634	R 488,299,530
Contribution per annum	**R 274,267,447**		**R 283,955,994**	**R 284,672,047**	**R 285,021,703**	**R 284,841,393**
Variance from Base Case	**R 0**		**R 9,688,547**	**R 10,404,600**	**R 10,754,257**	**R 10,573,946**

Case No :	1		3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0		163,500	148,500	153,500	150,500
Feed to Primary Spiral plant	0		300,000	300,000	0	300,000
Feed to Secondary Spiral plant	0		0	180,660	0	
Feed to DMC plant	0		0	0	300,000	163,710
Discards	1,651,800		1,563,350	1,551,850	1,548,500	1,550,150
Tons per hour :						
Fines Product	0.0		30.3	27.5	28.4	27.9
Feed to Primary Spiral Plant	0.0		55.6	55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0		0.0	33.5	0.0	0.0
Feed to DMC Plant	0.0		0.0	0.0	55.6	30.3
Operating cost :						
Spiral beneficiation	R 0		R 231,000	R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0		R 0	R 0	R 834,000	R 455,114
Discard Disposal	R3,303,600		R3,126,700	R3,103,700	R3,097,000	R3,100,300
Total	R3,303,600		R3,357,700	R3,346,700	R3,931,000	R3,786,414
Net Contribution	R 270,963,847		R 280,598,294	R 281,325,347	R 281,090,703	R 281,054,979
Variance from Base Case	**R 0**		**R 9,634,447**	**R 10,361,500**	**R 10,126,857**	**R 10,091,132**
Capital cost :						
Spiral plant	R 0		R 1,355,556	R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0		R 0	R 0	R 3,166,667	R 1,728,050
Total	R 0		R 1,355,556	R 1,822,222	R 3,166,667	R 3,083,606
Net Present Value						
Contribution per annum	**R0**		**R9,634,447**	**R10,361,500**	**R10,126,857**	**R10,091,132**
Capital Cost	**R0**		**R1,355,556**	**R1,822,222**	**R3,166,667**	**R3,083,606**
Payback Period (years)	0.00		0.14	0.18	0.31	0.31
Return on Investment %			710.74	568.62	319.80	327.25
Net Present Value over 10 yrs	**R0**		**R43,527,515**	**R46,447,901**	**R44,010,344**	**R43,926,979**
NPV Calc interest Rate **17** %						
Year						
1	R0		R8,234,570	R8,855,983	R8,655,433	R8,624,899
2	R0		R7,038,094	R7,569,216	R7,397,806	R7,371,709
3	R0		R6,015,465	R6,469,416	R6,322,911	R6,300,606
4	R0		R5,141,423	R5,529,415	R5,404,197	R5,385,133
5	R0		R4,394,379	R4,725,996	R4,618,972	R4,602,678
6	R0		R3,755,879	R4,039,313	R3,947,839	R3,933,913
7	R0		R3,210,153	R3,452,404	R3,374,222	R3,362,319
8	R0		R2,743,721	R2,950,773	R2,883,950	R2,873,777
9	R0		R2,345,060	R2,522,028	R2,464,915	R2,456,219
10	R0		R2,004,325	R2,155,579	R2,106,765	R2,099,333
	R0		R44,883,071	R48,270,123	R47,177,011	R47,010,584
Initial Capital Outlay	R 0		-R 1,355,556	-R 1,822,222	-R 3,166,667	-R 3,083,606
Net Present Value	**R0**		**R43,527,515**	**R46,447,901**	**R44,010,344**	**R43,926,979**

