File Number: 20/2/E100-02/C/1/4

CLANWILLIAM DAM
FEASIBILITY DESIGN OF RAISING

MAY 2006

Directorate: Civil Design

the dwaf

Sub-directorate: Dam Safety Surveillance Private Bag X313 PRETORIA 0001 South Africa

Title:	Feasibility Design of Raising
Project name:	Feasibility Study for the Raising of the Clanwilliam Dam in the Western Cape
Designed by:	A Bester, J Brink, J Beukes, W Ramokopa
DWAF report number:	20/2/E100-02/C/1/1
Report status:	Final
Date:	August 2006
Keywords:	Clanwilliam Dam; Olifants River; Design; Raising

2006-08-29

JA Brink Date

Design Coordinator and Author

Senior Engineer: Civil Design (Dam Safety Surveillance)

C Oosthuizen Pr Eng Date

Director: Civil Design 2006-08-29

ACKNOWLEDGEMENTS

The following persons are thanked for their valued contributions:

Dr Chris Oosthuizen, who assisted with the design and edited this report;

Mr Harry Swart, Contract Manger: Construction (South), who compiled the preliminary site layout.

Mr Gary Davis from the Council for Geosciences, who provided input on the geology and materials

Dr André Bester, for his contribution as initial design project leader and support in the compilation of the report.

EXECUTIVE SUMMARY

Clanwilliam Dam is located on the Olifants River (Van Rhynsdorp), approximately 2 km from the town of Clanwilliam in the Western Cape.

The dam was originally built in 1935 to augment the supply of Bulshoek Dam to the irrigation farms in the Klawer and Trawal areas. In 1969 the dam was raised by 6 m to its current level. The current capacity of the dam is 123,7 x 10^6 m^3 and its full supply is at reduced level (RL) 105,25 m. Water from the dam is currently used for irrigation and domestic supply to the Cedarberg Municipality.

Dam safety evaluations of the structure revealed three aspects that have a detrimental effect on the integrity of the structure:

- The quartzitic sandstone foundation is highly fractured and has a low modulus of elasticity.
- The effectiveness of the prestress cables used in the 1969 raising is doubted.
- Alkali-siliceous reaction (ASR) and/or sulphate attack in the concrete was identified.

It was concluded that remedial works should be done to ensure the safety of the dam.

Major construction works would be required for the rehabilitation. This would provide an opportunity to also raise the dam and thereby increase its yield. The increased yield can provide additional water to the agricultural community, thereby stimulating the local economy.

Increased environmental awareness and legislation prompted the evaluation of the impact of the dam on the downstream river. The evaluation revealed that more water should be allowed for environmental releases. This would require an increase in storage and larger discharge capacity from the outlet works.

A feasibility design was conducted by the Department: Water Affairs and Forestry (DWAF) Civil Design: Dam Safety Surveillance to determine feasible raising options for the dam and determine costs and flood levels. This report provides the results of the design. A number of spillway configurations were investigated and an outlet works configuration is proposed.

Costs were calculated for the various raising options. The values can be interpolated to provide reasonable cost estimations for any raising level between 0 m and 15 m.

TABLE OF CONTENTS

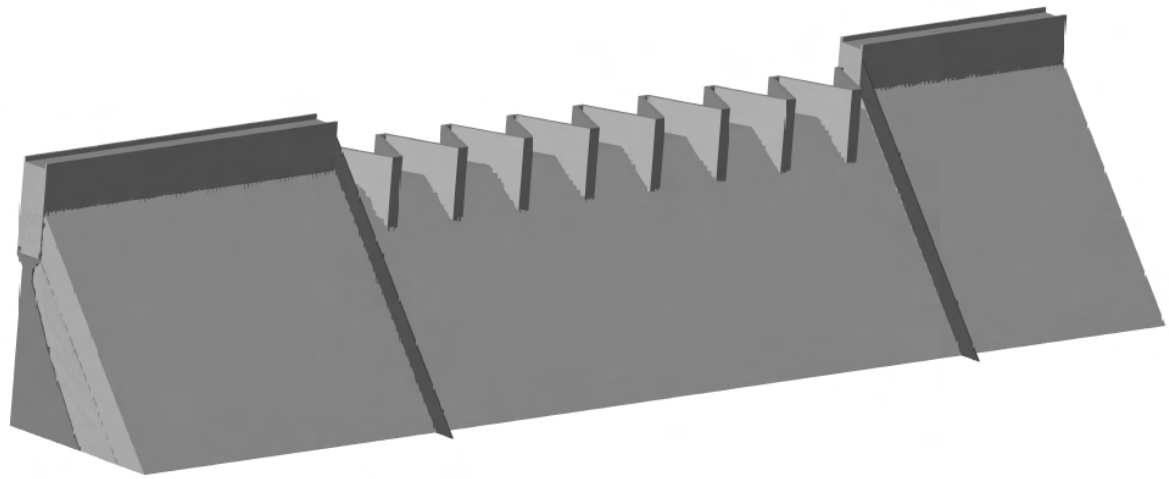


Figure 1-1: Extended length labyrinth spillway

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AAR ..... ALKALI-AGGREGATE REACTION
ASR ..... ALKALI-SILICATE REACTION
BOQ ..... BILL OFF QUANTITIES
EFR ..... ENVIRONMENTAL FLOW REQUIREMENTS
FBD ..... FLAG BOSHIELO DAM
FOS ..... FACTOR OF SAFETY
FSL ..... FULL SUPPLY LEVEL
h:v ..... NON-OVERSPILL CREST
NOC ..... NON-OVERSPILL CREST
PGA ..... PEAK GROUND ACCELERATION
RCC ..... ROLLER COMPACTED CONCRETE
RDF ..... RECOMMENDED DESIGN FLOOD
RL ..... REDUCED LEVEL
SEF ..... SAFETY EVALUATION FLOOD
ϕ ..... NOMINAL DIAMETER

1. INTRODUCTION

1.1 LOCATION

Clanwilliam Dam is located in the Olifants River (Van Rhynsdorp), approximately 2 km from the town of Clanwilliam in the Western Cape. Its co-ordinates are 32°11'05" S and 18°52'30" E.

1.2 HISTORY OF THE DAM

The Olifants River in the vicinity of Clanwilliam was first dammed with the construction of Bulshoek Dam in 1914-23. The main purpose of the dam was to supply irrigation water to the farms around Klawer and Trawal. The capacity of the dam proved to be inadequate to supply water during longer dry periods.

Clanwilliam Dam was constructed in 1935 to augment the supply from Bulshoek. The yield was still insufficient. The dam was raised by 6 m to its current level in 1969 and the vertical crest gates were added. Post-tensioned prestress cables were installed on the upstream side of the spillway to improve stability.

1.3 EXISTING STRUCTURE

Clanwilliam Dam is a concrete gravity dam with a non-overspill crest (NOC) length of approximately 250 m.

The spillway section is 117,5 m long and has an approximated ogee shape. Spillway discharge is controlled with 13 vertical spillway gates. The gates are used to provide additional storage above the spillway invert level. Piers support the gates and deck over the spillway, resulting in an effective spillway length of 101 m (ignoring contraction losses.)

The full supply level (FSL) of the dam is at RL 105,25 m and the crest of the ogee at RL 102,20 m.

Two outlet pipes of nominal diameter (ϕ) 1 219 mm discharge into the river. Their inlets are at RL 80,51 m. Discharge is controlled with sleeve valves. The maximum discharge capacity is approximately 10 m^3/s.

An additional outlet pipe delivers water to the (currently dysfunctional) hydropower plant and the irrigation canal on the downstream right flank.

1.4 DAM SAFETY REQUIREMENTS

Three five-yearly dam safety inspection reports in terms of Government Notice R1560 of 1986 have been compiled for Clanwilliam Dam. The reports were by Van der Spuy (1992, [14]), Van der Spuy and Kramer (2000, [18]) and Bester (2005, [2]).

The inspections highlighted three aspects that have a detrimental effect on the integrity of the structure:

- The quartzitic sandstone foundation is highly fractured and has a low modulus of elasticity.
- The effectiveness of the prestress cables used in the 1969 raising is doubted.
- Alkali-siliceous reaction (ASR) and/or sulphate attack in the concrete was identified.

Analyses incorporating these factors indicated that the stability of the structure under extreme floods is not adequate. It was concluded that remedial works should be done to ensure the safety of the dam.

1.5 PURPOSE OF THIS REPORT

Based on the dam safety requirements of the structure and the need for increased assured yield, a process was started to investigate the extent of a rehabilitation and possible raising project on the dam. DWAF Civil Design did preliminary designs of a number of possible remedial works and raising options.

Four raising options were considered. Their full supply levels and storage volumes are presented in Table 1-1.

Table 1-1: Raising options considered

Raising Option	FSL (RL)	Volume ($x10^6$ m^3)
0 m Raising	105,25	124
5 m Raising	110,25	186
10 m Raising	115,25	275
15 m Raising	120,25	335

Costs were calculated from the design results.

This report outlines the design philosophy and presents the results of the calculations.

2. DESIGN PHILOSOPHY

The design philosophy expresses the *strategic* functional and performance objectives that the designers addressed during the conceptual phase of the design process. The projected milieu in which the structure is expected to function should be matched with the outcomes expected by the stakeholders.

The design philosophy developed for the remedial works and/or proposed raising of Clanwilliam Dam was strongly influenced by experience gained through recent design pro-

jects and evaluation of existing South African dams. The following aspects were identified as important considerations:

- *Long-term structural reliability*: This implies the elimination of any structural components that deteriorate significantly or unpredictably with time. The use of (unreliable) stressed cables to ensure the stability of the raised concrete gravity section was therefore not considered.
- *Minimal operational requirements / predictable operation*: This implies that the "operational intelligence" should be "built in" and that the structure should deal safely and predictably with normal and extreme events without the intervention of an operator being required.
- *Minimal maintenance requirements*: This implies that the spillway and NOC should have no *regular* or "built in" maintenance requirements. Only the inlet / outlet works can be expected to require regular maintenance.
- *The budget of the sponsor*: In the event of a raising of more than the minimum required for dam safety and environmental purposes, the additional cost will be financed by the water users. The total cost of the raising should be acceptable to the sponsor, given the sponsor's need to keep risk to a practical minimum.

Based on the considerations listed, the design philosophy adopted for the feasibility design can be described as follows:

- A *robust* and *durable* solution to the raising problem has to be sought
- The *total cost* of the raising (including construction, operational, maintenance, environmental and risk costs) has to be considered, as opposed to considering only (initial) construction costs.

3. HYDROLOGY

A flood frequency analysis for Clanwilliam Dam was conducted by the Directorate Hydrological Service, DWAF (Kotzé, 2005 [1]). The report was compiled for the five-yearly dam safety evaluation and is assumed to be adequate for this design. The recommended flood peaks are reflected in Table 3-1.

Table 3-1: Recommended flood peaks for the critical storm duration of 28 hours (Kotzé, 2005)

Exceedance Probability (%)							RMF
50	20	10	5	2	1	0,5	
Proposed Flood Peaks (m^3/s)							
315	575	795	995	1 265	1 480	1 705	2 920

Further calculations, based on the SANCOLD Guidelines (SANCOLD, 1991 [12]), were done by using the method described by Kovacs (1988, [11]) and adjusting the K-factor one value higher. The calculations are shown in Table 3-2.

Table 3-2: SEF Flood

Area:	2 015,00	(km^2)
Flood Peak Region:	4,60	
Region +1	5,00	
Formula	$Q = 100xA_e^{0,50}$	
Flood	4 488,88	(m^3/s)

For the purposes of this report the 1:200 year flood of 1 705 m^3/s was used as the recommended design flood (RDF). The safety evaluation flood (SEF) was assumed to be 4 500 m^3/s, as calculated in Table 3-2.

4. GEOTECHNICAL ASPECTS

Clanwilliam Dam is founded on quartzitic sandstone of the Nardouw Formation, Table Mountain Group with minor, mostly discontinuous, interbedded shale bands.

The level of geological information on the dam is considered adequate. The dam was visited by geologists both prior to and during construction (Du Toit, 1930 [6] and Frommurze, 1933 [7]). No exploratory drilling was done at the time.

Four geological investigations for the purpose of dam safety evaluations were conducted by Geertsema (1988 [8]), Dick (1990 [5]), Botha (1993 [3]) and Davis (2004 [4]), respectively. These investigations found that the foundation is generally safe. Some findings are discussed below.

Geological and geotechnical investigations for the design of the raising of the dam is underway, but was not yet available for the purposes of this report.

4.1 ALKALI-AGGREGATE REACTION

Alkali-aggregate Reaction (AAR) was identified on the surface of the original structure.

"*The reaction between alkalis and certain mineral constituents in some aggregates may result in expansion within concrete and consequent cracking and distress of elements made with it. Concrete affected in this way becomes unsightly and its engineering properties tend to deteriorate.* " (Addis, 2001 [1])

AAR is very common in aggregates from the Table Mountain Group quartzitic sandstone. The original dam was constructed prior to the recognition of the problem in South Africa and preventative measures would not have been taken.

Concrete cores drilled for instrumentation purposes were retained and further investigated for signs of AAR (Botha, 1993 [3]). An ill-defined white reaction rim was identified around coarse aggregate in the cores and some air voids contained a white powder reaction product lining. These provide evidence that AAR might occur. However, micro-cracks filled with expansive reaction products were not found. Botha concluded that equilibrium of the reaction processes might have been reached. He further concluded that the influence of AAR is not significant enough to cause deterioration of the concrete.

For the purpose of this design it was assumed that AAR does not lower the engineering properties of the concrete significantly. The material properties assumed in the stability calculations of the structure are accepted as sufficiently conservative.

For the purposes of the detail design it is recommended that the downstream surface of the spillway be investigated and cores be obtained to compare to existing results.

It is further recommended that suitable tests to determine the potential for AAR in the aggregate for the raising be done. Low-alkali cement (% Na_2O_e < 0,6) and/or the use of

cement extenders or chemical admixtures may be required in the mix design for the concrete.

