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Competent person's report for the chrome and vanadium assets held by Xstrata South Africa

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20 March 2002

Dear Sirs

COMPETENT PERSON'S REPORT FOR THE CHROME AND VANADIUM ASSETS HELD BY XSTRATA SOUTH AFRICA

1. Introduction

1.1 Purpose of report

This report has been prepared by IMC Mackay & Schnellmann (IMC) for inclusion in listing particulars (the "Listing Particulars") to be published by Xstrata plc (the "Company") in connection with a global offer of ordinary shares in the Company (the "Global Offer") and the proposed admission of the ordinary shares of the Company to the Official List of the UK Listing Authority (the "UKLA") and the admission of such shares to trading on London Stock Exchange plc's market for listed securities.

IMC was instructed by the directors of the Company to prepare a Competent Person's Report for the South African chrome and vanadium assets of Xstrata South Africa (Pty) Limited ("Xstrata South Africa"). This report, which summarises the findings of IMC's review, has been prepared in order to satisfy the requirements of a Competent Person's Report as set out in Chapter 19 of the listing rules of the UKLA.

IMC has conducted its review in accordance with the requirements of Chapter 19 of the listing rules of the UKLA and, with respect to resources and reserves, the "Australasian Code for Reporting Mineral Resources and Reserves" (September 1999) published by the Joint Ore Reserves Committee ("JORC") of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and the Minerals Council of Australia (the "JORC Code"). The JORC Code establishes the nature of evidence required to ensure compliance with the code. The review was conducted with regard to the JORC Code because it is internationally recognised. In this report, all resource and reserve estimates are reported in accordance with the JORC Code and have been substantiated by evidence obtained from IMC's site visits and observation. They are supported by details of drilling results, analyses and other evidence and take account of all relevant information supplied by Xstrata South Africa's management and the directors of the Company.

In accordance with Chapter 19 of the listing rules of the UKLA, only Proved and Probable Reserves have been valued. Other chrome and vanadium assets of Xstrata South Africa, which include extensive resources, have not been included in the valuation.

1.2 Capability and independence

This report was prepared on behalf of IMC by the signatory to this report. Details of the qualifications and experience of the consultants who carried out the work are in Annex A to this report.

IMC operates as an independent technical consultant providing resource evaluation, mining engineering and mine valuation services to clients. IMC has received, and will receive, professional fees for its preparation of this report. However, neither IMC nor any of its directors, staff or sub-consultants who contributed to this report have any interest in:

- the Company or Xstrata South Africa; or
- the mining assets reviewed; or
- the outcome of the Global Offer.

Drafts of this report were provided to Xstrata South Africa, but only for the purpose of confirming both the accuracy of factual material and the reasonableness of assumptions relied upon in the report.

1.3 Scope of work/materiality/limitations and exclusions

IMC reviewed the assets in accordance with the scope of work and exclusions and limitations and on the basis of the materiality criteria set out in Annex B to this report.

Part IX Competent persons' and technical reports – South African chrome and vanadium assets

IMC has independently assessed the chrome and vanadium assets of Xstrata South Africa by reviewing pertinent data, including resources, reserves, manpower requirements, environmental issues and the life-of-mine plans relating to productivity, production, operating costs, capital expenditures and revenues.

All opinions, findings and conclusions expressed in this report are those of IMC and its sub-consultants.

1.4 Inherent mining risks

Mining and, in particular, underground metalliferous mining, is carried out in an environment where not all events are predictable. Whilst an effective management team can, firstly, identify the known risks and secondly, take measures to manage and mitigate these risks, there is still the possibility of unexpected and unpredictable events occurring. It is therefore not possible to remove totally all risks or state with certainty that an event that may have a material impact on the operation of a mine, will not occur.

1.5 Glossary of terms

Words and expressions used in this report are defined in Part X of the Listing Particulars.

2. Overview

2.1 Description of assets

IMC reviewed the following assets (**Table 2-1**) whose locations are shown in **Figure 2.**

Table 2-1 – List of assets with locations

	Date of commencement of operations
Rustenburg (W. Bushveld)	
6 ferrochrome furnaces	Start ups in 1988, 1989, 1995
1 operating chrome mine and 1 process plant – Waterval	Planned 2002 quarter 2
2 operating chrome mines and 2 process plants – Kroondal	Acquired in 1987
1 underground mine at the planning stage – Townlands	Not determined
1 open pit silica quarrying operation, for supplying smelter flux – Rietvlei	Acquired 1996
Wonderkop/Brits (W. Bushveld)	
6 ferrochrome furnaces, including two in Joint Venture with Samancor	Start ups in 1988, 1989, 1995, 2001
Wonderkop underground mine and process plant	1999
Lydenburg (E.Bushveld)	
4 ferrochrome furnaces	1977, acquired in 1998
1 underground mine and process plant – Thorncliffe	1998
Brits (Rhovan, W. Bushveld)	
1 opencast vanadium mine and plant	1990
Kennedy's Vale (Vantech, E. Bushveld)	
1 opencast vanadium mine and plant	Acquired 1992
Various undeveloped vanadium deposits	

2.2 Summary of geology

2.2.1 Chrome

The chromitite exploited by Xstrata South Africa in the Waterval, Kroondal, Wonderkop, Townlands and Thorncliffe properties occurs as reefs within the Bushveld Igneous Complex, a layered suite of ultrabasic rocks. The principal reefs are identified as LG6 and LG6a in the western Bushveld mines and as LG6 in the Thorncliffe mine. The reefs are laterally continuous in both grade and thickness: the grade is in the region of 38% to 42% Cr_2O_3, while the thickness of the combined LG6 and LG6a reefs varies from 1.7 metres to over 2 metres.

Chromitite is an almost monomineralic rock consisting mainly of chrome spinel (chromite) with accessory pyroxene, anorthite and other minerals, occurring as a series of regular layers or reefs within the ultramafic igneous complex. Waste rocks below and above the LG6/LG6a chromitite reefs are (ortho)pyroxenite, locally with basic pegmatoids and there are also cross-cutting dolerite and syenite dykes. None of these are of any particular economic significance.

There are three principal groups of chromitite reefs, known as the lower, middle, and upper groups and the individual reefs within each group are numbered from lowest to highest. Not all are of economic significance. The most important reef exploited by Xstrata South Africa in the western mines is LG6: the sixth reef in the Lower Group. This reef is split into two parts, separated by a pyroxenite waste parting (the 'middling') and is commonly referred to as LG6/LG6a. It is underlain and overlain by pyroxenite. Thorncliffe mine in the eastern Bushveld exploits a reef that Xstrata AG have identified as LG6 because of its similarities to the LG6 reef in the west. However, the geological correlation of the two is not established and the reef at Thorncliffe may actually correlate with the MG1 reef in the west. **Figure 2-2** illustrates the characteristics of the western LG6/LG6a and the eastern MG1 (known by Xstrata South Africa as 'LG6').

Part IX Competent persons' and technical reports – South African chrome and vanadium assets

Xstrata South Africa owns a silica quarry at Rietvlei near Rustenburg, supplying high-grade silica to the ferrochrome furnaces at Rustenburg. Probable Reserves are approximately 2.8 million tonnes and can be increased by pit expansions.

Figure 2-2 – Comparison between Western Bushveld LG6/LG6a reefs and the Eastern Bushveld MG1 reef (known by Xstrata South Africa as "LG6")

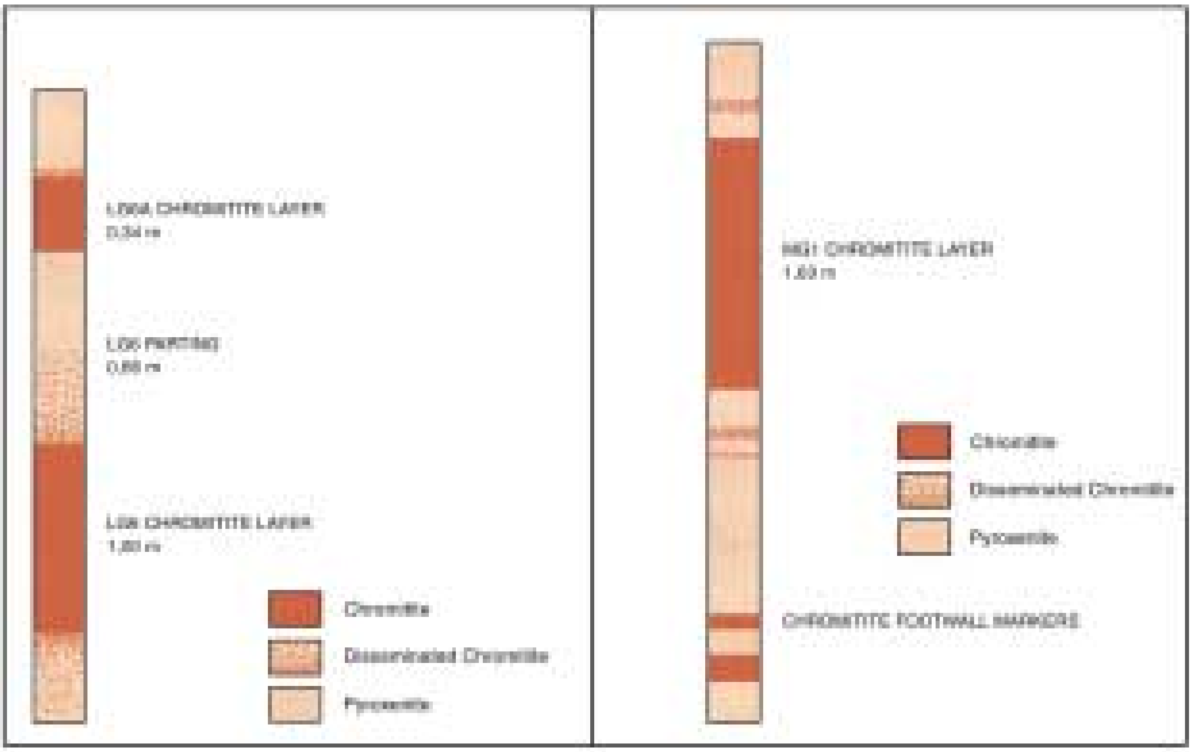

Figure 2-1, **Figure 3-3** and **Figure 3-4** are reproduced from "The mineral resources of South Africa", Wilson M.G.C., Anhaeusser C.R., eds., Pretoria: Council for Geoscience, 1998. 740pp. ISBN 1-875061-52-5.