Fine Coal Beneficiation - Evaluation of Options

Waterberg coal
Quality specification = 6000 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	26.96	Cannot achieve	Cannot achieve	25.41	24.70	24.46
Tons fines	0.00	Quality	Quality	1.76	2.45	2.69
Total	26.96			27.17	27.15	27.15
CV ex Cyclone	26.72			26.98	27.09	27.13
CV Fines	0.00			28.00	28.00	28.00
Combined MJ/kg AD	26.72			27.04	27.17	27.22
Moist ex Cyclone	8.76			8.79	8.80	8.80
Moist ex Fines	0.00			25.38	25.41	25.41
Combined	8.76			9.86	10.30	10.45
Combined - inherent moist	2.94			2.96	2.98	2.98
CV Kcals GAR	6000			6000	6000	6000
FOB Price (R/t GAR)	R 126.00			R 126.00	R 126.00	R 126.00
Tons railed per annum	1434146			1462467	1468056	1470668
Railage + Port fees per annum	R 78,878,005			R 80,435,688	R 80,743,054	R 80,886,749
Revenue per annum	R 180,702,338			R 184,270,848	R 184,974,995	R 185,304,189
Contribution per annum	**R 101,824,333**			**R 103,835,160**	**R 104,231,942**	**R 104,417,440**
Variance from Base Case	**R 0**			**R 2,010,827**	**R 2,407,609**	**R 2,593,106**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0			88,000	122,500	134,500
Feed to Primary Spiral plant	0			300,000	0	300,000
Feed to Secondary Spiral plant	0			135,000	0	
Feed to DMC plant	0			0	300,000	186,990
Discards	3,651,850			3,641,550	3,642,750	3,642,500
Tons per hour :						
Fines Product	0.0			16.3	22.7	24.9
Feed to Primary Spiral Plant	0.0			55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0			25.0	0.0	0.0
Feed to DMC Plant	0.0			0.0	55.6	34.6
Operating cost :						
Spiral beneficiation	R 0			R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0			R 0	R 834,000	R 519,832
Discard Disposal	R7,303,700			R7,283,100	R7,285,500	R7,285,000
Total	R7,303,700			R7,526,100	R8,119,500	R8,035,832
Net Contribution	R 94,520,633			R 96,309,060	R 96,112,442	R 96,381,607
Variance from Base Case	**R 0**			**R 1,788,427**	**R 1,591,809**	**R 1,860,974**
Capital cost :						
Spiral plant	R 0			R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0			R 0	R 3,166,667	R 1,973,783
Total	R 0			R 1,822,222	R 3,166,667	R 3,329,339
Net Present Value						
Contribution per annum	**R0**			**R1,788,427**	**R1,591,809**	**R1,860,974**
Capital Cost	**R0**			**R1,822,222**	**R3,166,667**	**R3,329,339**
Payback Period (years)	0.00			1.02	1.99	1.79
Return on Investment %				98.15	50.27	55.90
Net Present Value over 10 yrs	**R0**			**R6,509,350**	**R4,248,939**	**R5,340,202**
NPV Calc interest Rate **17** %						
Year						
1	R0			R1,528,570	R1,360,520	R1,590,576
2	R0			R1,306,470	R1,162,838	R1,359,467
3	R0			R1,116,641	R993,878	R1,161,937
4	R0			R954,394	R849,469	R993,109
5	R0			R815,722	R726,042	R848,811
6	R0			R697,198	R620,548	R725,480
7	R0			R595,896	R530,383	R620,068
8	R0			R509,312	R453,319	R529,973
9	R0			R435,310	R387,452	R452,968
10	R0			R372,060	R331,156	R387,152
	R0			R8,331,573	R7,415,605	R8,669,541
Initial Capital Outlay	R 0			-R 1,822,222	-R 3,166,667	-R 3,329,339
Net Present Value	**R0**			**R6,509,350**	**R4,248,939**	**R5,340,202**