4.2 STABILITY

The left flank and the river section are stable against sliding because the strata are keyed in in the direction of downstream thrust from the wall. The upper right flank contains a potentially unfavourable siltstone band which could contribute to a failure surface (Dick, 1990 [5]). The siltstone band might require some foundation improvements, but it is not expected to have a major influence on the design of the structure.

4.3 SEEPAGE

Only one leak, approximately 200 m downstream on the left flank, is currently visible. The leakage path is probably through an intersection of an open bedding plane with a major sub-vertical joint (Dick, 1990 [5]). Dick concluded that the plane and joint are both in hard, non-erodable rock.

Recent experience at Bulshoek Dam, which is built on similar foundations, indicated that erosion of the material in the bedding planes might result in a loss of shear resistance in the foundation and the formation of cavities or voids. Initial drilling results from the current investigations indicate no cavities and suggest that the foundation is sound (Davis, 2004 [4]).

Foundation grouting should be done to provide for the additional pressure head behind the dam and to ensure adequate shear resistance of the foundation. Dowling might also be required.

4.4 EROSION

The rock in the valley downstream of the spillway is mostly resistant to scour erosion. Major undercutting of the structure is not regarded as a serious threat (Dick, 1990 [5]). A form of apron is recommended. It will serve as both an energy dissipating structure for the spillway and additional shear resistance for the structure on the foundation.

4.5 SEISMICITY

Davis (2004, [4]) reported a Peak Ground Acceleration (PGA) of approximately 0,1g, with a 10% probability of being exceeded in a 50-year period. This is considered a moderate seismic hazard level.

For the purpose of stability analyses, 0,075g, 0,15g and 0,30g were accepted as seismic loads for the service, abnormal and extreme loads, respectively. (See Chapter 6.2)

5. MATERIAL

Preliminary results from geotechnical investigations indicate that adequate aggregate is available for the proposed raising by roller compacted concrete (RCC). RCC is the pre-

ferred material mainly due to the rapid tempo at which it can be placed, resulting in shorter construction periods and its relatively low heat of hydration.

For the purposes of this report the design was based on the use of RCC. The eventual choice of spillway type and construction programme may dictate the use of mass concrete.

6. DESIGN OPTIONS

Four raising options for the dam were evaluated. Based on the design philosophy (see Chapter 2), all raisings of the spillway are solid raisings with the full supply level at the crest of the spillway.

No flood gates or other mechanically or electrically operated equipment was considered. Such apparatus may jeopardize the flood release capacity when malfunctioning. The existing bridge deck over the spillway will be removed, as it is not required to support any gate operating equipment.

The “0 m raising” maintains the current full supply level (FSL) at RL 105,25 m. Three raisings above the FSL was designed at 5,0 m vertical intervals, i.e. 110,25 m, 115,25 m and 120,25 m. The storage volumes for the various options are presented in Table 1-1.

6.1 DESIGN PARAMETERS

A comprehensive list of parameters required for the static analysis of the structure was compiled.

The site parameters prescribe the material properties of the existing and raised dam, as well as the loads exerted on the structure.

The loading conditions prescribe the different load combinations. The loads are divided into three categories, namely Normal, Abnormal and Extreme conditions.

The design parameters are attached as Appendix A.

6.2 STRUCTURAL STABILITY

The stability of the structure was evaluated for the different raising options based on the traditional thin beam theory.

The parameters used in the analyses are given in Appendix A. The water levels used in the calculations were obtained from the results of the hydraulics calculation, as explained in paragraph 6.3. Only the water levels from the existing length ogee spillway were used. These values were the highest and thus provided the most conservative results.

The most important value required from the stability analysis was the downstream slope required to provide adequate factors of safety (FOS) against shear and over turning. The extreme values of compression and tension in the concrete also had to be within the pre-

scribed limits. The downstream slope governs the volume of material required to raise the dam and therefore has a major influence of the cost of the project.

It was calculated that a downstream slope of 0,8:1 horizontal : vertical (h:v) will ensure a stable structure. All volume calculations were based on this value.

6.3 SPILLWAY

At each FSL an ogee and a labyrinth spillway option were investigated. For the three raisings above 105,25 m the option of lengthening the spillway by 21,35 m was also considered.

6.3.1 OGEE SPILLWAY

A standard ogee profile was designed based on the method of the USBR (1987, [14]). The 1:200-year flood of 1 705 m^3/s was used as the design flood. Figure 6-1 shows the ogee crest and Figure 6-2 a section through the 10 m raising option with the existing spillway in dark colour. A flood routing was done using a spreadsheet compiled by Dr A Bester of DWAF for all the ogee options. The flood routing determined the various flood levels associated with each raising option for both the existing and lengthened spillway. The results are summarised in Table 6-1.

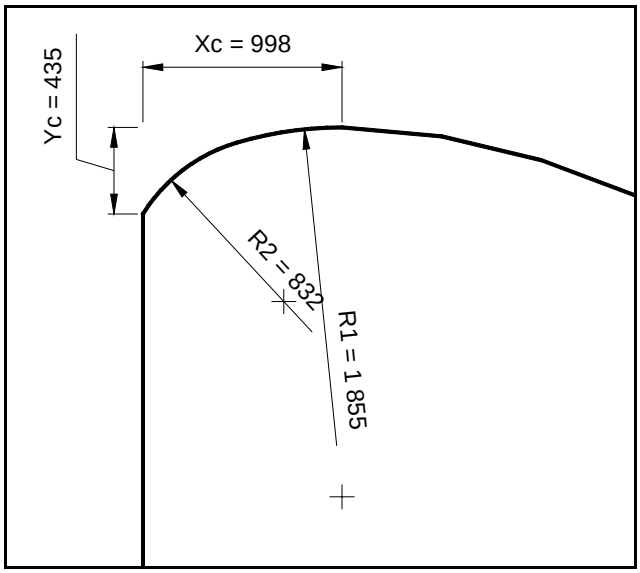


Figure 6-1: Ogee shape for 1 705 m^3/s design flood

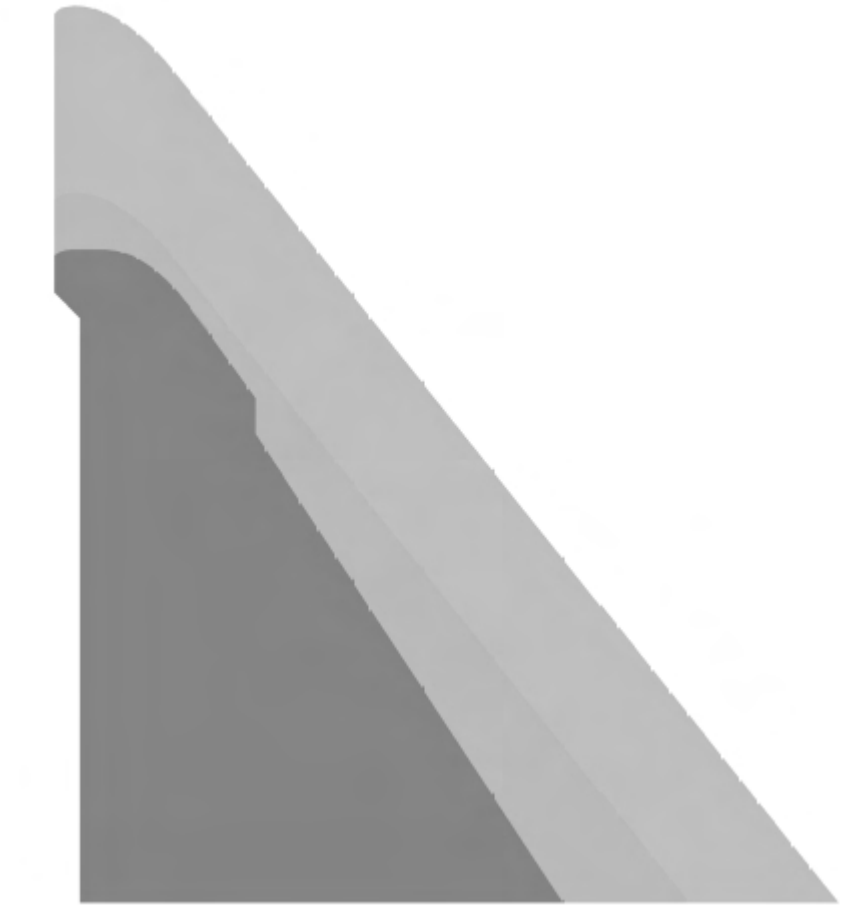


Figure 6-2: Section through ogee spillway for 10 m raising

6.3.2 LABYRINTH SPILLWAY

A similar flood routing to the ogee was conducted for the various labyrinth raising options. The spreadsheet, also compiled by Dr Bester, is based on the method developed by Tullis et al (1995, [14]). The method allows the optimisation of the labyrinth to minimise the flow depth over the spillway. The results of the designs are included in Table 6-1. Figure 6-3 shows a section through the labyrinth spillway of the 10 m raising.

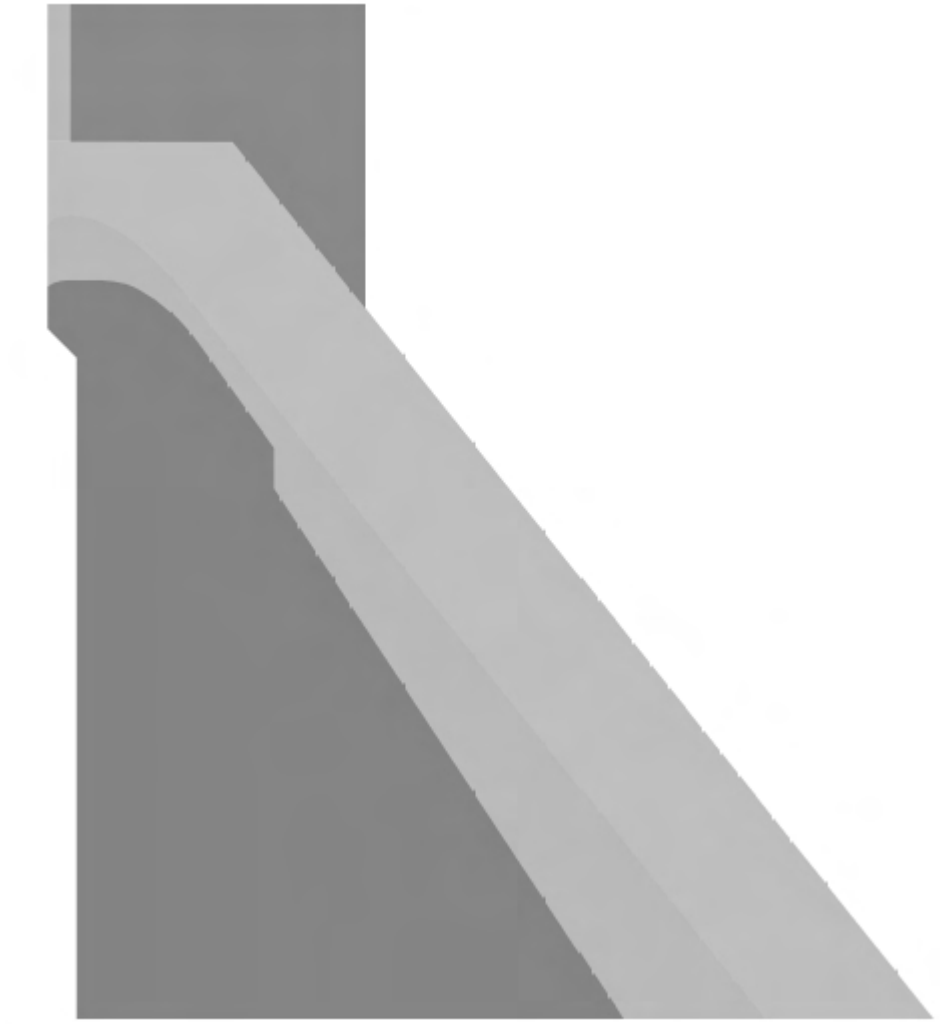


Figure 6-3: Section through labyrinth spillway

6.3.3 OTHER OPTIONS

A number of other options were considered, but not evaluated. These options may well be considered for the final design:

- A side-channel spillway can be constructed against the left flank, at a higher level than the service spillway. This could provide for additional spillway length to cater for abnormal floods. A return channel to the natural river would have to be constructed. It would probably be an expensive option.
- Extreme floods could be allowed to overtop the NOC during abnormal floods. This will result in some saving on concrete volumes and lower flood levels. To protect the outlet works, overtopping would probably only be allowed over the left NOC. Some kind of return channel would be required against the toe of the NOC.

Table 6-1: Summary of spillway flood levels

Raising Option	Length	Crest	FSL (RL)	Max Stage (m)	Max Water Level (RL)
0 m Raising	Exist. Width	Ogee	105,25	6,13	111,38
		Labyrinth	105,25	5,25	110,50
5 m Raising	Exist. Width	Ogee	110,25	6,04	116,29
		Labyrinth	110,25	5,19	115,44
	Extended	Ogee	110,25	5,63	115,88
		Labyrinth	110,25	4,52	114,77
10 m Raising	Exist. Width	Ogee	115,25	5,94	121,19
		Labyrinth	115,25	4,94	120,19
	Extended	Ogee	115,25	5,48	120,73
		Labyrinth	115,25	4,43	119,68
15 m Raising	Exist. Width	Ogee	120,25	5,83	126,08
		Labyrinth	120,25	4,83	125,08
	Extended	Ogee	120,25	5,39	125,64
		Labyrinth	120,25	4,35	124,60

6.4 NON-OVERSPILL CRESTS

For the purpose of this report the NOC's were raised vertically and waterproof concrete balustrades or parapet walls were added, thus adding to the storage height of the structure. Both the left and right NOC's were assumed to be 4,5 m wide. The crest levels of the NOC's were assumed to be at the maximum water levels as given in Table 6-1. This means that a 0 m freeboard is accepted during the SEF. Figure 6-4 shows a section through the non-overspill crest of the 10 m raising.