Figure 3-5 illustrates the locations of the chrome mines in the south western Bushveld area.

2.2.2 Vanadium

The vanadium ore extracted by Xstrata South Africa at its Rhovan and Vantech operations occurs as a solid solution in titaniferous magnetite deposits within the Bushveld Complex. At Ba-Mogopa and at Steelpoortdrift, the magnetite is present in a series of discrete magnetite layers and ferrogabbros, at the contact between the Main and Upper Zones of the Rustenburg Layered suite. At Kennedy's Vale, the magnetite occurs as a magnetite plug within the lower part of a sub-zone of the main zone of the Bushveld Complex and the Mokombe deposit is a similar, but irregularly-shaped, body nearby. At Ba-Mogopa, the mineralised zone strikes for over 15 kilometres and Rhovan is mining centrally at five pits. The thickness of the mineralised zone varies from 30 metres to 50 metres with a grade of 29% to 30% magnetic fraction which, in turn, carries 1.95% V_2O_5. At Kennedy's Vale the magnetite plug is some 350 metres long and 25 metres wide. The mineralisation within the planned pit has a mean grade of 73% magnetic fraction, which carries 2.4% V_2O_5.

Rhovan is currently drilling at Ba-Mogopa and expects that this drilling will add significant resources and reserves to the current inventory. Vantech has limited reserves, but it has identified significant resources at Steelpoortdrift and sizeable mineralisation at Mokombe.

2.3 Summary of resources and reserves

Resources and reserves have been estimated according to the Joint Ore Reserve Committee (JORC) of Australia. All figures are in thousands of tonnes and are estimated as at 31 December 2001 and reserves are a subset of resources.

For chrome, the in-situ resource volume is estimated by determination of the inclined area of the reef within the licence area (adjusting unmined lease area by the dip angle of the reef) and multiplication of this area by the combined (LG6+LG6a) average reef thickness as estimated from drillhole and mining data, with an associated waste volume determined from the middling thickness not in resource. An estimate of resource tonnage has been obtained by multiplication of the estimated volume by an assumed average specific gravity (SG) of 4.1. Few determinations have been made, but an average SG of six samples at Waterval is 4.15, while a determination at Kroondal gives an SG of 4.0. The resource grade is obtained from a regional 'average' grade from borehole assays of LG6 and LG6a. The quality of Xstrata South Africa's laboratory analyses is audited independently on a monthly basis. The simplicity of this resource/reserve estimation method is permissible because of the exceptional continuity of both thickness and grade of the chromitite reefs in this region.

For the vanadium operations, block models have been produced which have been subjected to mine planning to define mineral reserves. Grades are supported by drilling and production data. Tonnage factors are derived from the direct relationship between magnetic content and specific gravity.

2.3.1 Chrome operations

Grades of chrome ore (excluding the waste 'middling' in the western Bushveld mines) are 38% to 40% for the eastern Bushveld mines, 41.7% at Wonderkop and 41.0% for the other western Bushveld mines. Specific gravity of the ore of 4.10 is assumed for all mines.

Table 2-2 – Summary of chrome reserves as at 31st December 2001 ('000 tonnes)[1]

Mine	Proved	Probable	Total
Waterval East	0	5,848	5,848
Waterval West	0	2,994	2,994
Kroondal	4,461	3,931	8,392
Kroondal Gemini[2]	0	15,882	15,882
Wonderkop	0	0	0
Townlands	0	9,851	9,851
Thorncliffe UG	3,198	2,818	6,016
Thorncliffe OP	0	2,123	2,123
Total reserves	**7,659**	**43,447**	**51,106**

(1) Reserves are presented on a total mine basis.

(2) Pursuant to a joint venture arrangement with Samancor Limited, the chrome operations are entitled to operate the Kroondal Gemini mine and utilise the ore produced from the mine for the furnaces at Wonderkop (two of which are in a production joint venture with Samancor).

Reserves are quoted after allowing for pillars and geological losses (potholes, fracture zones).

Table 2-3 – Summary of chrome resources at 31st December 2001 ('000 tonnes)

Asset	Inferred Resources	Indicated Resources	Measured Resources	Total (Measured and Indicated Resources)
Western Bushveld				
Waterval East (reserves expressed as in-situ resource)	0	8,795	0	8,795
Waterval East (pillars in mined out areas)	0	0	2,118	2,118
Waterval West (reserves expressed as in-situ resource)	0	4,662	0	4,662
Kroondal	6,260	0	0	0
Kroondal (reserves expressed as in-situ resource)	0	6,260	6,709	12,967
Kroondal (pillars in mined out areas)	0	111	1,977	2,088
Kroondal Gemini (reserves expressed as in-situ resource)	0	24,510	0	24,510
Wonderkop	12,000	6,400	0	6,400
Townlands	111,273	0	0	0
Townlands (reserves expressed as in-situ resource)	0	14,814	0	14,814
Total resources (W. Bushveld)	**129,533**	**65,551**	**10,804**	**76,355**
Eastern Bushveld (Thorncliffe area)				
Thorncliffe UG	50,170	4,238	2,914	7,152
Thorncliffe UG (reserves expressed as in-situ resource)	0	4,035	4,579	8,614
Thorncliffe UG (pillars in mined out areas)	0	0	638	638
Thorncliffe OP	0	1,508	0	1,508
Thorncliffe OP (reserves expressed as in-situ resource)	0	2,123	0	2,123
De Grooteboom	0	1,306	344	1,650
Helena	115,231	122	675	797
Total resources (E. Bushveld)	**165,401**	**13,332**	**9,149**	**22,481**
Total (East and West combined)	**294,934**	**78,884**	**19,954**	**98,836**

Resources are quoted as in-situ totals and inclusive of reserves. Resources in pillars within mined-out areas are quoted on separate lines.

2.3.2 Vanadium operations

In the estimation of resources and reserves, IMC have used appropriate cut-off grades, mining recoveries and dilution factors based on current economic factors.

Table 2-4 – Rhovan reserves as at 31st December 2001

Reserves Class	Tonnes ('000)	% Magnetic fraction	% V_2O_5 in magnetic fraction	% V_2O_5 in-situ
Proved Reserves	13,415	29.9	2.00	0.60
Probable Reserves	23,125	29.7	1.94	0.58
Total	**36,540**	**29.8**	**1.96**	**0.58**

Table 2-5 – Rhovan resources as at 31st December 2001

Resources Class	Tonnes (000's)	% Magnetic fraction	% V_2O_5 in-situ
Measured Resources	22,510	29.7	0.61
Indicated Resources	19,830	30.0	0.61
Inferred Resources	60,000		

Resources are quoted as in-situ totals (i.e. with no allowance for either mining or geological losses) and inclusive of reserves.

Table 2-6 – Vantech reserves as at 31st December 2001

Reserves Class	Tonnes ('000)	% Magnetic fraction	% V_2O_5 in magnetic fraction	% V_2O_5 in-situ	Ratio V_2O_5 in-situ
Proved Reserves	670	73.4	2.39	1.75	2.6

Table 2-7 – Vantech resources as at 31st December 2001

Asset	Resources Class	Tonnes ('000)	% Magnetic fraction	% V_2O_5 in magnetic fraction	% V_2O_5 in-situ
Kennedy's Vale Open pit	Measured	785	71.2	2.36	1.68
Kennedy's Vale Talus	Indicated	630	38.6	2.00	0.80
Steelpoortdrift	Indicated	29,200	39.7	2.02	0.80
Steelpoortdrift	Inferred	40,000			

2.4 Mines, projects and process facilities

2.4.1 Mining, processing and smelting operations

Chrome

Chromite ore is extracted from four underground mining operations on the Bushveld Igneous Complex, three near Rustenburg to the west of the complex, and one near Lydenburg to the east of the complex. Of the two mines located near Rustenburg, Kroondal is producing around 110,000 tonnes per month and Waterval is expected to start production in early 2002. Kroondal and the Gemini JV are classified as two mines by Xstrata South Africa, although both operations share the same infrastructure. Although Waterval is considered here as a new mine it is, in fact, on the site of a previous successful operation, with significant remaining ore reserves. The design capacity of the Waterval mine will be 160,000 tonnes per month of ore, once fully equipped. In the east of the complex, the Thorncliffe mine is producing around 100,000 tonnes per month.

A new mine is planned near Rustenburg – the Townlands mine. This is adjacent to the Waterval mine and, when commissioned, will have a capacity of 110,000 tonnes per month. Construction may start in 2003.

A quarrying operation west of Rustenburg produces a graded silica product for use as a flux in the company's ferrochrome furnaces.

Operations at all chrome mines are similar, the method of mining being mechanised bord and pillar. Ore is loaded onto conveyors for transport to the surface. Pillars are left in-situ as support for mining operations and to avoid surface subsidence. Owing to the stoping width (of the order of 1.8 metres), low-profile equipment is used. All operations are carried out to industry standards in a competent and professional manner.

Mining is generally within the mineral seam. Three shafts are sunk on dip (approximately 12 degrees to 14 degrees). These are a conveyor haulage shaft, access for mobile equipment and an intake airway. The mine stoping method is room and pillar. Pillars are left between the rooms. The pillars are partially recovered by cross-cuts between the drives, with the resultant pillar dimensions of 6 metres by 15 metres.

The reef is generally regular and uniform and planning of the mines is relatively straightforward. One tonne of mined ore contains about 65% chromite concentrate which is separated using conventional wet gravity concentration equipment (dense medium separation ("DMS") and spirals).

Chromite concentrate is transported by rail or road to the nearest group of ferrochrome furnaces for conversion to ferrochrome. With the plant and equipment currently available at the mines, plants and smelters, together with planned acquisitions, it is the opinion of IMC that the future production of ore, chromite concentrate and ferrochrome at the planned quality and tonnage is feasible.