Fine Coal Beneficiation - Evaluation of Options

Waterberg coal
Quality specification = 6100 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	24.17	Cannot achieve	Cannot achieve	21.93	20.96	20.60
	0.00	Quality	Quality	1.76	2.45	2.69
Total	24.17			23.69	23.41	23.29
CV ex Cyclone	27.17			27.50	27.66	27.72
CV Fines	0.00			28.00	28.00	28.00
Combined MJ/kg AD	27.17			27.54	27.69	27.75
Moist ex Cyclone	8.81			8.84	8.86	8.87
Moist ex Fines	0.00			25.33	25.34	25.35
Combined	8.81			10.07	10.58	10.77
Combined - inherent moist	2.99			3.03	3.04	3.05
CV Kcals GAR	6100			6100	6100	6100
FOB Price (R/t GAR)	R 129.00			R 129.00	R 129.00	R 129.00
Tons railed per annum	1285802			1276957	1269371	1265392
Railage + Port fees per annum	R 70,719,137			R 70,232,612	R 69,815,431	R 69,596,577
Revenue per annum	R 165,868,521			R 164,727,399	R 163,748,920	R 163,235,608
Contribution per annum	**R 95,149,384**			**R 94,494,787**	**R 93,933,489**	**R 93,639,031**
Variance from Base Case	**R 0**			**-R 654,597**	**-R 1,215,895**	**-R 1,510,353**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0			88,000	122,500	134,500
Feed to Primary Spiral plant	0			300,000	0	300,000
Feed to Secondary Spiral plant	0			135,000	0	
Feed to DMC plant	0			0	300,000	186,990
Discards	3,791,400			3,815,750	3,829,400	3,835,400
Tons per hour :						
Fines Product	0.0			16.3	22.7	24.9
Feed to Primary Spiral Plant	0.0			55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0			25.0	0.0	0.0
Feed to DMC Plant	0.0			0.0	55.6	34.6
Operating cost :						
Spiral beneficiation	R 0			R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0			R 0	R 834,000	R 519,832
Discard Disposal	R7,582,800			R7,631,500	R7,658,800	R7,670,800
Total	R7,582,800			R7,874,500	R8,492,800	R8,421,632
Net Contribution	R 87,566,584			R 86,620,287	R 85,440,689	R 85,217,399
Variance from Base Case	**R 0**			**-R 946,297**	**-R 2,125,895**	**-R 2,349,185**
Capital cost :						
Spiral plant	R 0			R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0			R 0	R 3,166,667	R 1,973,783
Total	R 0			R 1,822,222	R 3,166,667	R 3,329,339
Net Present Value						
Contribution per annum	**R0**			**(R946,297)**	**(R2,125,895)**	**(R2,349,185)**
Capital Cost	**R0**			**R1,822,222**	**R3,166,667**	**R3,329,339**
Payback Period (years)	0.00			-1.93	-1.49	-1.42
Return on Investment %				-51.93	-67.13	-70.56
Net Present Value over 10 yrs	**R0**			**(R6,230,647)**	**(R13,070,370)**	**(R14,273,262)**
NPV Calc interest Rate 17 %						
Year						
1	R0			(R808,801)	(R1,817,005)	(R2,007,851)
2	R0			(R691,283)	(R1,552,995)	(R1,716,112)
3	R0			(R590,840)	(R1,327,346)	(R1,466,762)
4	R0			(R504,992)	(R1,134,484)	(R1,253,643)
5	R0			(R431,617)	(R969,645)	(R1,071,490)
6	R0			(R368,903)	(R828,756)	(R915,803)
7	R0			(R315,302)	(R708,339)	(R782,738)
8	R0			(R269,489)	(R605,418)	(R669,007)
9	R0			(R230,332)	(R517,451)	(R571,800)
10	R0			(R196,865)	(R442,266)	(R488,718)
	R0			(R4,408,424)	(R9,903,704)	(R10,943,923)
Initial Capital Outlay	R 0			-R 1,822,222	-R 3,166,667	-R 3,329,339
Net Present Value	**R0**			**(R6,230,647)**	**(R13,070,370)**	**(R14,273,262)**