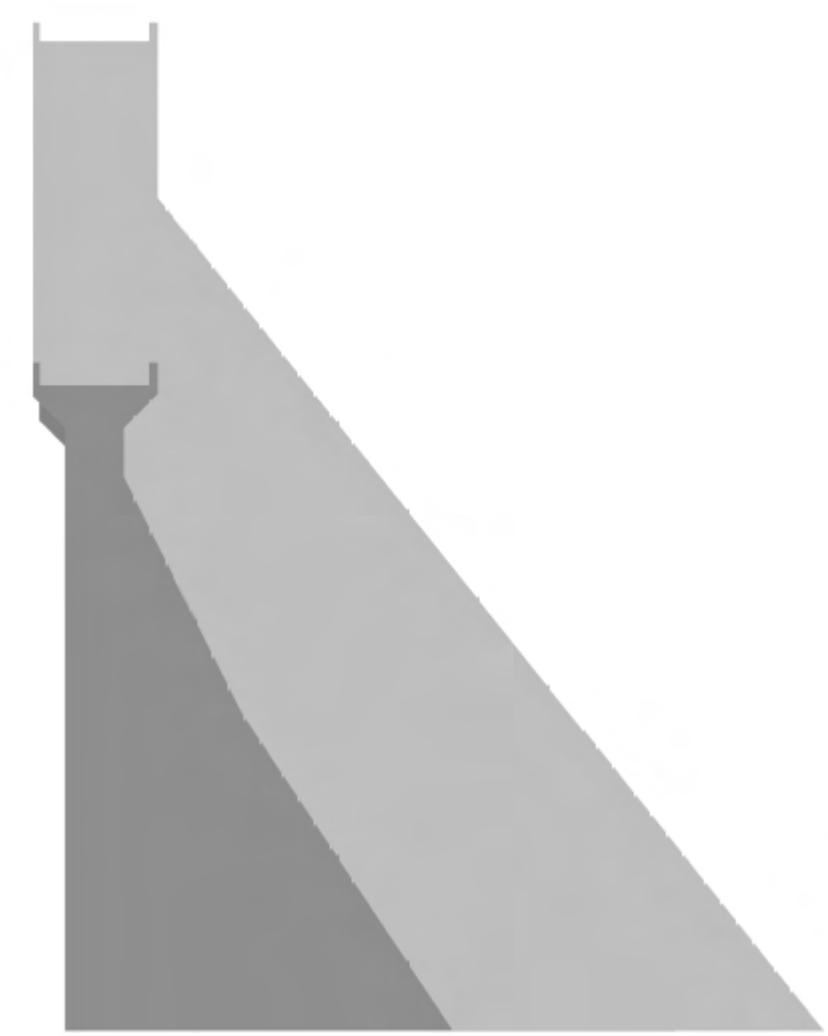


Figure 6-4: NOC of the 10 m Raising option

6.5 OUTLET WORKS

The design of the outlet works for the raising will mainly be influenced by environmental requirements and the cost to comply with such requirements. The current outlet works at the dam draws water from only one level. Aquatic life in the downstream river requires regular flooding of a minimum flow rate and at specific temperatures. To comply with this, water should be drawn from different levels in the dam and be released through adequately sized outlet pipes and valves. Multiple-level drawn down from the dam will also reduce stratification in the dam.

For the purpose of this report a conceptual design of the (possible) outlet works have been done with the following objectives:

- Identify practical possibilities and constraints in the provision of outlet works for the raised dam.
- Provide a cost estimate for the outlet works for the various raising options.

The environmental and social requirements relating to the design of the outlet works for the raised dam is not part of this study will not be detailed here-in.

6.5.1 DESIGN CONSIDERATIONS

The following will impact on the design of the outlet works for the raised dam:

- Use of water currently extracted from the dam
- Environmental flow requirements (EFR's)
- Operation and maintenance requirements
- Cost
- Vehicular and other access
- Position of gallery
- Aesthetics
- Future off-take demands (Domestic, agricultural and other)

6.5.2 INFORMATION REQUIRED

The following information would be required for a detailed design of the new outlet works.

- A detailed survey of the existing outlet works, particularly with relation to the existing dam wall.
- Final EFR's.

6.5.3 ENVIRONMENTAL FLOW REQUIREMENTS

The preliminary flow requirements are shown Table 6-2.

The class denotes the level of environmental importance of the downstream river section under consideration. The flows are the required maximum outlet capacity.

Table 6-2: Flow Requirements

Class	m^3/s
I	9
II	20
III	36
IV	85

A 'Class III' (and less) requirement is considered achievable at reasonable cost. The cost of complying with a 'Class IV' requirement is not impossible, but will have significant cost

implications. The cost of complying with the 'Class IV' requirement is estimated at 3 times that of the "Class III' requirement.

6.5.4 EXISTING OUTLET WORKS

The existing outlet works comprise of two ϕ 1219 mm pipes (RL 79,55) and two ϕ 914 mm pipes (RL 81,99). Both 1219 mm pipes are located within the spillway section, the one being just left of the existing outlet chamber and the other towards the middle of the spillway. These (ϕ 1219 mm) pipes are used for releases to the river. Water is discharged by means of two 914 mm sleeve valves, with a combined maximum capacity of 22 m^3/s (Van der Spuy, 2000 [18]).

The ϕ 914 mm pipes exits the dam wall in the outlet chamber, where flow through these pipes is controlled. One pipe is used for water supply to the Clanwilliam Irrigation Board while the other supplies water to a (privately owned and currently dysfunctional) hydro-electric turbine.

6.5.5 NEW OUTLET WORKS

(Note: All diameters given are nominal)

The new outlet works will comprise of a combination of ϕ 1200 mm pipes and ϕ 900 mm pipes. The ϕ 900 mm pipes will be used to extend the existing ϕ 914 mm pipes. All other pipes will have a diameter of 1200 mm. Discharging shall be done by means of 900 mm sleeve valves (for the ϕ 1200 mm pipes) and 600 mm sleeve valves (for the ϕ 900 mm pipes). The combination and quantity of valves shall depend on the required discharge capacity of the outlet works.

Smaller sleeve valves (than the pipe diameter) are chosen for better control of flow through these valves and to have a "throttle" effect on flow through the butterfly valves. High flow velocities through the butterfly valves may lead to cavitation and the velocity need to be limited by use of the sleeve valves. For preliminary design purposes the flow velocities through the butterfly valves have been limited to 5 m/s.

For a required discharge capacity greater than 12 m^3/s, it would be preferable to retain and extend the existing pipes in the spillway section. For smaller flows, discarding of the existing pipes might be considered.

Drawings of the proposed outlet works are attached as Appendix B.

6.5.6 COST

The cost of the outlet works are predominantly influenced by the required outlet capacity and whether a multi-level inlet system is used or not. The costs for the different raising options, using a multi-level inlet system, are not expected to vary with more than 15 % of the total cost of the outlet works.

For a discharge capacity of 30 m^3/s for instance, the cost between 0 m raising and a 15 m raising varies between R 16,6 million and 17,9 million (Includes cutting through existing wall, but excludes other civil works).

Figure 6-5 shows the expected costs of the mechanical works and cutting through the existing wall for various discharge capacities. Costs are for a multi-level intake system (3 or more levels). The values used for the figure are not presented here, but are displayed in Appendix C.

For cost estimates it was assumed that all valves will be new.

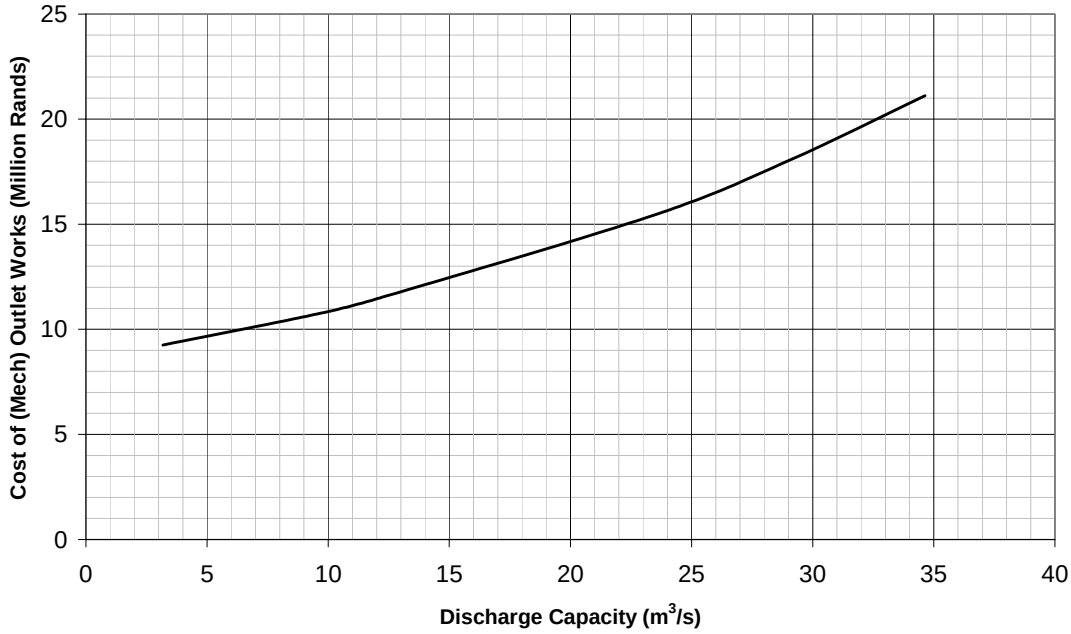


Figure 6-5: Cost of mechanical components of outlet works

7. CONSTRUCTION

7.1 SITE LAYOUT

A provisional site layout for the project was compiled by DWAF Construction (South). Two options for the stockpile and batching plant location were identified.

A sketch and notes are attached as Appendix D.

It should be noted that all haul and access roads between the various parts of the site are not indicated on the sketch. The layout of the roads will be determined when the final positions of the areas are established.

The area of the quarry was substantially enlarged by the engineer, based on the preliminary geological drilling results. The whole area will not be excavated, but provision is made for the crusher plant and rehabilitation of the quarry.

7.2 PROGRAMME

The estimated construction times for the various raising options are given in Table 7-1. The durations all include 6 months for site establishment at the start and 3 months for site rehabilitation at the end of the project.

Table 7-1: Construction duration

0 m Raising	24 Months
5 m Raising	30 Months
10 m Raising	36 Months
15 m Raising	42 Months

8. BILL OF QUANTITIES AND COSTS

A bill of quantities (BoQ) was compiled for each raising option. Items to include in the list were chosen based on experience with similar projects. Volume calculations were done for items that contribute more than 90% of the project cost.

DWAF Construction unit rates were used and inflated to April 2006 values, based on the construction inflation figures calculated by Stats SA. A summary of the costs is given in Table 8-1 and presented graphically in Figure 8-1.

The calculated values include estimates for the professional fees, access roads, instrumentation the mechanical components that were not included in the previous estimate (Van Veelen, 2003 [19]).

For the purposes of a feasibility design, a probable error of 25 to 40% in calculated costs can be accepted (Yeo, 1990 [20]).

Table 8-1: Cost per raising option

Option	Variation		Cost
0m Raising	Exist Width	Ogee	R 165 933 000
		Labyrinth	R 185 598 000
5m Raising	Exist Width	Ogee	R 212 627 000
		Labyrinth	R 230 936 000
	Extended	Ogee	R 226 944 000
		Labyrinth	R 237 880 000
10m Raising	Exist Width	Ogee	R 266 390 000
		Labyrinth	R 279 095 000
	Extended	Ogee	R 276 804 000
		Labyrinth	R 288 489 000
15m Raising	Exist Width	Ogee	R 343 706 000
		Labyrinth	R 344 152 000

Option	Variation		Cost
	Extended	Ogee	R 342 545 000
		Labyrinth	R 353 783 000

As expected, the costs of the labyrinth options are higher than the ogee options. This is due to the larger volumes of reinforcing steel to be used. It is also interesting to note that, for the 15 m raising, the cost of the existing length ogee and labyrinth and lengthened labyrinth are very similar. The volume of concrete required for the NOC's of the existing length ogee become very large due to the high discharge head over the spillway. This causes a more rapid increase in cost than for the other options.

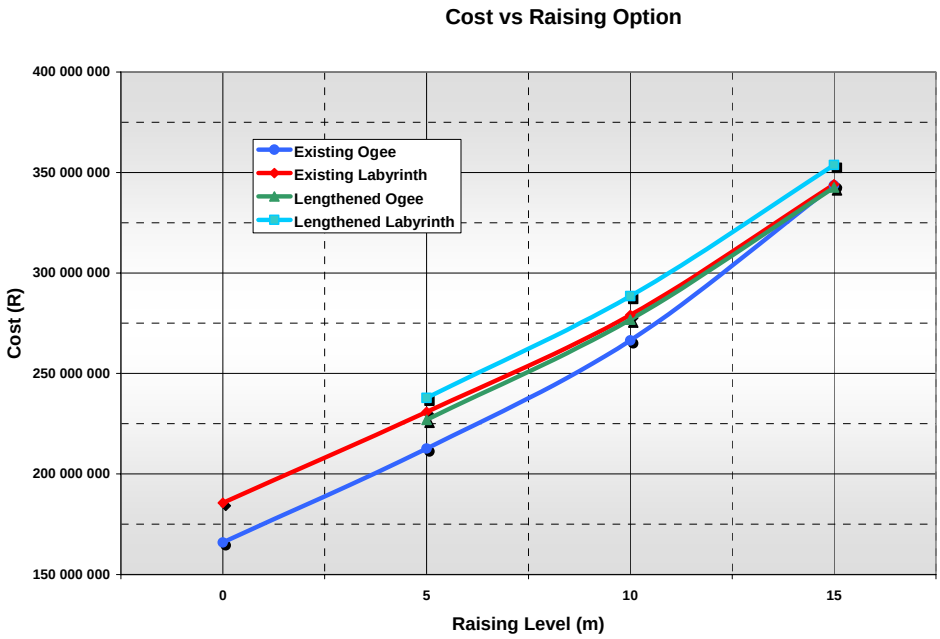


Figure 8-1: Graphical presentation of costs

9. CONCLUSIONS

Various options for the rehabilitation and possible raising of Clanwilliam Dam were investigated. A number of viable options were analysed and designed to an acceptable level of detail for the purposes of a feasibility study.