Vanadium

Vanadiferous magnetite is mined from small, shallow open pits at Brits and at Kennedy's Vale. Ore is subjected to conventional crushing, grinding and magnetic separation to produce a magnetite concentrate. The magnetite concentrate undergoes a conventional salt roast/leach/precipitation process to recover saleable vanadium pentoxide (V_2O_5). Most of the V_2O_5 produced in future will be converted to ferrovanadium (FeV) alloy.

Production at Kennedy's Vale will cease in approximately 18 months and management plans to compensate by increasing production at Brits. IMC believes this to be entirely feasible.

2.4.2 Production levels

Chrome

IMC has reviewed the forecast production levels for the chrome operations and found them to be reasonable and attainable.

Table 2-8 – Summary of production from chrome operations

Year	1999	2000	2001
Total saleable mine production ('000 tonnes)	2,102.3	1,850.2	2,250.0
Ferrochrome attributable production ('000 tonnes)	969.0	1,140.0	860.6
Attributable ferrochrome sales ('000 tonnes)	1,017.1	1,028.1	836.7

Vanadium

IMC has reviewed the forecast production levels for the vanadium operations and found them to be reasonable and attainable.

Table 2-9 – Summary of production from vanadium operations

Year	1999	2000	2001
Total mined ore ('000 tonnes)	1,455	1,638	2,160
Total V_2O_5 production (tonnes)	11,260	9,858	12,894
Total ferrovanadium production (tonnes)	1,845	1,070	6,118
Total V_2O_5 sales (tonnes)	9,665	7,735	3,745
Total FeV sales (tonnes)	2,025	1,325	4,454

2.4.3 Management and human resources

During this review, IMC's consultants were in regular contact and held numerous discussions with Xstrata South Africa management at various levels. Based upon this contact and on direct observations of the operations, IMC is satisfied that Xstrata South Africa management is capable of implementing the proposed production plans.

Xstrata South Africa's policy of making business unit managers fully accountable for their operations has contributed to making Xstrata South Africa one of the lowest cost ferrochrome and vanadium producers in the world. Common operating and financial reporting formats among the operations assist in minimising overheads and permit performance comparisons between the various operations to be made.

In compliance with the Employment Equity Act, Xstrata South Africa has submitted, and has had approved, a 5-year plan for the advancement of black South African employees. Xstrata South Africa is also actively canvassing universities in an effort to attract engineering graduates.

The National Union of Mineworkers represents black mine workers at Kroondal and Thorncliffe chrome mines and at the vanadium operations. The National Union of Metalworkers represents the Wonderkop and Rustenburg smelter workers. Pay agreements are negotiated annually.

2.4.4 Health and safety

Xstrata South Africa's management is fully committed to ensuring the safety of all workers. Each facility has a full time Safety Officer responsible for the implementation of Xstrata South Africa's safety policy. The Safety Officer has line responsibility to the Business Unit Manager.

Safety and Health Committees elected out of the constituencies representing the total workforce, meet on a monthly basis with middle management. No new standards or procedures or codes of practices are introduced without consultation with the Safety and Health Committee.

Injuries in the work place form part of each business unit's monthly report and are summarised in the monthly report to Xstrata AG's executive. The Disabling Injury Frequency Rate ("DIFR") per 200,000 man-hours worked is one of the key parameters used to monitor safety performance in the mining industry.

Xstrata AG's chrome operations in 2001 had a DIFR rate of 1.5 which is approaching Industry Best Practice of 1.0. Disabling injury frequency rates at the Rhovan and Vantech vanadium operations were 3.4 and 3.2 per 200,000 man-hours respectively. The latter two rates are elevated, mainly due to the retirement of workers with respiratory conditions.

2.4.5 Transport

Xstrata AG's chrome mines and smelters can be reached via a well-developed national road and rail network. The closest Spoornet (national rail operator) station is at Rustenburg. This is connected to Xstrata South Africa owned exchange yards at the Wonderkop and Rustenburg smelters. These are used to deliver heavy capital goods and reductants to the smelters and transport ferrochrome to customers. Small quantities of ferrochrome are also transported by road. Private road hauliers are contracted by the mine to load and transport chrome ore for delivery to the ferrochrome smelters.

2.5 Environmental issues and management

A mining licence will be granted on approval of an Environmental Management Programme (EMPR) under Section 36 of the Minerals Act (Act 50 of 1991). A recent amendment to the act provides that the EMPR must also comply with the requirements of the National Environmental Management Act (Act 107 of 1998). The National Water Act requires all users to register their current use and submit applications for licenses for future use of the water.

IMC's desktop review of environmental compliance and permitting raised a number of issues requiring further monitoring, studies and changes to environmental management plans. Management stated that adequate resources had been budgeted for such work and therefore continued control of emissions to the environment within statutory limits can be reasonably expected. IMC considers therefore that there are no environmental factors likely to affect the valuation materially.

2.5.1 Rehabilitation provisions

Under the Minerals Act, the EMPR must provide an indication of the rehabilitation liabilities of the mining operations and quantify the costs of remediation. Once defined, there are two main ways in which remediation can be funded:

- provision in the annual operating budget for ongoing rehabilitation; and
- provision in terms of a trust fund for rehabilitation on closure.

Ongoing rehabilitation

Ongoing rehabilitation of the mining operations is focused on dust suppression, separation of clean and dirty water circuits and routine maintenance of tailings facilities. Management recognises that the vanadium plants have a greater impact on the environment and have allocated approximately ZAR10 million over the next five years for rehabilitation, in addition to providing for closure costs.

Closure rehabilitation

The required funding for closure is reviewed annually and **Table 2-10** shows the cost estimate for Xstrata South Africa's mining operations.

Table 2-10 Mining operations closure cost estimates

	Rehabilitation cost (ZAR millions)
Vantech	2.8
Thorncliffe	3.7
Subtotal Mpumalanga jurisdiction	**6.5**
Rhovan	5.5
Waterval East (Rustenburg)	2.1
Waterval West	0.9
Kroondal	1.7
Wonderkop	4.5
Rietvlei	1.0
Subtotal NW Province jurisdiction	**15.7**
Total	**22.2**

IMC has assessed the methodology used to determine the rehabilitation cost estimates. Operations are subdivided into areas (e.g. mine, dumps, plant etc.) and within each of these categories, calculations are made for demolition, shaping, cladding and vegetating. Current estimates appear appropriate.

Xstrata South Africa has registered a trust fund (IT 9781/1999) under the name Xstrata South Africa Rehabilitation Trust with the Master of the Supreme Court in Pretoria. Mining companies have the option of depositing funds into the trust or providing bank guarantees and Xstrata South Africa has opted for the latter.

Rehabilitation cost has been calculated for the Wonderkop mine and ferrochrome complex as it falls under the Minerals Act (by virtue of the mine) and management is continuing to operate the ISO14001 environmental management system with an outgoing clean-up of the site. Provision has not been calculated for Rustenburg and Lydenburg ferrochrome smelters as there is no legal requirement for this.

Based on the examination of documents the cost estimates for rehabilitation requirements are appropriate. Issues such as the groundwater contamination at Rhovan will be addressed as part of the operational budget over the remaining life of mine.

2.6 Statutory Authorisations

An approved mining license is required for all mining operations in terms of Section 9 of the Minerals Act (Act 50 of 1991).

IMC has reviewed applicable statutory authorisations for mines and projects and a summary of the status of mining licences is given in **Table 2-11**.

Table 2-11 Summary of mining licences

Mine	Location(s)	Mining licence no.	Expiry date
Kroondal	Portions 24,26,45,46,47,50,51	22/01	Indefinite
	Parts of 13,41,43,44		
	Portions 86, 87, 89, 90, 133, 156	Approval expected early 2002[1]	2012
	Gemini	6/01	2011
Waterval East		13/98	2017
Waterval West	Townlands 45, 97	1/01	2011
Rietvlei	Portions 90, 98	94/00	June 2002
		1/95	2005
Thorncliffe		41/95	Indefinite
Wonderkop		None existing	–
Rhovan		17/00	2006
Vantech	Mineral areas 2, 3	29/97	Indefinite

(1) During an internal review in 2000, it was identified that a number of applications submitted in 1992 had not been approved and in fact portions of the Kroondal mine had no mining licence. The application has now been resubmitted and early approval is anticipated.

In IMC's opinion:

- for each mine and relevant project, appropriate statutory authorisations are in place or awaiting approval, which is not expected to be withheld;
- management is taking appropriate steps to maintain statutory authorisations for its mines and to obtain, where needed, new statutory authorisations for assets; and
- the mines are generally being operated in accordance with statutory authorisations and are not in material breach of those statutory authorisations.

2.7 Costs

2.7.1 Operating costs

IMC examined the forecasts of operating costs for all operations, as prepared by the management of Xstrata South Africa. The forecasts were compared with actual costs in previous years and, where considered appropriate, were modified following discussion with the Xstrata South Africa management. Operating costs were incorporated into the 15-year cash flows prepared by IMC for the purposes of the valuation of the Xstrata South Africa assets.

2.7.2 Capital costs

IMC examined the capital cost estimates prepared by management for the period 2002 to 2004. Where considered appropriate small adjustments were made to the figures, again following discussions with the company's management. The capital cost estimates were also incorporated into the cash flows. Where sustaining capital expenditure was considered to be necessary beyond 2004 then this was estimated by IMC.

2.8 Risks and synergies

Section 6 entitled "Special factors" refers to aspects of the business which may materially affect IMC's valuation, such as:

- furnace reductant prices;
- electricity prices;
- potential vanadium plant worker's health compensation claims; and
- markets.

2.9 Sales and marketing

Xstrata South Africa is a major producer of both ferrochrome and vanadium products and therefore has very detailed market knowledge and expertise in both products.

70% of Xstrata South Africa's ferrochrome sales are on long-term contracts and management believe that Xstrata South Africa currently commands approximately a quarter of world market share. Valuation of any ferrochrome production plan is very dependent on the view taken of the stainless steel market. The stainless steel industry has typically demonstrated an historical 4% per annum growth rate.