Fine Coal Beneficiation - Evaluation of Options

Waterberg coal
Quality specification = 6200 kCal

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Per 100 tons of FTP :						
Tons ex Cyclone	21.22	Cannot achieve Quality	Cannot achieve Quality	18.53 1.76	17.01 2.45	16.52 2.69
Total	21.22			20.29	19.46	19.21
CV ex Cyclone	27.61			28.06	28.30	28.39
CV Fines	0.00			28.00	28.00	28.00
Combined MJ/kg AD	27.61			28.05	28.26	28.33
Moist ex Cyclone	8.86			8.91	8.94	8.95
Moist ex Fines	0.00			25.38	25.41	25.41
Combined	8.86			10.34	11.01	11.26
Combined - inherent moist	3.04			3.09	3.12	3.13
CV Kcals GAR	6200			6200	6200	6200
FOB Price (R/t GAR)	R 132.00			R 132.00	R 132.00	R 132.00
Tons railed per annum	1128658			1096472	1059118	1048287
Railage + Port fees per annum	R 62,076,211			R 60,305,942	R 58,251,483	R 57,655,809
Revenue per annum	R 148,982,906			R 144,734,262	R 139,803,560	R 138,373,941
Contribution per annum	**R 86,906,695**			**R 84,428,319**	**R 81,552,076**	**R 80,718,132**
Variance from Base Case	**R 0**			**-R 2,478,376**	**-R 5,354,619**	**-R 6,188,563**

Case No :	1	2	3	4	5	6
	Base Case Fines discarded	Fines added raw	Fines beneficiated single spiral at RD 1.80	Fines beneficiated double spiral	Fines beneficiated DMC	Fines beneficiated spiral + DMC
Tons per annum :						
Fine Coal Product	0			88,000	122,500	134,500
Feed to Primary Spiral plant	0			300,000	0	300,000
Feed to Secondary Spiral plant	0			135,000	0	
Feed to DMC plant	0			0	300,000	186,990
Discards	3,939,100			3,985,500	4,027,150	4,039,600
Tons per hour :						
Fines Product	0.0			16.3	22.7	24.9
Feed to Primary Spiral Plant	0.0			55.6	0.0	55.6
Feed to Secondary Spiral plant	0.0			25.0	0.0	0.0
Feed to DMC Plant	0.0			0.0	55.6	34.6
Operating cost :						
Spiral beneficiation	R 0			R 243,000	R 0	R 231,000
Fines DMS beneficiation	R 0			R 0	R 834,000	R 519,832
Discard Disposal	R7,878,200			R7,971,000	R8,054,300	R8,079,200
Total	R7,878,200			R8,214,000	R8,888,300	R8,830,032
Net Contribution	R 79,028,495			R 76,214,319	R 72,663,776	R 71,888,100
Variance from Base Case	**R 0**			**-R 2,814,176**	**-R 6,364,719**	**-R 7,140,396**
Capital cost :						
Spiral plant	R 0			R 1,822,222	R 0	R 1,355,556
Fines DMS plant	R 0			R 0	R 3,166,667	R 1,973,783
Total	R 0			R 1,822,222	R 3,166,667	R 3,329,339
Net Present Value						
Contribution per annum	**R0**			**(R2,814,176)**	**(R6,364,719)**	**(R7,140,396)**
Capital Cost	**R0**			**R1,822,222**	**R3,166,667**	**R3,329,339**
Payback Period (years)	0.00			-0.65	-0.50	-0.47
Return on Investment %				-154.44	-200.99	-214.47
Net Present Value over 10 yrs	**R0**			**(R14,932,353)**	**(R32,817,370)**	**(R36,593,611)**
NPV Calc interest Rate **17** %						
Year						
1	R0			(R2,405,279)	(R5,439,931)	(R6,102,902)
2	R0			(R2,055,794)	(R4,649,513)	(R5,216,156)
3	R0			(R1,757,089)	(R3,973,943)	(R4,458,253)
4	R0			(R1,501,785)	(R3,396,533)	(R3,810,472)
5	R0			(R1,283,577)	(R2,903,019)	(R3,256,814)
6	R0			(R1,097,074)	(R2,481,213)	(R2,783,602)
7	R0			(R937,670)	(R2,120,695)	(R2,379,147)
8	R0			(R801,428)	(R1,812,560)	(R2,033,459)
9	R0			(R684,981)	(R1,549,196)	(R1,737,999)
10	R0			(R585,454)	(R1,324,099)	(R1,485,469)
	R0			(R13,110,130)	(R29,650,703)	(R33,264,272)
Initial Capital Outlay	R 0			-R 1,822,222	-R 3,166,667	-R 3,329,339
Net Present Value	**R0**			**(R14,932,353)**	**(R32,817,370)**	**(R36,593,611)**