The options varied mainly in the configuration of the spillway. An ogee and labyrinth spillway was designed for two spillway lengths and at four possible full supply levels. A proposed outlet works configuration was also designed.

Volumes and quantities were calculated to estimate costs of the various raising options. These values are presented in tabular and graphical form in this report. The values can be interpolated to estimate the cost of any intermittent raising level.

Cost calculations indicated that for all the raising options the lowest construction costs will be achieved by constructing an ogee spillway of the same length as the existing spillway. For the 15 m raising all the options will cost more or less the same. Only the lengthened labyrinth option will be significantly more expensive.

The construction costs should be weighed against the total cost of the project, as the savings of the cheaper options will probably be cancelled out by the increased cost of land expropriation and relocation of infrastructure.

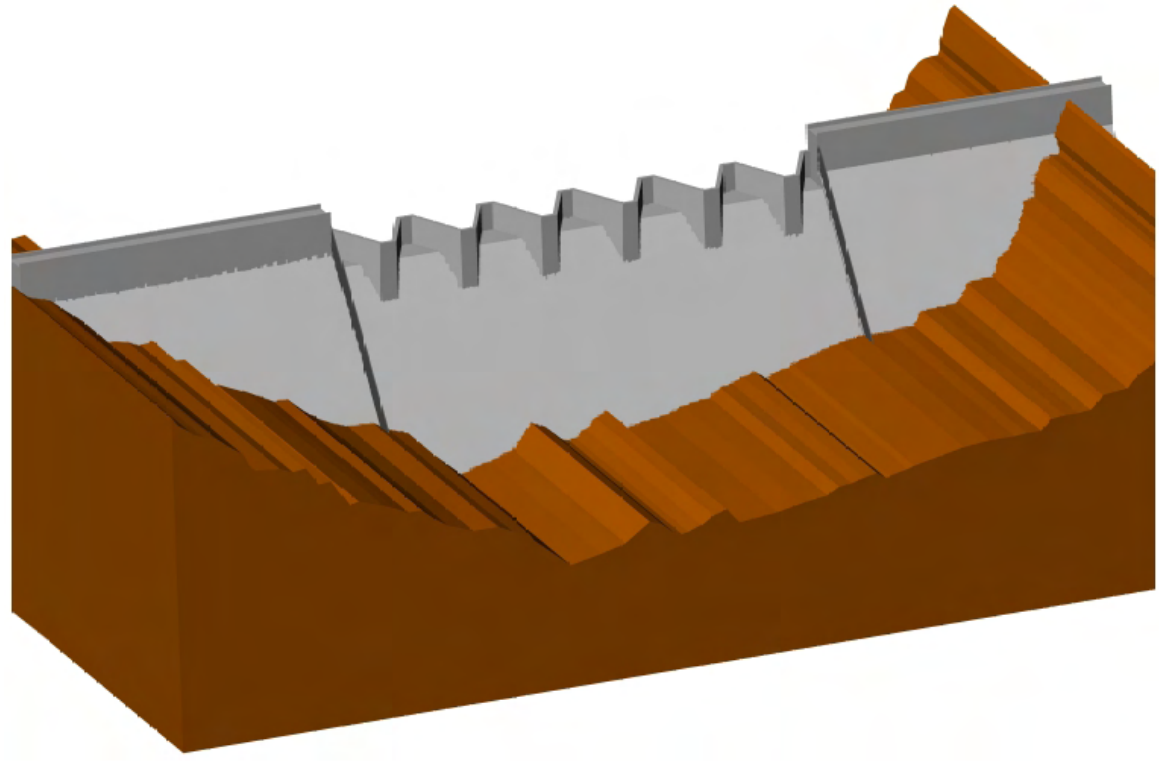


Figure 9-1: 10 m raising with a labyrinth spillway

10. REFERENCES

[1] Addis, A (red) (2001), *Fulton's Concrete Technology,* Cement and Concrete Institute, Midrand.

[2] Bester, A (2005), *Clanwilliam Dam Third Dam Safety Inspection Report,* Report Nr E100/02/DY03, Directorate Civil Design, DWAF, Pretoria.

[3] Botha, R.C.N. (1993), Third Engineering Geological Maintenance Investigation, Council for Geoscience, Pretoria.

[4] Davis, GN (2004), Clanwilliam Dam: Engineering Geological Report for Dam Safety Purposes, Council for Geosciences, Pretoria.

[5] Dick, A (1990), *Engineering Geological Report on the Safety of Clanwilliam Dam, Olifants River, Clanwilliam District, Cape Province.* Unpublished Report Nr GSO/1/90/5. Forbes Dick and Associates. Claremont.

[6] Du Toit, AL (1930), *Geological Report on the Proposed Clanwilliam Dam*, Report Nr 1930-0016, Geological Survey, Pretoria.

[7] Fommurze, HF (1933), *Foundations: Clanwilliam Dam*. Report Nr 1933-0010, Geological Survey, Pretoria.

[8] Geertsema, AJ (1988), *Clanwilliamdam: Tweede Geologiese Instandhoudingsverslag*, Report Nr 1988-0042, Geological Survey, Pretoria.

[9] Goldie, RH (2004), *Proposed raising of the Flag Boshielo Dam: Design Report*, Report Nr 20/2/B501-11/G/1/4, Directorate Civil Design, DWAF, Pretoria.

[10] Kotzé, A (2005), *Clanwilliam Dam Flood Frequency Analysis: Estimation of Flood Peaks for Required Probabilities*, Report No. E100-R002-2005.02, Directorate: Hydrological Services, DWAF, Pretoria.

[11] Kovacs, Z (1988), *Regional Maximum Flood Peaks in Southern Africa*, Technical Report Nr 137, Directorate of Hydrology, DWAF, Pretoria.

[12] Kroon, J (1984), *Swaartekrag Damstrukture,* University of Pretoria, Pretoria.

[13] Reyneke, J (2004), *Capacity Determination of Clanwilliam Dam 2004*, Directorate: Business Information, DWAF, Pretoria.

[14] SANCOLD (1991), South African National Committee on Large Dams, *Guidelines on Safety in Relation to Floods*, The South African Committee on Large Dams, Pretoria.

[15] Tullis, JP, Amanian, N and Waldron, D (1995), *Design of Labyrinth Spillways*, Journal of Hydraulic Engineering, vol. 121, No 3.

[16] USBR (1987), *Design of Small Dams,* United States Department fo the Interior, Bureau of Reclamation, Denver, colorado, USA.

[17] Van der Spuy, D (1992), *Clanwilliamdam Damveiligheidsinspeksie*, Verslag Nommer E100/02/DY01, Direktoraat: Siviele Ontwerp, DWAF, Pretoria.

[18] Van der Spuy, J en Kramer, S (2000), *Clanwilliamdam Damveiligheidsinspeksie*, Verslag Nommer E100/02/DY02, Direktoraat: Siviele Ontwerp, DWAF, Pretoria.

[19] Van Veelen, M and Jonck, JL (2003), *Study into the Possible Raising of the Clanwilliam Dam*, Project Nr H0203, BKS (Pty) Ltd, Pretoria.

[20] Yeo KT (1990). *Risks, Classification of Estimates, and Contingency Management. Journal of Management in Engineering*, Vol6, No4.

APPENDIX A DESIGN PARAMETERS FOR STATIC ANALYSIS

RAISING OF CLANWILLIAM DAM

Parameters Required for Static Analysis

Version 4

1 PURPOSE

The purpose of these notes is to provide the necessary information required to ensure that a consistent analysis is conducted that is based on the site parameters that influence the stability of the Clanwilliam Dam.

2 PROGRAM

The CADAM version 1.4.13 must be used in the analysis and be crossed check with hand calculations.

3 SITE PARAMETERS

The following parameters must be used:

- Gravitational acceleration: 9,81 m²/s
- Volumetric Mass of Concrete: 2 300 kg/m³
- Lowest foundation level for the
    - Spillway: RL 67,28 m
    - NOC: RL 77,00 m
- FSL for raisings
    - 0 m: RL 105,25 m
    - 5 m: RL 110,25 m
    - 10 m: RL 115,25 m
    - 15 m: RL 120,25 m
- NOC for raisings
    - 0 m: RL 111,20 m
    - 5 m: RL 116,10 m
    - 10 m: RL 121,00 m
    - 15 m: RL 125,90 m
- Compression strength: 15 000 kPa

- Tensile strength: 1 000 kPa
- Concrete peak cohesion: 200 kPa
- Concrete friction angle: 45°
- Concrete residual cohesion: 0 kPa
- Concrete residual angle: 45°
- Base joint peak cohesion: 120 kPa
- Base joint friction angle: 36°
- Base joint residual cohesion: 120 kPa
- Base joint residual angle: 36°
- Ignore passive shear strength at the rock joint
- Horizontal joint spacing every 2 metre from bottom to top.
- No initial cracks
- Service flood
    - Upstream: 1:200 dam
    - Downstream: 1:200 river
- Abnormal flood
    - Upstream: RMF dam
    - Downstream: RMF river
- Extreme flood
    - Upstream: SEF dam
    - Downstream: SEF river
- Ice loads: None
- Floating debris: None
- Sediment: RL 82 m (density 9 kN/m^3 and angle of friction 34°)
- Crest overtopping: None
- Drainage: None
- Post-tensioning: None
- Added forces: None
- Service seismic load: 0,075 g

- Abnormal seismic load: 0,15 g
- Extreme seismic load: 0,30 g

4 LOADING CONDITIONS

4.1 Normal

4.1.1 Loading N-1

- Dam at service flood
- River at service flood
- Uplift (FSL)
- Drainage working
- Silt

4.1.2 Loading N-2

- Dam at FSL
- River at zero flow
- Uplift (FSL)
- Drainage working
- Silt
- Service seismic load

4.1.3 Loading N-3

- Dam at FSL
- River at zero flow
- Uplift (FSL)
- Drainage not working
- Silt

4.2 Abnormal

4.2.1 Loading A-1

- Dam at abnormal flood
- River at abnormal flood

- Uplift (FSL)
- Drainage working
- Silt

4.2.2 Loading A-2

- Dam at FSL
- River at zero flow
- Uplift (FSL)
- Drainage working
- Abnormal seismic load
- Silt

4.2.3 Loading A-3

- Dam at sediment level
- River at zero flow
- Uplift (FSL)
- Drainage working
- Silt
- Service seismic load

4.3 Extreme

4.3.1 Loading E-1

- Dam at extreme flood
- River at extreme flood
- Uplift (FSL)
- Drainage working
- Silt

4.3.2 Loading E-2

- Dam at FSL
- River at zero flow
- Uplift (FSL)

- Drainage working
- Abnormal seismic load
- Silt

4.3.3 Loading E-3

- Dam at sediment level
- River at zero flow
- Uplift (FSL)
- Drainage working
- Silt
- Service seismic load

5 DESIGN CRITERIA

5.1 Allowable stress

5.1.1 Normal loading

- Tensile None
- Compression 3 000 kPa

5.1.2 Abnormal

- Tensile 100 kPa
- Compression 4 000 kPa

5.1.3 Extreme

- Tensile 200 kPa
- Compression 5 000 kPa

5.2 Factor of Safety

5.2.1 Normal loading

- Overturning ≥ 1,50
- Uplift ≥ 1,50
- Shear (peak) ≥ 3,00
- Shear (residual) ≥ 1,50

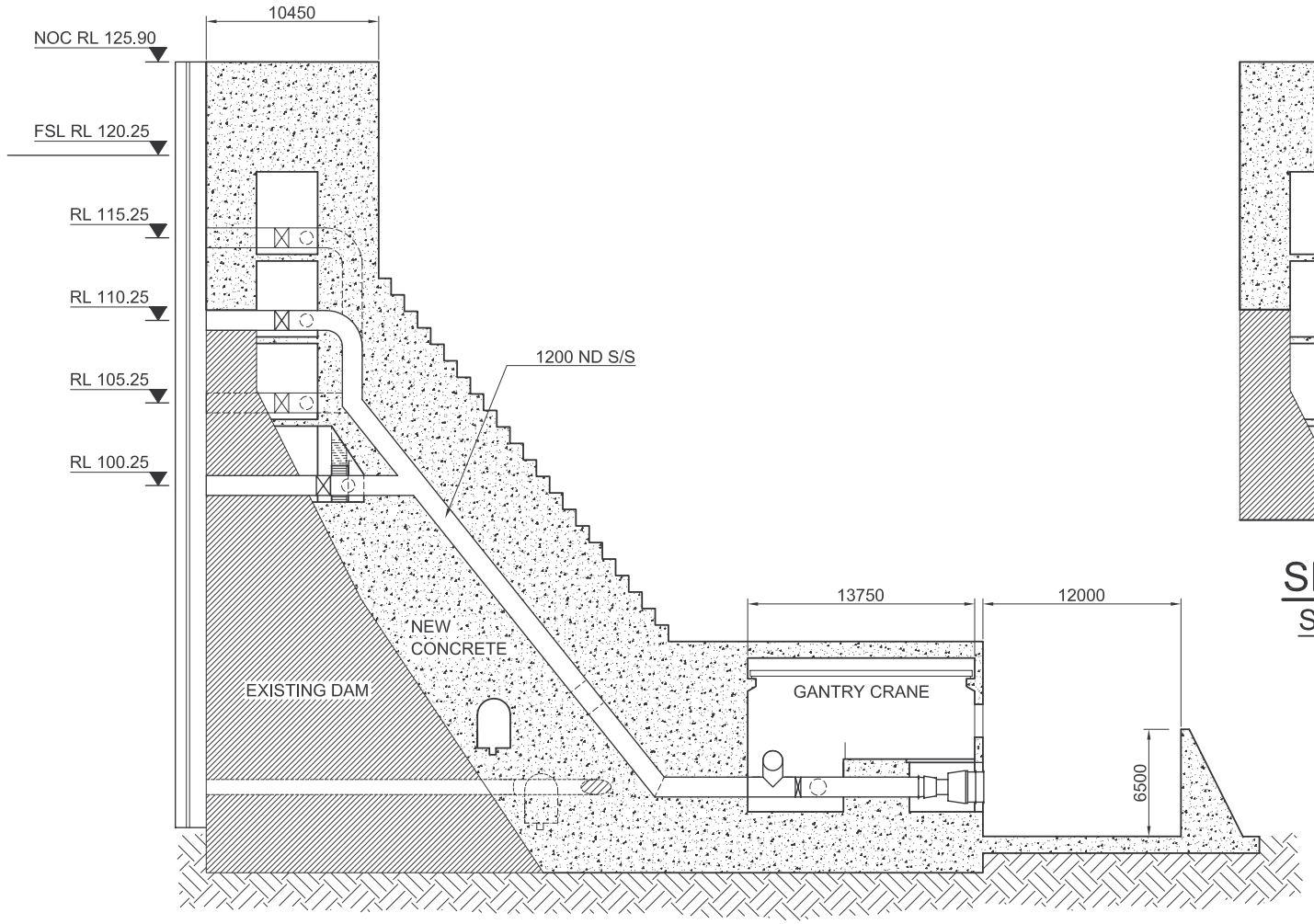
5.2.2 Abnormal loading

- Overturning ≥ 1,25
- Uplift ≥ 1,25
- Shear (peak) ≥ 1,50
- Shear (residual) ≥ 1,25