2.10 Valuations of reserves

2.10.1 Methodology and assumptions

- The chrome and vanadium assets of Xstrata South Africa have been valued using the DCF method. A 15-year (or less where insufficient Proved and Probable Reserves exist), post-tax cash flow has been prepared, covering all vanadium and chrome operations.
- The cash flow valuations have been based on the budgets prepared by the vanadium and chrome operations. IMC consultants have examined the operations and consider that the production forecasts are both reasonable and achievable.
- The cash flow has been prepared in constant year 2001 money values and on an "all equity" basis. In this way, the robustness of the assets of Xstrata South Africa are valued on a stand-alone basis. The post-tax annual cash flows have been discounted at a real rate of 9.5% (approximately equivalent to a nominal discount rate of 12.5%) and the Net Present Values (NPV's) in US$ calculated.
- Cash flows generated from Proved and Probable Reserves have been estimated and valued separately. IMC do not consider it necessary to further discount the probable reserves in view of their realisation in later years of the cash flow period.
- A ZAR/US$ exchange rate of 11.00 has been used in the valuation.
- Plant and equipment has not been valued separately since this is considered an integral component in the generation of the cash flows. The residual value of equipment is considered to be zero.
- Vanadium pentoxide prices used in the model are in line with independent forecasts from Roskill Information Services Ltd. Ferrochrome prices are based on management forecasts, which are generally more conservative than independent forecasts from the Commodity Research Unit.

Table 2-12 – Base case forecast prices

Real prices		2002	2003	2004
Ferrochrome CIF	USc/lb	27.3	27.3	28.0
Vanadium Pentoxide CIF	US$lb	1.1	1.7	2.4
Ferrovanadium CIF	US$/t	7.2	9.6	12.5
ZAR/US$		11.0	11.0	11.0

2.10.2 Valuations

Chrome

The "Gemini" joint venture with Samancor – involving 85,000 tonnes per annum of ferrochrome production attributable to Samancor has been allowed for in calculating Xstrata South Africa's share of the cash flow.

The increase in mine production is forecast to come from the Waterval mine, which is currently in development.

At a real discount rate of 9.5%, the post-tax NPV of the chrome operations is US$646 million. This valuation takes into account the value added by the furnace operations associated with the chrome operations.

Table 2-13 – Chrome operations valuation

Real discount rate (%)	NPV (US$ millions)
+2%	575
+1%	609
9.5%	646
–1%	687
–2%	732

The sensitivity of the NPV (at a 9.5% real discount rate) to variations in operating costs, revenues, capital expenditures and exchange rate is summarised below:

Table 2-14 – Base case valuation of attributable chrome reserves

	Proved Reserves (US$ million)	Probable Reserves (US$ million)	Total Reserves (US$ million)
Base case valuation	97	549	646

Table 2-15 – Chrome operations sensitivity analysis

	Base case total value (US$ millions)	Operating costs (+10%) (US$ millions)	Prices (–10%) (US$ millions)	Capital expenditure (+10%) (US$ millions)	Production/ sales level (–10%) (US$ millions)	Exchange rate (–10%) (US$ millions)
NPV Valuation	646	633	474	642	578	487

Vanadium

At a real discount rate of 9.5% the post tax NPV of the vanadium operations is US$195 million. This valuation takes into account the added value of the ferrovanadium conversion operation at Rhovan.

Table 2-16 – Vanadium operations valuation

Real discount rate (%)	NPV (US$ millions)
+2%	174
+1%	184
9.5%	195
–1%	207
–2%	221

Table 2-17 – Base case valuation of attributable vanadium reserves

	Proved Reserves (US$ million)	Probable Reserves (US$ million)	Total Reserves (US$ million)
Base case valuation	82	113	195

Table 2-18 – Vanadium operations sensitivity analysis

	Base case total value	Operating costs (+10%)	Prices (–10%)	Capital expenditure (+10%)	Production/ sales level (–10%)	Exchange rate (–10%)
	(US$ millions)	(US$ millions)	(US$ millions)	(US$ millions)	(US$ millions)	(US$ millions)
NPV Valuation	195	174	153	193	172	173

2.11 Conclusions

IMC concludes from the independent technical review that:

- management's geological and geotechnical mining knowledge and understanding is of a sufficient level to support short, medium and long-term planning as appropriate;
- the mine plans appropriately consider geological and geotechnical factors to minimise mining hazards;
- Xstrata South Africa's mining equipment (either in place or planned in the capital forecasts) is suited to its mine plans and adequate for the production levels forecast;
- chrome and vanadium ore-processing and associated ferrochrome and ferrovanadium plants and other infrastructure are capable of continuing to supply appropriate quality products to satisfy the export markets at the forecast volumes and can also supply domestic markets;
- environmental issues are well managed and there are no issues that could materially impede production nor are any prosecutions pending;
- the assumptions used in estimating both capital and operating costs are appropriate and reasonable;
- capital and operating costs used in the financial models reflect the mine plans, development and construction schedules and the forecast production levels;
- special factors identified by IMC are well understood by management and appropriate action to mitigate these risks is being taken. Further, the mine plans and cost forecasts appropriately account for these risks; and
- management operate a clear and comprehensive management accounting system and are able to monitor and forecast production and cost parameters.

IMC has estimated the value of Xstrata South Africa's chrome and vanadium operations at US$646 million and US$195 million respectively, assuming a real discount rate of 9.5%, ZAR/US$ exchange rate, product prices and cost and production forecasts which are soundly based.

3. Chrome mining operations

Xstrata South Africa chrome mines are located in the eastern and western Bushveld complexes near the towns of Kroondal and Lydenburg respectively in the North-West Province of South Africa. A map showing the positions of these mines can be found below (**Figure 3-3** and **Figure 3-4**).

3.1 Waterval

3.1.1 Geological characteristics

These mines exploit the LG6/LG6a reefs. Here the reef consists of approximately 1.0 metre LG6, 0.4 metres pyroxenite 'middling' and 0.25 metres LG6a – as measured during a mine visit (Waterval West) by IMC on 4 December 2001 and estimated during a mine visit (Waterval East, Purity section) by IMC on 12 December 2001 – but the thicknesses vary across the mine area. The reef dips north-eastwards at approximately 10 degrees north-eastward in the area of new development, and about 12 to 14 degrees in the old Waterval East and Waterval West areas. Between these established mine areas and the new areas to be mined there is a zone of disturbance, spatially associated with a 20 metre thick dolerite dyke (which trends south-east by north-west) and with downward displacement on the northern side. The rocks in this zone of disturbance are heavily fractured with close-spaced joints.

3.1.2 Maps and plans

Relevant maps and plans are included below (**Figure 3-1** and **Figure 3-2**). A general map showing the locations of all the western area chrome mines is provided in **Figure 3-4**.

3.1.3 Resource and reserve statement

Estimates of tonnage and grades

Waterval East has total Probable Reserves of 5.8 million tonnes of mineable chromitite (after allowing for pillars and geological losses).

According to Xstrata South Africa, Waterval West has an in-situ Indicated Resources of 4.5 million tonnes. IMC is satisfied that the mining and processing plans allow this to be upgraded to Probable Reserves of 3.0 million tonnes after allowance for pillars and geological losses.

The boundary between Waterval West and East mines has yet to be fixed and thus reserves might be transferred from one to the other. Note that as resources and reserves are established within Townlands A section (see Section 3.4.1 and **Figure 3-6**) these can be mined from Waterval West mine.

Expected recovery and dilution factors

Resource or reserve tonnage in unmined areas is adjusted for causes of loss.

The mining method leaves a substantial tonnage in supporting pillars. This is recorded as a measured resource. In the future, the tonnage of material in pillars will be dependent on the mining geometry adopted. Xstrata AG estimate that this averages 30% of total in-situ tonnage. It is subtracted from the resource and reserves figures. The extent of this loss will depend on geotechnical conditions and pillar design. There are losses due to geological problems such as potholes and minor faulting. This amounts to a 5% reduction in resource and reserves. Xstrata AG state that almost 100% of the identified reserves are mined. IMC concur with this statement.

3.1.4 Long-term prospects

There are inferred resources totalling an estimated 111 million tonnes in Townlands section 'A' ("Townlands A").

If Waterval West mines half of Townlands A at the anticipated mining rate the mine life will be 30 years. Some of the LG6/LG6a reef of Townlands A has a depth of more than 400 metres which makes the economics of mining it questionable.

3.1.5 Mining

Mines and plants follow ISO9001 quality procedures for training, but have not been accredited.

All production has so far come from the "Purity" section of Waterval.

There is no production from the Waterval East section, but the shafts are being advanced. Production will start in early 2002. Limited production from Waterval West will start during the first quarter of 2002.

The East section is forecast to produce 60,000 tonnes per month run-of-mine (ROM) ore in year 2002. Fully developed, the West section's estimated capacity will be 100,000 tonnes per month by mid 2003.

The mine is assumed to increase production to 900,000 tonnes per annum in 2007 and continue at this rate after this date. This production rate is less than the installed capacity of the mine.

Production from the Waterval mine after 2007 will come from the adjacent Townlands A minerals area. Based on the mine equipment seen, the production rates and proposed utilisation factors, these scheduled rates are achievable.

3.2 Kroondal

3.2.1 Geological characteristics

The mine exploits the LG6/LG6a reef. The total thickness is approximately 1.8 metres including LG6 (1.0 metres), the waste middling (0.5 metres) and LG6a (0.3 metres). The reef in this mine dips at an angle of about 8 to 10 degrees to the north.

There are features known as 'potholes' (less than 10 encountered so far) in which the reef appears to flex downwards in an oval or circular structure. Potholes are the principal reason for defining the 'geological loss' discussed below.

Down-dip from the existing central Kroondal workings, the pyroxenite middling increases in thickness, to a maximum of 2 metres beyond the limits of the Anglo American Platinum Ltd Northern lease (and hence beyond the area currently expected to be worked by Xstrata AG).