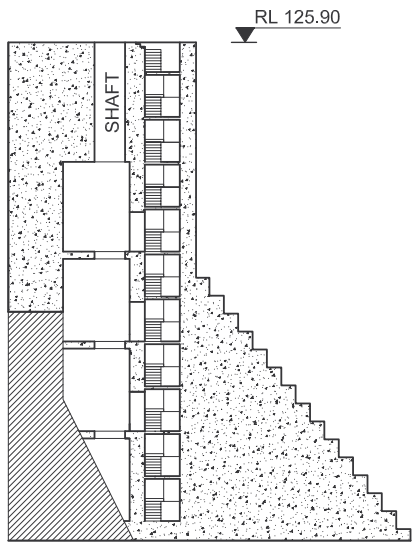
5.2.3 Extreme loading

- Overturning ≥ 1,00
- Uplift ≥ 1,00
- Shear (peak) ≥ 1,25
- Shear (residual) ≥ 1,00

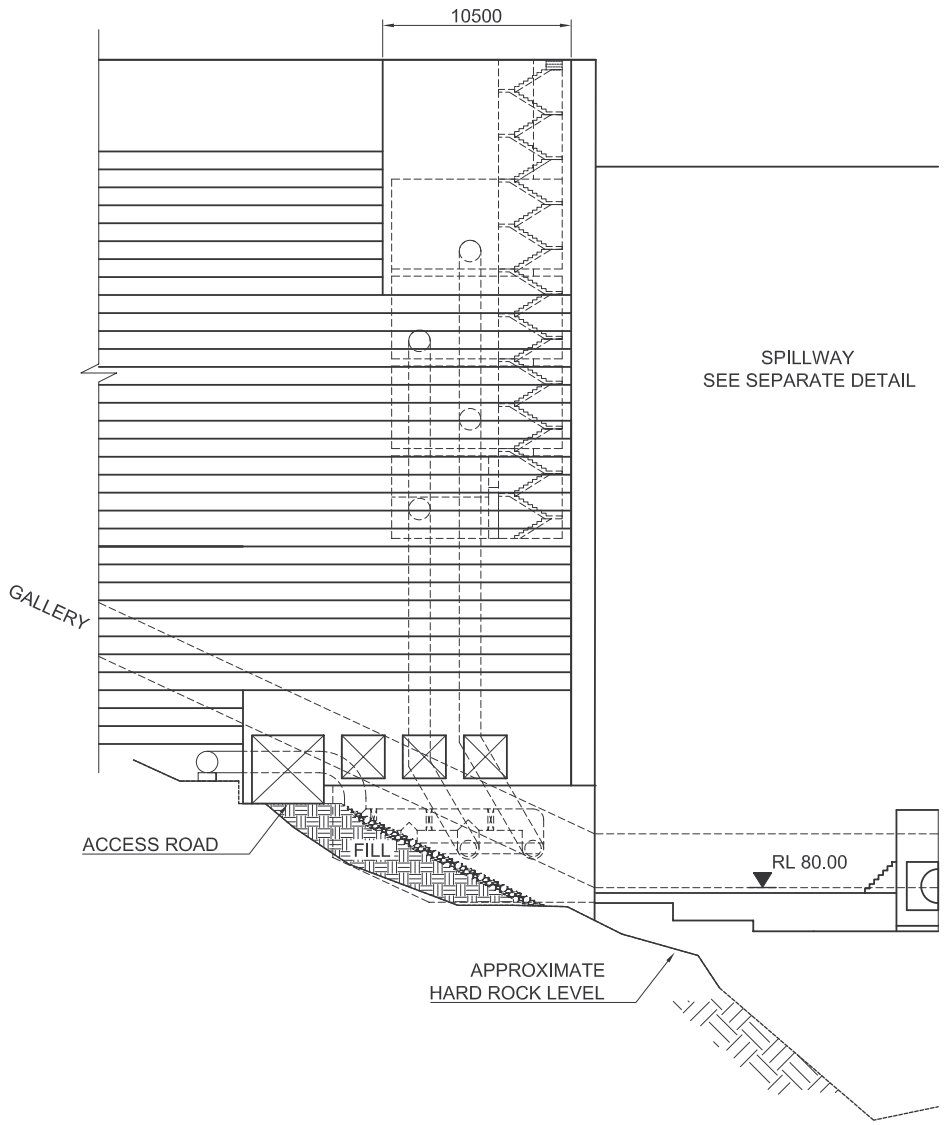
APPENDIX B OUTLET WORKS DRAWINGS



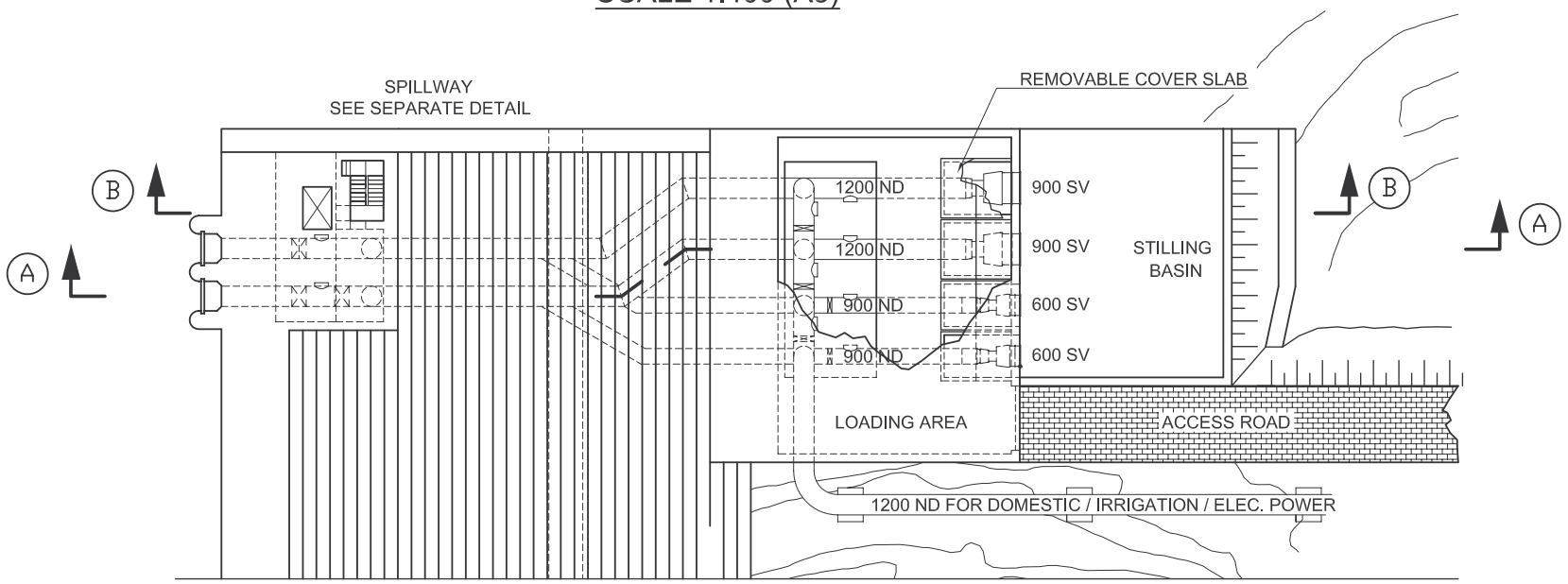
SECTION A- A
SCALE 1:400 (A3)



SECTION B- B
SCALE 1:400 (A3)



DOWNSTREAM ELEVATION
SCALE 1:400 (A3)



PLAN
SCALE 1:400 (A3)

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
REPUBLIC OF SOUTH AFRICA

FEASIBILITY STUDY FOR THE RAISING OF

CLAINWILLIAM DAM

OUTLET WORKS

GENERAL LAYOUT

APPENDIX C BILLS OF QUANTITIES

CLANWILLIAM DAM - FEASIBILITY STUDY

CONSTRUCTION COSTS: Dam Safety and Alternative Raising Costs, Existing Length Ogee

DESCRIPTION	UNIT	RATE	VOLUME				COST			
			DS (Enviro)	5m Raising	10m Raising	15 Raising	0m Raising	5m Raising	10m Raising	15m Raising
P&G's										
Site establishment	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000	2 500 000
Overheads (% of Capital Work)	%	50,00	1	1	1	1	41 739 719	53 485 349	67 009 193	86 457 722
Excavation										
Soft	m³	15	10 809	15 953	22 871	31 846	162 136	239 295	343 070	477 691
Intermediate	m³	35	10 809	15 953	22 871	31 846	378 317	558 355	800 497	1 114 612
Rock	m³	85	10 809	15 953	22 871	31 846	918 770	1 356 005	1 944 065	2 706 915
Concrete	m³	85	11 138	11 138	11 138	11 138	946 701	946 701	946 701	946 701
Preparation of Solum (foundation)										
Preperation	m³	30	6 168	7 590	9 210	11 469	185 026	227 700	276 286	344 078
Drilling										
Grouting	m dril	150	20 753	43 723	76 067	127 559	3 112 998	6 558 409	11 410 018	19 133 777
Draining	m dril	150	6 154	7 620	9 297	11 427	923 052	1 142 975	1 394 599	1 714 102
Foundation improvement										
Consolidation Grouting	ton	1 000	65	137	238	399	64 881	136 910	237 806	398 783
Formwork										
Reinforced Concrete	m²	180	5 382	5 485	5 719	5 811	968 699	987 299	1 029 464	1 045 931
RCC	m²	135	10 995	14 755	18 822	24 310	1 484 307	1 991 899	2 540 949	3 281 886
Waterstop	m	250	1 220	1 367	1 539	1 772	305 029	341 787	384 672	443 102
Formed construction joints	m²	150	3 084	4 361	5 918	7 935	462 575	654 213	887 742	1 190 182
Steel floating of chute surface	m²	20	1 176	1 176	1 267	1 359	23 516	23 516	25 346	27 175
Concrete										
Rollcrete	m³	300	43 409	81 736	127 888	187 874	13 022 597	24 520 880	38 366 295	56 362 131
Mass (dental)	m³	380	6 168	7 590	9 210	11 469	2 343 661	2 884 205	3 499 618	4 358 326
Structural	m³	450	10 300	10 353	10 601	10 891	4 635 191	4 658 838	4 770 578	4 900 976
Dagha layer to form skin for RCC	m²	20	12 050	16 461	21 330	28 091	241 006	329 226	426 605	561 817
Cooling for the RCC	m²	500	5 000	6 000	8 000	11 000	2 500 000	3 000 000	4 000 000	5 500 000
Reinforcing										
Rebar	t	5000	3705	3929	4269	4630	18 524 266	19 646 731	21 344 953	23 149 621
Other										
Mechanical Equipment for the outlet works	Sum	1	16 592 000	17 916 000	16 872 960	17 487 120	16 592 000	17 916 000	16 872 960	17 487 120
Miscellaneous (% of Capital Work)	%	10	1	1	1	1	6 163 157	8 010 995	10 136 566	13 194 993
Instrumentation	%	1	1	1	1	1	573 659	782 159	1 047 658	1 408 528
Roads	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000	2 500 000
Environmental (% Capital Work)	%	5	1	1	1	1	3 947 894	5 056 597	6 331 939	8 166 996
Contingencies (% of Capital Work)	%	10,00	1	1	1	1	12 521 916	16 045 605	20 102 758	25 937 317
Professional Fees	%	8,00	1	1	1	1	10 017 533	12 836 484	16 082 206	20 749 853
TOTAL							**R 147 758 606**	**R 189 338 134**	**R 237 212 542**	**R 306 060 336**
						Inflation adjusted Aug 2002 to April 2006	165 932 914	**R 212 626 725**	**R 266 389 684**	**R 343 705 757**

CLANWILLIAM DAM - RECONNAISSANCE STUDY
CONSTRUCTION COSTS: Dam Safety and Alternative Raising Costs- Extended Length Labyrinth Spillway

DESCRIPTION	UNIT	RATE	VOLUME			COST		
			5m Raising	10m Raising	15 Raising	5m Raising	10m Raising	15m Raising
P&G's								
Site establishment	Sum	2 500 000	1	1	1	2 500 000	2 500 000	2 500 000
Overheads (% of Capital Work)	%	50,00	1	1	1	59 837 627	72 568 031	88 992 402
Excavation								
Soft	m³	15	15 953	22 871	31 846	239 295	343 070	477 691
Intermediate	m³	35	15 953	22 871	31 846	558 355	800 497	1 114 612
Rock	m³	85	15 953	22 871	31 846	1 356 005	1 944 065	2 706 915
Concrete	m³	85	11 138	11 138	11 138	946 701	946 701	946 701
Preparation of Solum (foundation)								
Preparation	m³	30	8 323	9 609	11 257	249 703	288 257	337 702
Drilling								
Grouting	m dril	150	44 135	76 634	122 770	6 620 244	11 495 155	18 415 508
Draining	m dril	150	7 900	9 442	10 985	1 185 002	1 416 272	1 647 696
Foundation improvement								
Consolidation Grouting	ton	1 000	138	240	384	138 203	239 580	383 813
Formwork								
Reinforced Concrete	m²	180	7 382	7 382	7 249	1 328 748	1 328 748	1 304 821
RCC	m²	135	13 011	17 501	22 494	1 756 513	2 362 646	3 036 728
Waterstop	m	250	1 517	1 625	1 782	379 140	406 258	445 554
Formed construction joints	m²	150	4 649	6 086	7 750	697 374	912 928	1 162 497
Steel floating of chute surface	m²	20	0	0	0	0	0	0
Concrete								
Rollcrete	m³	300	74 191	122 306	175 320	22 257 368	36 691 897	52 595 989
Mass (dental)	m³	380	8 323	9 609	11 257	3 162 907	3 651 257	4 277 558
Structural	m³	450	16 122	16 122	15 602	7 254 998	7 254 998	7 020 946
Dagha layer to form skin for RCC	m²	20	16 741	21 753	28 019	334 819	435 065	560 372
Cooling for the RCC	m²	500	6 000	8 000	11 000	3 000 000	4 000 000	5 500 000
Reinforcing								
Rebar	t	5000	5945	5945	6021	29 726 214	29 726 214	30 106 584
Other								
Mechanical Equipment for the outlet works	Sum	1	17 916 000	16 872 960	17 487 120	17 916 000	16 872 960	17 487 120
Miscellaneous (% of Capital Work)	%	10	1	1	1	9 009 781	11 010 597	13 593 528
Instrumentation	%	1	1	1	1	902 014	1 152 542	1 456 352
Roads	Sum	2 500 000	1	1	1	2 500 000	2 500 000	2 500 000
Environmental (% Capital Work)	%	5	1	1	1	5 655 869	6 856 358	8 406 117
Contingencies (% of Capital Work)	%	10,00	1	1	1	17 951 288	21 770 409	26 697 721
Professional Fees	%	8,00	1	1	1	14 361 030	17 416 327	21 358 176
TOTAL						**R 211 825 198**	**R 256 890 831**	**R 315 033 102**
					Inflation adjusted Aug 2002 to Aug 2005	**R 237 879 697**	**R 288 488 403**	**R 353 782 174**

CLANWILLIAM DAM - RECONNAISSANCE STUDY

CONSTRUCTION COSTS: Dam Safety and Alternative Raising Costs- Existing Length Labyrinth Spillway

DESCRIPTION	UNIT	RATE	VOLUME				COST			
			DS (Enviro)	5m Raising	10m Raising	15 Raising	0m Raising	5m Raising	10m Raising	15m Raising
P&G's										
Site establishment	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000	2 500 000
Overheads (% of Capital Work)	%	50,00	1	1	1	1	46 686 145	58 090 820	70 204 967	86 569 950
Excavation										
Soft	m³	15	10 809	15 953	22 871	31 846	162 136	239 295	343 070	477 691
Intermediate	m³	35	10 809	15 953	22 871	31 846	378 317	558 355	800 497	1 114 612
Rock	m³	85	10 809	15 953	22 871	31 846	918 770	1 356 005	1 944 065	2 706 915
Concrete	m³	85	11 138	11 138	11 138	11 138	946 701	946 701	946 701	946 701
Preparation of Solum (foundation)										
Preperation	m³	30	6 237	7 692	9 016	10 698	187 096	230 760	270 472	320 938
Drilling										
Grouting	m dril	150	20 753	44 135	76 634	122 770	3 112 998	6 620 244	11 495 155	18 415 508
Draining	m dril	150	6 181	7 647	9 205	10 761	927 193	1 147 116	1 380 702	1 614 169
Foundation improvement										
Consolidation Grouting	ton	1 000	65	138	240	384	64 881	138 203	239 580	383 813
Formwork										
Reinforced Concrete	m²	180	7 166	7 236	7 236	7 236	1 289 809	1 302 400	1 302 400	1 302 400
RCC	m²	135	8 929	13 339	17 786	22 775	1 205 374	1 800 821	2 401 043	3 074 680
Waterstop	m	250	1 234	1 392	1 508	1 672	308 480	348 070	377 072	418 043
Formed construction joints	m²	150	3 111	4 412	5 864	7 541	466 716	661 806	879 615	1 131 189
Steel floating of chute surface	m²	20	0	0	0	0	0	0	0	0
Concrete										
Rollcrete	m³	300	34 685	75 701	123 604	176 610	10 405 554	22 710 400	37 081 111	52 982 980
Mass (dental)	m³	380	6 237	7 692	9 016	10 698	2 369 888	2 922 965	3 425 985	4 065 219
Structural	m³	450	14 622	14 622	14 622	13 600	6 579 677	6 579 677	6 579 677	6 119 898
Dagha layer to form skin for RCC	m²	20	12 050	16 801	21 808	28 070	241 006	336 023	436 159	561 401
Cooling for the RCC	m²	500	5 000	6 000	8 000	11 000	2 500 000	3 000 000	4 000 000	5 500 000
Reinforcing										
Rebar	t	5000	5539	5454	5251	5343	27 693 270	27 271 541	26 253 240	26 715 755
Other										
Mechanical Equipment for the outlet works	Sum	1	16 592 000	17 916 000	16 872 960	17 487 120	16 592 000	17 916 000	16 872 960	17 487 120
Miscellaneous (% of Capital Work)	%	10	1	1	1	1	6 940 897	8 735 126	10 639 046	13 212 639
Instrumentation	%	1	1	1	1	1	666 988	869 055	1 107 956	1 410 646
Roads	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000	2 500 000
Environmental (% Capital Work)	%	5	1	1	1	1	4 414 538	5 491 075	6 633 428	8 177 584
Contingencies (% of Capital Work)	%	10,00	1	1	1	1	14 005 843	17 427 246	21 061 490	25 970 985
Professional Fees	%	8,00	1	1	1	1	11 204 675	13 941 797	16 849 192	20 776 788
TOTAL							**R 165 268 953**	**R 205 641 501**	**R 248 525 584**	**R 306 457 625**
						Inflation adjusted Aug 2002 to April 2006	185 597 034	**R 230 935 406**	**R 279 094 231**	**R 344 151 913**

CLANWILLIAM DAM - RECONNAISSANCE STUDY
CONSTRUCTION COSTS: Dam Safety and Alternative Raising Costs- Lengthened Ogee Spillway

DESCRIPTION	UNIT	RATE	VOLUME				COST		
			DS (Enviro)	5m Raising	10m Raising	15 Raising	5m Raising	10m Raising	15m Raising
P&G's									
Site establishment	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000
Overheads (% of Capital Work)	%	50,00	1	1	1	1	57 086 704	69 628 652	86 165 638
Excavation									
Soft	m³	15	10 809	15 953	22 871	31 846	239 295	343 070	477 691
Intermediate	m³	35	10 809	15 953	22 871	31 846	558 355	800 497	1 114 612
Rock	m³	85	10 809	15 953	22 871	31 846	1 356 005	1 944 065	2 706 915
Concrete	m³	85	11 138	11 138	11 138	11 138	946 701	946 701	946 701
Preparation of Solum (foundation)									
Preperation	m³	30	6 237	8 323	9 609	11 257	249 703	288 257	337 702
Drilling									
Grouting	m dril	150	20 753	44 135	76 634	122 770	6 620 244	11 495 155	18 415 508
Draining	m dril	150	6 181	7 900	9 442	10 985	1 185 002	1 416 272	1 647 696
Foundation improvement									
Consolidation Grouting	ton	1 000	65	138	240	384	138 203	239 580	383 813
Formwork									
Reinforced Concrete	m²	180	5 398	5 830	5 900	5 900	1 049 461	1 061 985	1 061 985
RCC	m²	135	10 995	15 001	19 207	24 200	2 025 198	2 592 947	3 267 029
Waterstop	m	250	1 234	1 517	1 625	1 782	379 140	406 258	445 554
Formed construction joints	m²	150	3 111	4 649	6 086	7 750	697 374	912 928	1 162 497
Steel floating of chute surface	m²	20	1 176	1 359	1 359	1 359	27 175	27 175	27 175
Concrete									
Rollcrete	m³	300	43 409	81 963	128 590	181 604	24 588 944	38 577 068	54 481 161
Mass (dental)	m³	380	6 237	8 323	9 609	11 257	3 162 907	3 651 257	4 277 558
Structural	m³	450	11 028	12 638	12 118	11 734	5 687 198	5 453 146	5 280 495
Dagha layer to form skin for RCC	m²	20	12 050	16 741	21 753	28 019	334 819	435 065	560 372
Cooling for the RCC	m²	500	5 000	6 000	8 000	11 000	3 000 000	4 000 000	5 500 000
Reinforcing									
Rebar	t	5000	4021	4838	4914	5012	24 187 979	24 568 349	25 058 167
Other									
Mechanical Equipment for the outlet works	Sum	1	16 592 000	17 916 000	16 872 960	17 487 120	17 916 000	16 872 960	17 487 120
Miscellaneous (% of Capital Work)	%	10	1	1	1	1	8 577 246	10 548 430	13 149 068
Instrumentation	%	1	1	1	1	1	850 110	1 097 082	1 403 017
Roads	Sum	2 500 000	1	1	1	1	2 500 000	2 500 000	2 500 000
Environmental (% Capital Work)	%	5	1	1	1	1	5 396 348	6 579 058	8 139 441
Contingencies (% of Capital Work)	%	10,00	1	1	1	1	17 126 011	20 888 596	25 849 692
Professional Fees	%	8,00	1	1	1	1	13 700 809	16 710 876	20 679 753
TOTAL							**R 202 086 931**	**R 246 485 427**	**R 305 026 360**
						Inflation adjusted Aug 2002 to April 2006	**R 226 943 624**	**R 276 803 135**	**R 342 544 602**

APPENDIX D CONSTRUCTION SITE LAYOUT

RAISING OF CLANWILLIAM DAM:
SITE ESTABLISHMENT ALTERNATIVES

1. GENERAL

Two options were investigated. For both these two options the following will apply, namely:

- It was assumed that the necessary permission would be obtained from the local authority to allow the erection of temporary buildings inside the municipal boundaries to accommodate personnel during the construction period. The writer is unaware of any negotiations with the local authority in this regard. Because of the steep topography at the dam site the option to accommodate personnel on site will only be explored as a last resort. If the local authority declines a request to make municipal area available for this purpose negotiations with private owners to acquire land for this purpose might be explored as a useful alternative, and
- The provisioning of concrete materials for construction will be acquired by an open bid tender system. The development of the existing quarry situated on the western side of the existing road to Vredendal could be seen as one alternative to provide concrete materials for construction work. Materials could be provided from existing commercial sources or commercial quarry operators could develop any other existing or new quarry in the area for this purpose. To make the development of the existing quarry close to the dam available for construction purposes this aspect should be addressed as part of site layout establishment application. Remember to make provision for the area required to establish and operate the crusher plant. An area of 200 m x 200 m will be required for this purpose situated as close as possible to quarry site.

2. OPTION 1

This option has the intention to have all site establishment infrastructure to be situated on the left-hand side of the existing dam wall. Because of the unfavourable topography available close to site development of infrastructure both sides of the existing road will be a necessity. An area of 300 m x 150 m situated on the western side of the road will be required to accommodate the concrete batching plant/s, the concrete aggregate stockpiles and the mechanical workshop. An area of 60 m x 200 m situated on the eastern side of the existing road downstream of the dam wall will provide area for the offices, training facility, laboratory and serve as area to store construction materials during construction. Concrete from the batching plant will be transported to the dam wall with a conveyer system. This conveyer system must cross the existing road and if the existing road remains in use during the raising of the dam wall a concrete pipe (if no existing structure could be utilized) will be jack through the road fill section to accommodate the conveyer system. Additional access roads to transport concrete to accommodate other concrete placing methods than with the conveyer system will also be required.

3. OPTION 2

This is not the preferred option. It differs from Option 1 in relation to the location of the concrete batching plant in an area of 300 m x 150 m situated on the plateau on the right-hand side downstream of the existing dam wall. This option will require an additional access road to the concrete batching plant area on the right-bank of the river. The steep topography on the right-hand side downstream of the dam wall will have to accommodate a zigzag pattern of conveyer belts to get concrete to the placing area. Additional access roads to transport concrete to accommodate other concrete placing methods than with the conveyer system will be required. For Option 2 the positioning of the offices, etc. will be as for Option 1.

4. SERVICES

- Water supply for drinking purposes by means of a borehole,
- Water supply for the batching plant, dust suppression and other construction purposes by means of abstractions from the Olifants River,
- Sewage by means of a conservancy system,
- Electricity by ESKOM, and
- Fuel storage facilities on site smaller than 30 000 litre.