3.2.2 Maps and plans

The licence areas are shown in **Figure 3-7**.

3.2.3 Resource and reserve statement

Estimate of tonnage and grades

Kroondal mine (excluding the Gemini project area) has Proved Reserves of 4.5 million tonnes and Probable Reserves of 3.9 million tonnes of mineable chromitite (both after allowing for pillars and geological losses) in the Farmers, Anglo American Platinum Ltd Royalty and Northern Royalty areas.

Xstrata AG had identified 2.2 million tonnes in-situ (1.4 million tonnes after losses) of indicated resource in the Farmers Area. IMC is satisfied that the mining and processing plans allow this to be upgraded to a Probable Reserve and it is included in the reserves figures reported above. In the Gemini joint venture area, Xstrata AG reports a further 15.9 million tonnes of reserves owned by Samancor. IMC is satisfied that there is an adequate mining and processing plan and that these reserves can therefore be classified as a probable reserve. All of the reserves can be mined by Xstrata AG, subject to 20,000 tonnes per month required for supply to Samancor in fulfilment of Xstrata AG's obligations under the joint venture agreement.

Expected recovery and dilution factors

Recovery and dilution factors are as described in Section 3.1.3.

3.2.4 Long-term prospects

There are significant inferred resources of 6.3 million tonnes in the middle group (Mb) seams above the LG6/LG6a currently being worked. Xstrata AG has no current plans to prove or exploit these.

With the negotiation of the Gemini joint venture there is potentially a longer term future for the Kroondal mine, with a possible extension of the mine life to 20 years at a production rate of 110,000 tonnes per month.

3.2.5 Mining

Kroondal is a producing mine, with a demonstrated capacity of 110,000 tonnes per month of ROM ore. The Kroondal mine extracts reserves and resources from both the Kroondal and the Gemini sections. Average production in 2001 has been 85,280 tonnes per month.

IMC considers the planned production rates to be achievable.

3.3 Wonderkop

3.3.1 Geological characteristics

The Wonderkop mine exploited chromitite reef LG6/LG6a. However, it is understood that the principal reason for closure was the instability of the pillars resulting from local alteration of the 'middling' waste to a soft montmorillonite-clay. This resulted in extensive pillar failures in the mine and resultant loss of integrity of the roof spans.

3.3.2 Resource and reserve statement

Because of the closure of the Wonderkop mine and the anticipated difficulty of reopening, none of the chromitite can be classified as reserves. According to Xstrata South Africa's estimates, (with calculations verified by IMC), there are 6.4 million tonnes of Indicated chromitite Resource remaining in-situ, given an assumed specific gravity of 4.1.

The grade of this chromitite has been estimated by the company on the basis of a grade of 41% Cr_2O_3.

3.3.3 Long-term prospects

According to Xstrata AG there are large inferred resources: an estimated 12 million tonnes of chromitite in the MG reefs in ground owned by Xstrata AG at Wonderkop.

3.3.4 Mining

The underground mine at Wonderkop is not currently operating. The mine has a similar layout to the Kroondal mine. Since removing the pumps, the mine has flooded to about 10 metres vertically from surface. There are currently no plans to re-establish this operation.

3.4 Townlands Underground mine project

3.4.1 Geological characteristics

The geology of the Townlands area is similar to the Waterval area (Section 3.1.1). The LG6/LG6a reef dips westwards at 7 degrees to 12 degrees. There is a known fault zone and dolerite dyke, which has been encountered in both Waterval East and West and which extends into Townlands A. A north-east by south-west fault, with throws of 2 metres to 4 metres, was extrapolated from adjacent platinum workings in the Merensky reef by D. Macleod (1995).

3.4.2 Maps and plans

A plan of the Townlands A and B1 licence areas is shown in **Figure 3-6**.

3.4.3 Resource and reserve statement

The LG6/LG6a chromitite in Townlands B1 is classified (calculations verified by IMC) as a Probable Reserve of 9.9 million tonnes, with an assumed specific gravity of 4.1 and after subtraction of 33.5% for mining losses (pillars) and estimated geological losses (potholes, dykes, and faulting).

The grade of this chromitite has been estimated by the Company at 41.7% Cr_2O_3.

3.4.4 Long-term prospects

Townlands A has a mineable surface area of 20 million square metres and hence a substantial Inferred Resource (see **Figure 3-5**), estimated at 111 million tonnes. Subject to confirmation of the resource, Xstrata AG plans to extract half of these resources through the proposed Townlands mine and half through Waterval West mine.

The LG6/LG6a reef over much of Townlands A has a depth of more than 400 metres and therefore there could be some doubt over the economics of working it.

3.4.5 Mining

The Townlands mine is the subject of a pre-feasibility planning study. The mining operation will be similar to Xstrata AG's existing operations in layout and mining method.

A production capacity of 110,000 tonnes per month of ROM ore is planned. Mining conditions are likely to be similar at Townlands to those at Waterval. Therefore, Townlands' production is expected to reach the planned tonnage.

Xstrata AG management estimate that there is a lead-time of 20 months to construct and prepare a mine for production. Mine construction could start at the beginning of 2003.

3.5 Rietvlei Silica quarry

The Rietvlei Silica quarry is situated 5 kilometres north-west of Rustenburg. Silica is obtained from a quarry in a prominent Silica ridge striking approximately north-south. The ore is crushed down to various size fractions. The bulk of the product supplies the ferrochrome furnaces of Xstrata AG in Rustenburg and Wonderkop.

3.5.1 Geological characteristics

The Magaliesburg Formation consists of quartzites (often recrystallised) and shales varying in thickness from 500 to 3,800 metres. The formation forms a very resistant, prominent topographical ridge.

At Rietvlei, the quartzite dips towards the east and north east varying between 32 degrees and 62 degrees. The Magaliesburg Formation forms the immediate floor to the Bushveld Igneous Complex. The quartzites vary in grain size from fine to coarse grained.

3.5.2 Resource and reserve statement

The reserves have been estimated from the 1,340 metres level up to the topographical surface.

Indicated Resources inclusive of reserves	30,378 ('000 tonnes)
Probable in-situ Reserves	22,783 ('000 tonnes)

The reserve estimate is based on an estimated recovery of 75%.

IMC is satisfied that there are sufficient reserves of silica in Rietvlei to meet the future requirements of the Xstrata AG furnaces for at least 15 years.

3.5.3 Mining

Rietvlei is a quarrying operation and processed to provide a silica product for use as a flux in Xstrata AG's ferrochrome furnaces. The quarry currently produces around 15,000 tonnes per month of product.

3.6 Thorncliffe

3.6.1 Geological characteristics

The Thorncliffe mine is situated in the eastern Bushveld. The geological correlation of chromitite reefs in the eastern Bushveld with those in the western Bushveld is uncertain. However, the most important reef in the Thorncliffe mine has the appearance and similar properties to LG6/LG6a in the western mines and is also known as LG6. A significant difference, however, is that the LG6 seam itself is considerably thicker than in the west, while LG6a (if it can be considered at all) is much thinner and the pyroxenite middling contains disseminated chromite.

Although thicker than in the western Bushveld mines, the LG6 chromitite contains lenticles of pyroxenite. It also has a poikilitic texture, with enclosed crystals of pyroxene, suggestive of a higher internal waste content – though the overall chromitite grade at 38% to 40% Cr_2O_3 is not significantly lower than in the western mines. In places, it is also cut by pegmatoid intrusions – identified by a lighter colour.

3.6.2 Maps and plans

A plan of surface rights in the Thorncliffe licence area is shown in **Figure 3-8**. Xstrata South Africa own all of the mineral rights within the entire area indicated. Xstrata South Africa also owns chrome rights on the De Grooteboom and Helena farms.

3.6.3 Resource and reserve statement

Estimates of tonnage and grades

A total thickness of LG6/LG6a and waste was measured underground by IMC at 2.4 metres, of which 2.0 metres was identified as the main LG6 reef.

Thorncliffe mine has Proved Reserves of 3.2 million tonnes (mineable) in the LG6/LG6a reef and Probable Reserves of 2.8 million tonnes mineable underground. There is further Probable Reserves of 2.1 million tonnes available for opencast exploitation adjacent to the Thorncliffe mine.

Measured Resources of 2.9 million tonnes of in-situ chromitite (with an estimated 410,000 tonnes of internal waste) plus Indicated Resources of 8.8 million tonnes in-situ have also been identified down-dip from the current mine.

There is also 343,000 tonnes of Measured Resources and 1.3 million tonnes of Indicated Resources in the de Grooteboom 373,000 tonnes property to the north of Thorncliffe, as well as 675,000 tonnes of in-situ Measured Resources and 122,000 tonnes of in-situ Indicated Resources on the Helena 6JT farm to the south of Thorncliffe. None of these figures allow for possible geological or mining losses.

Chromitite grades of the reserves and resources are reported to vary within a narrow range of 38% to 40% Cr_2O_3.

Expected recovery and dilution factors

Resources in unmined areas must be adjusted for two causes of loss.

The tonnage of material to be left in pillars during future mining is dependent on the mining geometry adopted. According to the Xstrata South Africa's own estimates, this represents about 28% of total in-situ tonnage.

Secondly, there are losses due to geological problems such as the potholes and minor faulting. At Thorncliffe a 3% reduction in resource estimates is included for this.

There is inevitably some dilution during mining as a result of a mixture of waste from the hangingwall. However, because of the contrast in physical properties of the chromitite (which tends to be friable and breaks into small pieces) and the waste rock (which is tough and breaks into large blocks), any waste which has been loaded with the ore can be removed manually at the loading point on the conveyor.

3.6.4 Long-term prospects

There are significant Inferred Resources estimated at 50 million tonnes by Xstrata South Africa, in the LG6/LG6a, MG and UG2 reefs (the latter containing also platinum values owned by Xstrata South Africa). There are also very significant Inferred Resources on the adjacent Helena property, estimated at 115 million tonnes, on which Xstrata South Africa owns the chrome mineral rights.