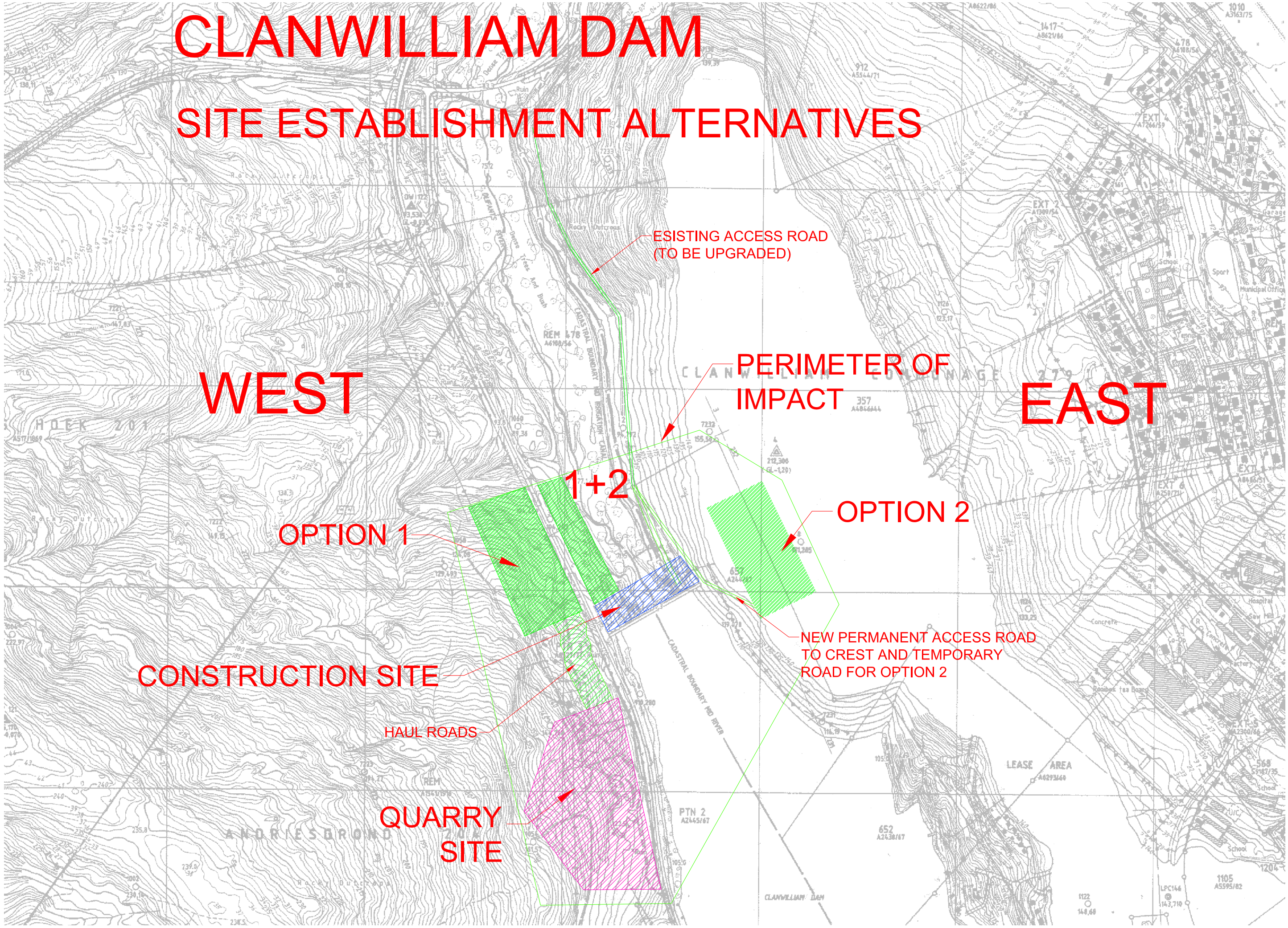
_____

CONTRACT MANAGER
CONSTRUCTION: SOUTH

Date: 22 May 2006

CLANWILLIAM DAM

SITE ESTABLISHMENT ALTERNATIVES



APPENDIX E LIST OF AVAILABLE DRAWINGS

Scanned	Drg. Reg. No.	Locality	Scheme	Project	Description	Key1	Key2	Key3	Key4	Key5
FALSE	10071/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF DOOR FRAMING & DOORS FOR LIFTING GANTRY HOUSING	SRO	OUL	DOR	HOU	FRM
FALSE	10228/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT OF HOIST FOR 10'x10' SCOUR GATES	SRO	HRP	GTV	CRS	GAR
FALSE	10229/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF WIRE ROPE DRUM & GEARING FOR HOIST	SRO	HRP	GTV	CRS	DET
FALSE	10230/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF BEARING & CLUTCH FOR HOIST	SRO	HRP	GTV	CRS	BEA
FALSE	10231/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF BASE & GEAR GUARDS FOR HOIST	SRO	HRP	GTV	CRS	BEA
FALSE	10307/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF COVER PLATES FOR SCOUR GATE SHAFTS	SRO	SHA	GTV	COV	DET
FALSE	10322/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF STEPS IN GANTRY HOUSING	SRO	CRS	LDR	HOU	DET
FALSE	10399/36ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF ALTERATIONS TO GATE & GROUTING	SRO	GTV	MON	N/A	N/A
FALSE	10401/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : CANAL OUTLET DETAILS OF 15' OUTLET	CAN	OUW	PWO	DET	N/A
FALSE	10412/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : 36' OUTLET : DETAILS OF 36' OUTLET HEADSTOCK PLATFORM	OUW	HST	LDR	DET	N/A
FALSE	10425/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT OF GANTRY HOUSING DOOR	SRO	CRS	HOU	DOR	GAR
FALSE	10426/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF GANTRY HOUSING DOOR COLUMNS	SRO	CRS	HOU	DOR	DET
FALSE	10433/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF LADDERS/ FOUNDATION BOLTS/ HANDRAILS & MOVABLE SUPPORTS FOR SCOUR GATE SHAFTS	SRO	GTV	SHA	LDR	HRG
FALSE	10468/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF SUSPENSION CEVISE & COUPLINGS FOR SCOUR GATES	SRO	GTV	SHA	DET	N/A
FALSE	10485/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT OF LIFTING GANTRY FOR SCOUR GATES	SRO	GTV	CRS	GAR	N/A
FALSE	10486/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF LIFTING GANTRY FOR SCOUR GATES	SRO	GTV	CRS	DET	N/A
FALSE	10613/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF TRAVERSING GEAR FOR LIFTING GANTRY FOR SCOUT GATES	SRO	OUL	GTV	CRS	DET
FALSE	10615/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF LIFTING SLINGS FOR SCOUR GATES	SRO	OUL	GTV	CRS	DET
FALSE	10628/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT OF STEEL WORK & LIFTING TACKLE IN SCOUR GATE SHAFTS	SRO	OUL	GTV	CRS	GAR
FALSE	10629/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF LINKS & PINS FOR SCOUR GATES	SRO	OUL	GTV	CRS	DET
FALSE	10630/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT & DETAILS OF WHEELS ETC. OF TRAVERSING GEAR FOR SCOUR GATES LIFTING GANTRY	SRO	OUL	GTV	CRS	GAR
FALSE	10631/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF HOISTING SHEAVES FOR SCOUR GATES	SRO	OUL	GTV	CRS	DET
FALSE	106551/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS - CLANWILLIAM DAM WALL AS BUILT TERRESTRIAL PLAN AND CONTOUR SURVEY	N/A	CON	N/A	N/A	N/A
TRUE	106552/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS - CLANWILLIAM DAM WALL DOWNSTREAM VIEW OF CLANWILLIAM TERRESTRIAL PHOTOGRAMMETRY	DET	DAU	ELE	N/A	N/A
TRUE	109228/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109229/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109230/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109231/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109232/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109233/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109234/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109235/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109236/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
FALSE	109237/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109238/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109239/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109240/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109241/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109242/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109243/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109244/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109245/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	109246/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
FALSE	10945/90	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTSRIVIER GWS BULSHOEK NA CLANWILLIAM LUG KONTOEROPMETING	SAR	CON	N/A	N/A	N/A
TRUE	112973/92	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM DEFLECTION SURVEYS LAYOUT OF MONITORING POINTS	DFS	KPL	SLS	N/A	N/A
TRUE	114794/94	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CADASTRAL KEYPLAN FOR CLANWILLIAM DAM 1994	SCA	FDC	KPL	N/A	N/A
TRUE	114795/94	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CADASTRAL KEYPLAN FOR CLANWILLIAM DAM 1994	SCA	FDC	KPL	N/A	N/A
TRUE	133459/00	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	DIRECTORATE HYDROLOGY CLANWILLIAM DAM OLIFANTS R. NEW W COMPONENT LAYOUT	HYD	WGG	PNL	N/A	N/A
TRUE	133460/00	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	DIRECTORATE HYDROLOGY CLANWILLIAM DAM OLIFANTS R. NEW W COMPONENT SECTIONS & DETAILS	HYD	WGG	SCT	DET	N/A
FALSE	133461/00	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	DIRECTORATE HYDROLOGY CLANWILLIAM DAM OLIFANTS R. NEW W COMPONENT INSTRUMENTATION	HYD	WGG	INS	N/A	N/A
FALSE	19364/45	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM IRRIGATION SCHEME PROPOSED RAISING OF DAM PLAN OF AREA TO BE PURCHA.	DSR	IRR	N/A	N/A	N/A
FALSE	22480/48	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	LOWER OLIFANTS RIVER KEY PLAN	KPL	N/A	N/A	N/A	N/A
FALSE	23758/49	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM RAISING PPD RAISING BY MEANS OF CREST GATES	DSR	GTC	N/A	N/A	N/A
FALSE	33550/55	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM PROPOSED RAISING LOCATION OF NATIONAL ROAD	RRD	N/A	N/A	N/A	N/A
FALSE	40634/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SILT SURVEY OF 1961 11=500F	CON	DSM	N/A	N/A	N/A
FALSE	40929/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SURVEY OF DAM SITE AREA	SGR	CON	PNS	N/A	N/A
FALSE	40930/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SURVEY OF DAM STRUCTURE 11120F	STR	OUW	PNL	N/A	N/A
FALSE	40931/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SILT SURVEY OF 1961 11=500F	CON	DSM	N/A	N/A	N/A
FALSE	40932/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SILT SURVEY OF 1961 11=500F	CON	DSM	N/A	N/A	N/A
FALSE	40933/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SILT SURVEY OF 1961 11=500F	CON	DSM	N/A	N/A	N/A
FALSE	40934/62-A	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER CLANWILLIAM DAM CLANWILLIAM SILT SURVEY OF 1961 11=500F	CON	DSM	N/A	N/A	N/A
FALSE	41243/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM CLANWILLIAM DAM RISING GEOLOGICAL PROFILE ALONG THE THE DAM WALL	DSR	GEG	PFA	WLL	N/A
FALSE	41292/62	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS [RHYNSDORP] CLANWILLIAM DAM RAISING	DSR	PNL	TRS	N/A	N/A
FALSE	41829/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAMS DAM CAPACITY	DSM	GPS	N/A	N/A	N/A
FALSE	42119/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING BRIDGE	DSR	BRG	REI	SCT	N/A
FALSE	42120/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING REINFORCEMENT OF STEP SPLITTERS & DOWELS	DSR	REI	OUS	ELE	N/A
FALSE	42133/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING NON OVERFLOW SECTION & PARAPET WALL	DSR	WLL	SCT	N/A	N/A
FALSE	42134/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING FOUNDATION GROUTING & DRAINAGE HOLES	DSR	FDS	GRU	DRA	N/A
FALSE	42135/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING : INSTALLATION AND DETAILS OF PRESTRESSED CABLES	DSR	INN	CAB	SEL	N/A
FALSE	42143/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS REINFORCEMENT OF PIERS	PIE	REI	ELE	SCT	N/A
FALSE	42144/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS HEAD OF PIER REINFORCEMENT DETAILS	DSR	PIE	REI	ELE	N/A
FALSE	42145/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS PARAPET WALL AT PANELS	DSR	WLL	N/A	BRG	N/A
FALSE	42168/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	MALELANE IRRIGATION BOARD SCHEME GENERAL PLAN OF IRRIGATION PIPELINE	GAR	IRR	PLO	RTE	N/A
FALSE	42230/63	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING REINFORCEMENT OF SPILLWAY FLANK WALLS	DSR	SPN	WLL	REI	N/A
FALSE	42745/63ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET LAYOUT OF PIPES/ VALVES AND OPERATING PLATFORM	SRO	PWO	VAG	LYT	N/A
FALSE	42746/63ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF CAST IRON PIPES AND SPECIALS	SRO	PWO	PIC	DET	N/A
FALSE	42747/63ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF STAIRS FOR OPERATING PLATFORM	SRO	LDR	DET	N/A	N/A
FALSE	43013/64	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS PRELIM PURCHASE AREAS PLAN CLANWILLIAM DAM BASIN	PPL	CON	DSM	N/A	N/A
FALSE	43047/64	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS TRACH RACK FOR NEW 4F-OI OUTLET PIPE THROUGH SCOUR GATE TUNNEL	OUS	TRS	REI	SCT	N/A
FALSE	43048/64	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM RAISING : DETAILS OF OUTLET THROUG SCHOUR GATE TUNNELS	OUS	REI	GTV	TNS	N/A