Xstrata South Africa is in the process of re-opening an existing exploration adit on the UG2 reef on the Thorncliffe property with a view to evaluation of the UG2 potential for both chrome and platinum extraction.

The existing Thorncliffe mine has many years of potential development. It is currently constrained between two parallel dolerite dykes trending north-north-east to south-south-west, but there is no reason why the mine should not be extended laterally across either or both of these to access further resources.

3.6.5 Mining

Thorncliffe mine is a producing underground mine, with a capacity of 110,000 tonnes of ROM ore per month. The ore is delivered to the adjacent Thorncliffe processing plant. Average monthly production in 2001 was 91,911 tonnes.

It is reasonable to assume that once the mine plan has been extended, present resources will be transferred to the reserve category for production to continue after this estimated period of 5 years. The type of equipment seen at the mine is adequate to meet planned production rates.

4. Chrome furnace operations

There are two smelting operations in the Rustenburg region, namely Rustenburg and Wonderkop.

The Lydenburg smelting operation is fed mainly from the Thorncliffe mine near Steelpoort. Ore is also purchased from outside the Group by all smelters when low cost supplies become available. The principal features of each smelting plant are:

- receiving raw materials, storage and blending;
- furnace operations;
- separation of metal from slag, casting, crushing and screening;
- processing of slag for recovery of metal; and
- product storage and despatch.

All furnaces and auxiliary equipment are connected to dust collection facilities. Each plant has its own accredited ISO14001 environmental management system and ISO9001 quality management systems which support both furnace efficiency and customer requirements.

4.1 Wonderkop

4.1.1 Production schedule

The Wonderkop plant has the installed capacity to produce 514,800 tonnes per annum of ferrochrome, of which 85,800 tonnes per annum is attributable to Samancor under the Gemini Joint Venture agreement. A further 30,000 tonnes per annum of metal is recovered from slag, of which 10,000 tonnes per annum is saleable. Only limited capital is required for repair and replacement items in the operating furnaces to achieve the planned increase in production from 282,152 tonnes in 2001 to 432,000 tonnes in 2004.

4.1.2 Plant and equipment

Wonderkop has six 45MVA furnaces, each with a capacity of 85,800 tonnes of ferrochrome. Furnaces 5 and 6, built in 2001, operate in a production joint venture agreement with Samancor who shared equally in the capital cost of the expansion and receive half the production at the joint venture's cost of production.

Raw materials including chromite concentrate, reductant and flux are delivered by rail and truck. Coals and chars are sourced from the Witbank area and local coke from Vanderbijlpark, about 250 kilometres away. The only rail deliveries are coke imported from Zimbabwe and China, the latter through Richards Bay, and anthracite from Swaziland.

Feedstock is prepared in two types of agglomeration unit. The pelletising plant was built to agglomerate the UG2 (platinum mine tailings) concentrates. The pelletising process includes drying, milling, binder addition, balling and induration. While the plant is maintenance intensive, availability above 95% has been achieved. A third dryer is being installed to improve plant performance. The plant currently achieves a production of 35,000 tonnes per month of pellets.

The block-making plant, has a capacity of 360,000 tonnes per annum and is a flexible agglomeration unit, which combines the elements of in-plant fines recycling with size enlargement of UG2 concentrates. Cement is used as a binder.

Product crushing and screening operations are on a campaign basis with specific reference to customer requirements for chemistry and sizing. Approximately 10% of feed to the crusher is reduced to less than 10 millimetres, a size fraction which is sold at a discount to the price of lump product. In addition to the prime quality products that meet the 1% maximum slag specification, there are also products recovered from slag which typically contain between 2% and 3% slag.

Metal recovery from slag is approximately 30,000 tonnes per annum.

Samples of finished product for shipment are taken using an automatic sampler according to ISO sampling standards. The plant has its own laboratory that provides analytical support to the production department and which verifies shipment quality.

The baghouse dust is slurried, treated with ferrous chloride solution to prevent the release of hexavalent chromium and then pumped to a double plastic-lined tailings dam fitted with a leak detection system. Treated water is recycled to the process.

Most reductants are brought into the complex owned siding by rail where they are off-loaded by grab. In future, to facilitate reductant off-loading, a rail car tippler mechanism is being installed along with a conveyor to the storage area.

Rail wagons are marshalled using three Xstrata South Africa-owned locomotives. Track is maintained by contract labour.

ESKOM supplies its electricity via the national grid to a transformer sub-station located on the site of the Wonderkop smelting operations. The incoming ESKOM voltage of 88 kilovolts 50 Hertz is transformed to 33 kilovolts via five transformers, two of which are dedicated to the two new furnaces. Load capacity is 400 megavolt amperes. Maximum demand has been set at 310 megavolt amperes.

Wonderkop smelting facility transforms the 33 kilovolts incoming ESKOM feed to 11 kilovolts and 380 V 3 phase for distribution within the complex. Flexibility of the internal network enables the power to be switched to any of the six furnaces units.

The Rand Water Board supplies the make-up water for the Wonderkop complex. All other water used in the operation is re-cycled water.

4.1.3 Environmental

There is an informal settlement downwind of the plant and an air monitoring programme is planned for implementation shortly. Management intend to review the validity of the risk assessment.

4.2 Rustenburg

The six furnaces comprise one of 45 megavolt amperes, two of 40 megavolt amperes and three of 33 megavolt amperes with a total ferrochrome production capacity of 430,000 tonnes per annum, including the slag recovery plant. One of the two ex-CMI furnaces has been converted to a slag cleaning operation under contract to Anglo American Platinum Ltd.

4.2.1 Production schedule

Furnaces 1,2 and 3 could be modified to produce approximately 75,000 tonnes per annum extra. Any increase in the capacity of Furnaces 5 and 6 would require considerable modifications. A pelletising and pre-reduction project for Rustenburg has been approved and the first phase is expected to be in operation by March 2003. This would supply agglomerated feed with a degree of metallisation.

The Rustenburg plant produced 186,808 tonnes of ferrochrome in 2001 but has the capacity to produce 430,000 tonnes per annum. A further 10,000 tonnes per annum of metal will be produced after the completion of the Anglo Platinum slag treatment project. The capital required for repair and replacement is higher than Wonderkop to maintain this level of productivity. Furnace capacity expansion is not possible, but the introduction of more agglomeration equipment will enhance productivity.

4.2.2 Plant and equipment

There are two block making plants, both using the same equipment as at Wonderkop. The first plant has a capacity of 220,000 tonnes per annum and the second of 360,000 tonnes per annum. The blocks produced at Rustenburg incorporate a small percentage of pebbles, which permits the cement addition to be lowered by 2%. As at Wonderkop, the block plants provide a convenient means to recycle in-plant fines and add UG2 concentrates into the process. The second block plant is being modified under the Anglo American Platinum Ltd contract to make the two lines completely independent, such that PGM slags can be agglomerated.

The handling of metal from the furnace to its final saleable form is the same as for Wonderkop.

The metal recovery from slag processing is different from Wonderkop. A new plant utilises the existing primary jaw crusher, storage bin and primary screen. From this point the equipment is new and under commissioning. Three parallel lines treat the three sizes separately and generate saleable metal, which is delivered to the finished product yard and "skrot" or contaminated metal, which is recycled to the furnaces. The reject streams from the jigs are treated with ferrous chloride solution to reduce any hexavalent chromium present and transported to the slag dump. There is an old slag dump at Rustenburg which is expected to be reprocessed by mid-2003 and the ex-CMI slag dump by mid-2006. After this, current arisings of slag will be the sole feed. The performance of this plant is still to be proven.

Gas handling systems and product despatch are the same as for Wonderkop.

A small mechanical and electrical repair facility is maintained to handle the day-to-day plant maintenance. All major machine shop, fabrication work and large component repairs are sub-contracted to approved local companies. The Rustenburg smelter operates a railway exchange siding for ferrochrome deliveries and receipt of reductants (coke). Maintenance of the track and the overhead transmission system is contracted out.

A basic planned maintenance programme is in place covering all major equipment. Record keeping is diligent and management's control of costs is good.

The Rustenburg smelter has power supply agreements with both ESKOM and the Rustenburg Municipality. Sufficient flexibility exists within the internal electrical network to maintain power to the different furnaces under various operating scenarios.

No significant ESKOM power failures were experienced in 2001.

4.2.3 Environmental

Semi-quantitative measurements taken within the plant area in 2000 indicated that certain areas were out of compliance, including NO_x and SO_2 measurements in the baghouses. IMC share management's view that the measurements are probably suspect as the Wonderkop baghouse system, which is similar to that at Rustenburg, is operating in compliance. Management intend to re-analyse gases by a quantitative method.

4.3 Lydenburg

The Lydenburg plant was originally a two furnace operation started in 1977 using a technology supplied by Showa Denko of Japan. Xstrata South Africa purchased the Lydenburg assets and the associated Thorncliffe mine in 1998.

4.3.1 Production schedule

The Lydenburg plant has a rated capacity to produce 354,800 tonnes per annum of ferrochrome, with a bias towards low silicon granulated product. A further 24,000 tonnes per annum of metal can be extracted from the slag, of which approximately 10,000 tonnes per annum is saleable. Production in 2001 was 391,649 tonnes of ferrochrome. The capital required for repair and replacement is slightly higher than for the furnaces at Rustenburg and Wonderkop.

4.3.2 Plant and equipment

Half of all raw materials including all ore is delivered by road and the remainder by rail. The coals and chars are sourced from the Witbank area and local coke from Vanderbijlpark, about 200 kilometres from Lydenburg. Anthracite is sourced from Xstrata South

Africa's captive Maloma mine in Swaziland and bentonite from Mozambique. Fluxes are available local to the plant. Electrical power is supplied from the grid from ESKOM.

The pellets are heated in a rotary kiln to a temperature of about 1,200°C using pulverised coal as the fuel with oxygen enrichment to boost productivity. The two kilns have the combined capacity to produce about 60 tonnes per hour of pellets with 40% metallisation, or about 450,000 tonnes per annum at an availability of 85%. The hot metallised pellets are blended with fluxes and reductants and fed directly to the No. 1 and 2 furnaces. Surplus pellets are quenched and stored for use during periods of kiln maintenance. Some of the cold pellets are incorporated into the batch to No. 3 and 4 furnaces.