Scanned	Drg. Reg. No.	Locality	Scheme	Project	Description	Key1	Key2	Key3	Key4	Key5
FALSE	43049/64	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS AMEND POSIT OF PRE-STRESSED CABLES & DRAINAGE HOLES	DSR	CAB	DRA	PNL	N/A
FALSE	431491/64ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET GENERAL ARRANGEMENT OF BULKHEAD	SRO	GSO	GAR	N/A	N/A
FALSE	431492/64ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF BULKHEAD	SRO	GSO	DET	N/A	N/A
FALSE	431493/64ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF BULKHEAD	SRO	GSO	DET	N/A	N/A
FALSE	43279/64ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER G/W/S : CLANWILLIAM DAM : GENERAL ARRANGEMENT AND DETAILS OF SCOUR OUTLET PIPE	SRO	PWO	GAR	DET	N/A
FALSE	43391/64	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS DAM RAISING PROG. PLAN : PLAN & ELEVAT TO SHOW MONTHLY PROGRES	DSR	PNL	CAB	SEL	N/A
FALSE	4424711/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : ELECTRICAL DIAGRAM	OUW	VAS	ETQ	DIA	N/A
FALSE	442751/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCHEDULE OF DRAWINGS	OUW	VAS	SHE	DSU	N/A
FALSE	442752/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : LAYOUT OF VALVES	OUW	VAS	LYT	N/A	N/A
FALSE	442753/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCHEMATIC LAYOUT OF VALVES	OUW	VAS	LYT	DIA	N/A
FALSE	442754/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCHEMATIC HYDRAULICS LAYOUT	OUW	VAS	LYT	HDR	DIA
FALSE	44276/20/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER PIPE DETAILS	OUW	VAS	PIP	DET	N/A
FALSE	44276/21/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER PIPE FLANGE DETAILS	OUW	VAS	PIP	DET	N/A
FALSE	44276/22/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/23/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER END FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/24/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER STUD DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/25/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TRUNNION/ FREE END DETAILS	OUW	VAS	TRU	DET	N/A
FALSE	44276/26/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TRUNNION/ DRIVING END DETAILS	OUW	VAS	TRU	DET	N/A
FALSE	44276/27/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TRUNNION BEARING DETAILS	OUW	VAS	TRU	BEA	DET
FALSE	44276/28/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TRUNNION SEALING BUSH DETAILS	OUW	VAS	TRU	SEA	DET
FALSE	44276/29/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : COVER DETAILS	OUW	VAS	COV	DET	N/A
FALSE	44276/30/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : FOUNDATION BLOCK DETAILS	OUW	VAS	FDS	DET	N/A
FALSE	44276/31/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : LEVER DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/32/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : 1000 kg. COUNTERWEIGHT DETAIL	OUW	VAS	DET	N/A	N/A
FALSE	44276/33/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BASE PLATE DETAILS	OUW	VAS	ACT	HDR	PLT
FALSE	44276/34/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR PEDESTAL DETAILS	OUW	VAS	PED	ACT	HDR
FALSE	44276/35/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BRACKET DETAIL	OUW	VAS	BRC	ACT	HDR
FALSE	44276/36/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR CYLINDER DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/37/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR CYLINDER DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/38/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR COVER DETAILS	OUW	VAS	ACT	HDR	COV
FALSE	44276/39/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR PISTON ROD DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/40/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR PISTON DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/41/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR CONNECTING LINK DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/42/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR SPRING DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/43/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR LOCKING PLATE DETAILS	OUW	VAS	ACT	HDR	PLT
FALSE	44276/44/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR ORIFICE SCREW DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/45/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BUSH DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/46/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BUSH DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/47/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BUSH DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/48/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BUSH DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/49/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR BOLT DETAILS	OUW	VAS	ACT	HDR	DET
FALSE	44276/50/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE LEVER DETAILS	OUW	VAS	SEA	HDR	CTL
FALSE	44276/51/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE SEALING ROD DETAILS	OUW	VAS	SEA	HDR	CTL
FALSE	44276/52/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE HOUSING (LEFT HAND)	OUW	VAS	SEA	HDR	CTL
FALSE	44276/53/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE SPRING DETAILS	OUW	VAS	SEA	HDR	CTL
FALSE	44276/54/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE COVER DETAILS	OUW	VAS	SEA	COV	CTL
FALSE	44276/55/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE SPRING LOCKING DISC	OUW	VAS	SEA	HDR	CTL
FALSE	44276/56/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE ROLLER DETAILS	OUW	VAS	SEA	HDR	CTL
FALSE	44276/57/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE BOLT DETAILS	OUW	VAS	SEA	HDR	CTL
FALSE	44276/58/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE BOLT	OUW	VAS	SEA	HDR	CTL
FALSE	44276/59/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE SEALING HEAD	OUW	VAS	SEA	HDR	CTL
FALSE	44276/60/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : N.B. TEST FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/61/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : N.B. TEST FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	44276/62/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : VALVE HOUSING (BODY)TEST FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/63/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES VALVE HOUSING (BODY) TEST FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/64/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCOUR FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/65/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCOUR TEST FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/66/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CLOSER SCOUR FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/67/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : INTERMEDIATE SCOUR FLANGE FLANGE	OUW	VAS	DET	N/A	N/A
FALSE	44276/68/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR TEST FLANGE	OUW	VAS	ACT	HDR	DET
FALSE	44276/69/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR TEST FLANGE	OUW	VAS	ACT	HDR	DET
FALSE	44276/70/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TRUNNION TEST FLANGE	OUW	VAS	TRU	DET	N/A
FALSE	44276/71/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : HOUSING (BODY) TEST FLANGE GASKET	OUW	VAS	GAS	DET	N/A
FALSE	44276/72/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCOUR PIPE DETAILS	OUW	VAS	PIP	SCR	DET
FALSE	44276/73/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : INSTALLATION ANCHORAGE	OUW	VAS	INN	BIP	N/A
FALSE	44276/74/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : INSTALLATION FOUNDATION CONDUIT	OUW	VAS	INN	COT	N/A
FALSE	44276/75/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR DRIVING INDICATOR SHAFT	OUW	VAS	IND	SHA	DET
FALSE	44276/76/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR DRIVEN INDICATOR SHAFT	OUW	VAS	IND	SHA	DET
FALSE	44276/77/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR TIMING BELT PULLEY	OUW	VAS	IND	DET	N/A
FALSE	44276/78/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR DISTANCE WASHER	OUW	VAS	IND	DET	N/A
FALSE	44276/79/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR BUSH	OUW	VAS	IND	DET	N/A
FALSE	44276/80/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR LEVER	OUW	VAS	IND	DET	N/A
FALSE	44276/81/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR SHAFT BEARING	OUW	VAS	IND	SHA	BEA
FALSE	44276/82/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : POSITION INDICATOR GUARD	OUW	VAS	IND	N/A	N/A
FALSE	44276/83/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET INSTRUMENT PANEL	OUW	VAS	CTL	INS	N/A
FALSE	44276/84/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET PEDESTAL	OUW	VAS	PED	CTL	N/A
FALSE	44276/85/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET PEDESTAL WITH FRAME	OUW	VAS	FRM	PED	CTL
FALSE	44276/86/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET OIL TANK AND MOTOR BASEPLATE	OUW	VAS	MOT	PLT	CTL
FALSE	44276/87/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET MOTOR COVER PLATE	OUW	VAS	MOT	COV	CTL
FALSE	44276/88/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET OIL TANK COVER PLATE	OUW	VAS	TKS	COV	CTL

Scanned	Drg. Reg. No.	Locality	Scheme	Project	Description	Key1	Key2	Key3	Key4	Key5
FALSE	44276/89/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET CONTROL EQUIPMENT PARTS LIST	OUW	VAS	PRU	CTL	N/A
FALSE	44276/90/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET LABELS	OUW	VAS	PRU	CTL	N/A
FALSE	44276/91/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : PARTS LIST	OUW	VAS	PRU	N/A	N/A
FALSE	44276/92/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : PARTS LIST	OUW	VAS	PRU	N/A	N/A
FALSE	44276/93/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : TEST SCHEDULE	OUW	VAS	SHE	N/A	N/A
FALSE	442761/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : FOUNDATION LAYOUT	OUW	VAS	FDS	LYT	N/A
FALSE	4427610/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : HYDRAULIC SCHEMATIC DIAGRAM	OUW	VAS	HDR	DIA	N/A
FALSE	4427612/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : FOUNDATION LAYOUT	OUW	VAS	FDS	LYT	N/A
FALSE	4427613/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : VALVE POSITION INDICATOR	OUW	VAS	IND	N/A	N/A
FALSE	4427614/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : VALVE HOUSING (BODY) DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	4427615/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SPHERE BODY DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	4427616/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : END FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	4427617/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : INTERMEDIATE FLANGE DETAILS	OUW	VAS	DET	N/A	N/A
FALSE	4427618/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING SLEEVE DETAILS	OUW	VAS	SEA	DET	N/A
FALSE	4427619/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING RING DETAILS	OUW	VAS	SEA	DET	N/A
FALSE	442762/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET ASSEMBLY	OUW	VAS	CTL	ASD	N/A
FALSE	442763/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SERVO ACTUATOR DETAIL	OUW	VAS	ACT	HDR	N/A
FALSE	442764/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCHEMATIC LAYOUT	OUW	VAS	LYT	DIA	N/A
FALSE	442765/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CROSS SECTION	OUW	VAS	SEC	DET	N/A
FALSE	442766/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : GENERAL ASSEMBLY	OUW	VAS	ASD	N/A	N/A
FALSE	442767/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SEALING CONTROL VALVE DETAILS	OUW	VAS	SEA	CTL	N/A
FALSE	442768/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : CONTROL CABINET ASSEMBLY	OUW	VAS	CTL	ASD	N/A
FALSE	442769/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' SPHERICAL VALVES : SCHEMATIC LAYOUT	OUW	VAS	LYT	DIA	N/A
FALSE	44755/65ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : GENERAL ARRANGEMENT OF OPERATING AND EMERGENCY GATES GANTRY CRANE	CRS	GTC	GTE	GAR	N/A
FALSE	46089/A/66ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF PIPEWORK THROUGH SCOUR OUTLET TUNNEL	SRO	OUL	PWO	DET	N/A
TRUE	46111/66	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLAINWILLIAM DAM RAISING PURCHASE AREA	PPL	CON	PNS	N/A	N/A
FALSE	46209/66	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CALANWILLIAM DAM RAISING - OUTLET HOUSE PLAN DE- TAIL REINFORCEMENT	DSR	OUH	STA	REI	N/A
FALSE	46210/66	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CALANWILLIAM DAM RAISING - OUTLET HOUSE PLAN DE-	DSR	OUH	STA	REI	N/A
FALSE	46211/66	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CALANWILLIAM DAM RAISING - OUTLET HOUSE	OUH	ROO	REI	BCH	N/A
FALSE	47335/67	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS CLANWILLIAM DAM DETAILS OF PRESTRESSED CABLES	DSR	LYD	SCT	N/A	N/A
FALSE	5103/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5104/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5105/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5106/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5107/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5108/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5109/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	5110/30	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS COTOUR PLAN OF CLANWILLIAM BASIN	CON	DSM	N/A	N/A	N/A
FALSE	51751/70	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS PURCHASE PLAN FOR HOUSING SITE : CLANWILLIAM DAM	PPL	HOU	PNS	N/A	N/A
FALSE	8006/33	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER WORKS CLANWILLIAMS IRRIG. PROFILE OF WALL	IRR	WLL	N/A	N/A	N/A
FALSE	8863/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS GENERAL ARRANGEMENT OF SCOUR GATES AND OUTLETS	OUW	PWO	GTV	GAR	N/A
TRUE	89937/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89938/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89939/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89940/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89941/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89942/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	CLANWILLIAM DAM SEDIMENT SURVEY	DRT	SGR	SHY	N/A	N/A
TRUE	89959/84	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS INSTRUMENTATION DATA	DGR	INO	N/A	N/A	N/A
FALSE	9081/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF 36' OUTLET PIPES & BELLMOUTHS	OUW	PWO	BEL	DET	N/A
FALSE	9143/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS PLAN OF DAM SHOWING DETAILS OF SCOUR GATE TUNNELS	OUW	TNS	SRO	DET	N/A
FALSE	9180/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS FOUNDATION PLAN & BOLT DETAILS FOR 10'x10' SCOUR GATES	OUW	GTV	BIP	DET	N/A
FALSE	9181/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS GENERAL ARRANGEMENT OF 36' OUTLETS FOUNDATION PLAN	OUW	PWO	FDS	GAR	N/A
FALSE	9253/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF CASTINGS (GUIDES) FOR 10'x10' SCOUR GATES	OUW	GDS	DET	N/A	N/A
FALSE	9272/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF 36' OUTLETS ON DOWNSTREAM SIDE OF WALL	OUW	PWO	DET	N/A	N/A
FALSE	9628/35ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET ARRANGEMENT OF CASTINGS FOR SCOUR GATES	SRO	OUL	GTV	FRM	ARR
FALSE	9733/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF M.S. FITTINGS FOR 10'x10' SCOUR GATES	SRO	GTV	DET	N/A	N/A
FALSE	9736/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF 10'x10' SCOUR GATES	SRO	GTV	DET	N/A	N/A
FALSE	9764/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : SCOUR OUTLET DETAILS OF C.I. TOP PIECES FOR FIXED TRACK & C.I. ROLLERS FOR SIDE BRACKETS	SRO	GTV	GDS	N/A	N/A
FALSE	9808/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS GENERAL ARRANGEMENT OF OUTLETS	OUW	GAR	N/A	N/A	N/A
FALSE	9809/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF SPINDLES AND COUPLINGS	OUW	SPI	DET	N/A	N/A
FALSE	9815/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS SHOWING 36' OUTLET GATE FRAME FIXING	OUW	GTE	FRM	BIP	N/A
FALSE	9816/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS RAIL TRACK ON SPILLWAY	SPR	CRS	GTC	N/A	N/A
FALSE	9837/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF HEADSTOCK BRACKET ETC.	OUW	HST	BRG	N/A	N/A
FALSE	9842/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS PENSTOCK ROLLER GATE FRAME FOR 36' OUTLETS	OUW	GTE	FRM	PEN	N/A
FALSE	9846/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF C.I. GUIDES & LOCKING WEDGE FOR 36' OUTLET GATE	OUW	GTE	GDS	N/A	N/A
FALSE	9862/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF PENSTOCK ROLLER GATES FOR 36' OUTLETS	OUW	GTE	DET	PEN	N/A
FALSE	9910/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF SCREENS FOR 36' OUTLETS	OUW	SCN	DET	N/A	N/A
FALSE	9916/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS DETAILS OF DOORS FOR LIFTING GANTRY	OUW	CRS	DOR	DET	N/A
FALSE	9948/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS FOUNDATION BOLT LAYOUT FOR LIFTING GANTRY HOUSING (DOOR FRAMING)	OUW	CRS	FDS	FRM	LYT
FALSE	9949/34ME	E100-02	OLIFANTS RIVER GWS	CLANWILLIAM DAM	OLIFANTS RIVER GWS : CLANWILLIAM DAM : OUTLET WORKS 36' OUTLET HEADSTOCK PLAFORMS	OUW	HST	LDR	DET	N/A