The Lydenburg plant was designed to granulate most of the hot metal. However, the market requires the low silicon levels unique to the Lydenburg process in both a lump and granulated form.

The slag processing plant at Lydenburg was commissioned in August 2000 for the dual purpose of metal recovery and to treat hexavalent chromium from dusts which had in the past been dumped with the slag. The process includes crushing and screening, followed by jigs and spirals. The reject stream is treated with ferrous chloride solution to reduce the hexavalent chromium. The capacity of the plant is 100,000 tonnes per annum of slag and is expected to yield 2% to 3% metallics. About 50% is current slag and the rest will come from the old slag dumps, which should be reprocessed in eight years. The jigs and spirals produce both saleable metal which is delivered to the finished product yard and skrot, which is recycled to the furnaces.

Furnaces 1, 2 and 3 are connected to wet venturi scrubbers while No. 4 furnace is connected to a dry gas cleaning system such as at Wonderkop and Rustenburg. The advantage of wet gas scrubbing is that the furnace gas retains its calorific value and may be used in-plant as a fuel source. The venturi sludge and baghouse dust are slurried, treated with ferrous chloride solution and then pumped to the tailings dams.

The Lydenburg plant has the capability to produce an extra low silicon alloy. Limited capacity exists in South Africa for producing this quality, including at the Rustenburg and Wonderkop plants. The market for low silicon alloy is more secure, such that the Lydenburg plant may well be needed to operate at full capacity in weak markets.

Despatch of finished products is usually by rail. The products are transferred by front-end loader, from where the shipment samples are collected. The plant has its own ISO17025 certified laboratory which provides analytical support to the production department and which verifies shipment quality.

4.3.3 Environmental

Prior to Xstrata's purchase of the Lydenburg operations in 1998 there was evidence that groundwater contamination had taken place in the vicinity of dams 10, 11 and 12. The extent of the contamination was extremely localised with no impact on adjacent landowners.

Subsequent to the acquisition of the Lydenburg operations Xstrata initiated a detailed geo-hydrological study in order to properly define the source and extent of the contamination. The ongoing results of the study indicate that the current level of contamination is below South African statutory limits. Notwithstanding this Xstrata continues to apply neutralising agents to the above dumps in order to prevent any further contamination.

Xstrata South Africa management continually review their environmental management plan in the light of ongoing results obtained from the geo-hydrological modeling study.

5. Vanadium mining, processing and conversion operations

5.1 Rhovan

5.1.1 Geological characteristics

The vanadium occurs as vanadium pentoxide, V_2O_5, in solid solution in magnetite in a series of vanadiferous titaniferous magnetite seams and magnetite-rich ferrogabbro layers at the base of the Upper Zone of the Rustenburg igneous layered suite of the Bushveld Complex. This mineralised zone, which is some 30 metres to 50 metres thick, lies between the Anorthosite at the top of the Main Zone and the Main Magnetite Seam at the base of the Upper Zone.

This mineralised zone extends at surface or under shallow cover for a strike length of between 15 and 17 kilometres, within the Mining Licence. The zone strikes east west and dips at between 10 degrees and 42 degrees to the north. It shows some local folding with the strike swinging more north to south and dipping to the east. The zone is broken up by sets of cross-cutting diabase dykes and faulting, with minor pegmatoid intrusions.

Rhovan has divided the mineralised zone into the lower zone sequence, which sits on the anorthosite footwall and the intermediate zone. The lower zone is composed of the footwall seam, the footwall sub-zone, the boulder sub-zone and the hanging-wall sub-zone. The intermediate zone begins with the low-grade ore sub-zone, a waste layer, the Lucky Strike, another waste layer and the top the intermediate seam. At surface the magnetite-rich rocks have weathered to form deposits called talus.

5.1.2 Maps and plans

Figure 5-1 shows the Rhovan mining licence

Figure 5-2 shows the reserves and resources at the Rhovan opencast site.

5.1.3 Resource and reserve statement

Estimates of tonnage and grades

A statement of Rhovan's reserves and resources as at 31 December 2001 is shown in **Tables 2-4** and **2-5**. Rhovan has converted a proportion of the mineral resources to reserves by applying mining, metallurgical, and economic factors based on operating experience since 1992 and current market conditions.

Shallow Probable Reserves in Pit 1 could be upgraded to Proved Reserves once their extraction has been planned in more detail. The Probable Reserves include 2.1 million tonnes of talus, which can be blended in during production.

IMC has independently estimated and confirmed the mineral resources in Pit 5. If any of the criteria changes then the reserves can change either by the addition of currently marginal material or by the removal of material that is no longer economic.

Expected recovery and dilution factors

A mining recovery of 97.5% and a mining dilution of 5% were applied. The mining recoveries are high since the footwall contact has a very distinctive boundary. The dilution is mainly a result of inclusion of sub-grade mineralisation as either included waste or from the hanging wall. The SG has been determined for 248 samples with a range of magnetic content. These results have been used to calculate a formula to show the relationship between magnetic content and specific gravity. The average SG used to determine the reserves for Rhovan was 3.38.

5.1.4 Long-term prospects

At Pit 5, drill data, which is not yet modelled, could increase the tonnage of shallow mineral resources, which would require limited planning to add it to the Proved Reserves. The current infill drilling of the down dip extension of Pit 2 could result in a significant increase in the Probable Reserves.

In the remainder of the licence area, including the Pit 3 site, Rhovan has estimate Inferred Resources of some 60 million tonnes.

5.1.5 Mining, processing and conversion

Production schedule and comment on extraction rates

The mining schedule is based on ore production from Pit 5 for 2002 and 2003. The down dip extension of Pit 5 will provide ore for 2004. Increased waste removal is planned for by increasing the use of contracted mining equipment.

The vanadium production facilities at Rhovan consist of conventional vanadium pentoxide (V_2O_5) and ferrovanadium (FeV) plants. The latter entered commercial production in November 2000 with sales commencing in June 2001.

Run-of-mine ore is crushed and conveyed to a 5 megawatt autogenous grinding mill fitted with a pebble crusher and operating in a closed circuit with cyclones. Magnetite is separated from the ground material in low-intensity magnetic separators, followed by regrinding in a ball mill and a second stage of magnetic separation. Magnetite concentrate is filtered and stockpiled under cover prior to being blended with sodium carbonate flux and roasted in a coal-fired kiln.

The resulting calcine is conveyed to one of three leach dams that are used to recover the vanadium bearing solution. Barren solid residue is mechanically scraped from the dams and conveyed to the calcine stockpile.

Silica is removed from the pregnant solution by addition of aluminium sulphate, followed by filtration. Ammonium metavanadate is precipitated from the clean pregnant solution by addition of ammonium sulphate, then filtered. Ammonia is driven off in two electric kilns to form V_2O_5 powder that is then melted in an electric furnace to form V_2O_5 flakes.

V_2O_5 flakes form the feed for the ferrovanadium process where V_2O_5 is reacted with aluminium, iron and lime in an exothermic process to produce FeV ingots and an alumina slag.

Plant production is scheduled to approximately double over the period 2002 to 2004 following the closure of the Vantech operation.

Electrical power is supplied through the grid by ESKOM while the kiln is fuelled by coal.

Plant and equipment

The combined existing Rhovan and Vantech mining fleet will not be capable of achieving the production requirements from 2004 and management intend to continue with their hire/lease policy or bring in contract mining for waste removal.

The V_2O_5 plant is in generally satisfactory condition with some sections having been renewed within the last 4 years, including the autogenous grinding mill, de-ammoniator section and flaking wheel. One exception is the sulphuric acid storage tank foundations which have subsided, probably due to contamination. Management state that measurements have been made to confirm the integrity of the tank.

Environmental

Groundwater contamination on site is severe. Preliminary data suggests sulphate concentrations of up to 123,000 milligrammes per litre adjacent to the scrubber dams and 8,000 milligrammes per litre off site. The extent of the contaminated plume has recently been defined and mitigation options include those currently being undertaken at Vantech such as pumping to evaporation ponds. The potential liability for groundwater pollution is of concern and while it is not affecting adjacent users currently, management intend to define clearly end land use and resultant ground water qualities. Over the last four years, management have taken a responsible approach to reducing new groundwater contamination by sealing roads and plant foundations and installing lined evaporation ponds for contaminated water. Management intends to continue this approach over the life of the mine which will limit the liability for final closure.

The North West Province Air Pollution Officer is reported to be considering changing the compliance criteria in the air pollution certificates. Some discussions which have taken place indicate that these changes will affect the overall operations. The extent of this potential liability has not yet been determined and with the new atmospheric pollution act coming into place in 2002, there will be increased pressure on compliance. This could have cost implications if negotiations to maintain current standards fail and additional air pollution control equipment is required.

5.2 Kennedy's Vale (Vantech)

5.2.1 Geological characteristics

The Kennedy's Vale deposit is a pipe-shaped body within the lower part of the main zone of the Bushveld Complex. The V_2O_5 occurs in solid solution in coarse-grained titanomagnetite, which occurs in massive irregular lenses in a magnetite pyroxenite, some 350 metres long and some 25 metres wide and tapers at depth. This magnetite body is enclosed within a marginal grade envelope of magnetite pyroxenite, which is within an outer envelope of ultra coarse-grained pegmatitic pyroxenite. The orebody has been interpreted as a replacement of a pegmatoid or the result of slumping of magnetite from the base of the upper zone of the Bushveld Complex.

The Steelpoortdrift prospect has a similar setting to the mineralisation at Rhovan. The vanadium occurs as vanadium pentoxide, V_2O_5, in solid solution in magnetite in a series of vanadiferous titaniferous magnetite seams and magnetite rich ferrogabbro layers at the base of the Upper Zone of the Rustenburg suite of the Bushveld Complex.

This zone subcrops beneath a layer of talus and it dips at 10 degrees to 12 degrees to the south-west. Vantech has concentrated on a 1,000 metre section in the south that is favourable for mining.

On the De Goedverwachting farm, Mokombe Hill contains a vanadiferous magnetite body, which lies below the Kennedy's Vale body in the Bushveld sequence. It displays a finely layered texture but it has not been possible to interpret its structure.

5.2.2 Maps and plans

See **Figure 5-4** for a map of Kennedy's Vale reserves.

5.2.3 Resource and reserve statement

Estimates of tonnage and grades

The Vantech statement of reserves and resources at Kennedy's Vale as at 31st December 2001 is shown in **Table 2-6** and **2-7**.

Expected recovery and dilution factors

Based on design and operating experience since 1992, Vantech has converted a proportion of the mineral resources to reserves. Mining losses are minimal and sub-grade material is normally identified from blast hole data and stockpiled separately for blending. IMC has examined the estimated impact of a nominal mining recovery of 97.5% and a mining dilution of 5% of sub-grade mineralisation and it has found that this has only minor impact on the reserves tonnages and grades reported by Vantech. The average SG used to determine reserves as Vantech was 3.68.

5.2.4 Long-term prospects

The current reserves are confined to the Kennedy's Vale pit. The Indicated Resources at Steelpoortdrift could be promoted to reserves once licensing issues are resolved and the technical studies are updated.

Vantech has estimated additional Inferred Resources at Steelpoortdrift of some 40 million tonnes. At Mokombe Hill on De Goedverwachting, Rhovan have identified significant mineralisation but is not sufficiently defined to be a resource.

5.2.5 Mining and processing

Production schedule

The ore within the Kennedy's Vale Open Pit is almost exhausted and there is only sufficient ore remaining to maintain production until approximately September 2003.

The current ore production level is bench 870 and it is planned to mine down a further 30 metres to bench 840.

The processes employed at Vantech are very similar to those at Rhovan but the magnetic content of the ore is much higher than at Rhovan, at approximately 70%. Consequently, the amount of ore treated per tonne of V_2O_5 produced is approximately one third. Run-of-mine ore is subjected to three stages of crushing and a preliminary dry magnetic separation stage. Magnetics are ground in a ball mill in closed circuit with a cyclone and then subjected to wet magnetic separation to produce a magnetic concentrate.

The kiln and subsequent V_2O_5 production circuits are the same as Rhovan except that Vantech uses the ammonium polyvanadate (APV) route, which uses less sodium sulphate at lower pH, modified with sulphuric acid.

As at Rhovan, electrical power is supplied by ESKOM and the kiln is coal-fired.

A small (60 tonnes per month capacity) chemical grade V_2O_5 plant was commissioned in April 2001, which produces a high purity product by re-dissolving metavanadate (using caustic soda) followed by double precipitation.

The production schedule can be met with the existing plant equipment and associated calcine and tailings dams.

Plant and equipment

All equipment in the plant appeared to be maintained in a satisfactory condition and no major failures are considered likely to jeopardise the production schedule. A baghouse has recently been commissioned to recover dusts from the kiln off-gases. Vantech have planned for closure in 2003 at a cost of ZAR 2million, excluding redundancy costs. Approximately 80 skilled staff will be transferred to the expanded plant at Rhovan. Approximately 600 tonnes per month of sodium sulphate salt will be recovered using the plant evaporator and evaporation ponds over a period of five years. The operating cost of this operation will be paid for by the purchase of the salt by Rhovan. At the same time, Vantech will continue to produce chemical grade V_2O_5, using AMV purchased from Rhovan.

Environmental

IMC did not detect any non-compliance with environmental regulations at Vantech.

6. Special factors

Where risks are likely to impact on Xstrata South Africa's forecast production, capital and operating costs by less than 10%, they are not considered significant. Any identified potential significant risks which are not adequately addressed in Xstrata South Africa's production plans are considered to be "material" and are listed below.

6.1 Reductants (medium risk)

One major concern in relation to the ferrochrome smelters is the supply of suitable quality reductants. Metallurgical coke has always been the preferred material, but there is insufficient supply for the expanding demand. Xstrata South Africa has developed other coke supplies, but the quality of Zimbabwean coke has been variable and imports from China, while of good quality, must be paid for in US Dollars. The company has taken the following measures to lessen this concern:

- conversion of the kilns from coke fines to anthracite fines;
- Xstrata South Africa purchases reductant from Glencore International's Chartech plant at Witbank which produces char from local coal; and
- Xstrata South Africa has purchased an anthracite mine (the Maloma mine) in Swaziland to supply Xstrata South Africa with a low phosphorus reductant.

An increase in the supply of reductants with acceptable levels of phosphorus and sulphur will be required to meet increased production levels. The supply of coal within South Africa should, however, not present a constraint on increased production.

Xstrata South Africa's purchase of coal mines in South Africa and Australia will go a long way to reducing their dependency on outside sources of reductants.

6.2 Health issues (low to medium risk)

Vantech are currently co-operating in a public enquiry into the health of workers at the plant.

Some dust control measures remain to be implemented at Rhovan in 2002 for which capital expenditure has been allowed. These are expected to bring the plant hygiene to a regulated standard. In parallel, management are rigidly enforcing the use of personal protective equipment (PPE) in relevant areas.

IMC considers that both Vantech and Rhovan could be the subject of as yet unquantified claims for compensation from former employees, who have retired on health grounds. While some responsibility will lie with previous owners, IMC consider that a portion of any potential claims will fall on Xstrata South Africa. Workers' compensation payments in South Africa come from a fund to which employers are required to contribute which would limit Xstrata South Africa's commercial exposure. However, in some cases the commissioner of the compensation fund may pass on costs to the employer.

6.3 Electricity (medium risk)

Heavy consumers of electrical power in the South African mining industry currently enjoy some of the cheapest power available world-wide, with prices starting at US$0.01 per kilowatt hour. With energy accounting for approximately 30% of the total smelting cost, clearly any price increase would impact significantly on South African ferrochrome producers' costs and their global competitiveness.

6.4 Markets (medium/high risk)

Given the stability in the chrome price, there is only a medium risk in the short-term of a detrimental effect on the valuation of the chrome assets.

Based on historic volatility of the vanadium price it is possible that the valuation of the South African vanadium assets will be affected by the price in the short-term .

7. Conclusions

IMC concludes from the independent technical review that:

- management's geological and geotechnical mining knowledge and understanding is of a sufficient level to support short, medium and long-term planning as appropriate;
- the mine plans appropriately consider geological and geotechnical factors to minimise mining hazards;
- Xstrata South Africa's mining equipment (either in place or planned in the capital forecasts) is suited to its mine plans and adequate for the production levels forecast;
- chrome and vanadium ore processing and associated ferrochrome and ferrovanadium plants and other infrastructure are capable of continuing to supply appropriate quality products to satisfy the export markets at the forecast volumes and also can supply domestic markets;
- environmental issues are well managed and there are no issues that could materially impede production nor are any prosecutions pending;
- the assumptions used in estimating both capital and operating costs are appropriate and reasonable;
- capital and operating costs used in the financial models reflect the mine plans, development and construction schedules and the forecast production levels;
- the special factors identified by IMC are well understood by management and appropriate action to mitigate these risks is being taken. Further, the mine plans and cost forecasts appropriately account for these risks; and
- management operate a clear and comprehensive management accounting system and are able to monitor and forecast production and cost parameters.

IMC has estimated the value of Xstrata South Africa's chrome and vanadium operations as US$646 million and US$195 million respectively, assuming a real discount rate of 9.5%, ZAR/US$ exchange rate, product prices and cost and production forecasts which are soundly based.

Yours faithfully

IMC Mackay and Schnellmann

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London EC2A 2HD

Andrew P. Wells BSc (Hon's), ARSM, MIMM, CEng

Director

Part IX Competent persons' and technical reports – South African chrome and vanadium assets

Annex A – Qualifications of Consultants

A. Wells – Project Manager & Vanadium Team Leader – B.Sc. (Eng.) (Hon's) Mineral Technology 1976 – Associate of the Royal School of Mines, Imperial College, London – Member of the Institution of Mining and Metallurgy, Chartered Engineer – Certified Internal Quality Auditor for ISO 9000 & ISO 10011

25 years experience in metalliferous mining and processing, including four in chrome and vanadium.

**** G. Bowyer – Geologist – Vanadium – BSc (Geology) London University 1969 – Fellow, Institution of Mining and Chartered Engineer – Fellow, Australasian Institute of Mining and Metallurgy***

30 years of experience in the mineral industry including the preparation of Competent Persons' Reports, orebody modelling, mineral resources and ore reserves estimations; feasibility studies and technical audits.

**** K. Gahan – Mining Engineer – Vanadium – BSc Mining Engineering 1961 – Associate Camborne School of Mines (ACSM) – Fellow, S.A. Institute Mining and Metallurgy – S.A. Mine Manager's Certificate (Fiery Mines)***

40 years in the minerals industry with experience in major minerals including iron ore, copper, zinc, nickel, coal, vanadium, gold and diamonds.

**** C. Streets – Minerals Economist – Associateship (First Class) of the Camborne School of Metalliferous Mining 1962 – Chartered Engineer – Fellow of the Institution of Mining and Metallurgy***

40 years experience in the international mining industry, with previous assignments including technical audits of both chrome and vanadium operations.

**** J. Hawke – Infrastructure, Transport & Chrome Team Leader – Higher National Certificate – Mechanical Engineering – Chartered Engineer – Member of the Institution of Mechanical Engineers – Member of the Institute of Mining and Metallurgy***

More than 35 year's experience in the base metal mining and metallurgical extraction industry.

**** S. Henley – Geologist – Chrome – BSc 1st class Honours Geology, Nottingham – PhD Geology, Nottingham – Member Institution of Mining and Metallurgy, Chartered Engineer – Fellow Geological Society of London – Charter Member International Association for Mathematical Geology***

30 years experience in the minerals industry as a geologist/geostatistician conducting resource evaluations throughout the world including major chrome mines in Kazakhstan.

**** J. Bennett – Mining Engineer – Chrome – BSc Engineering in Mining (Honours) from Royal School of Mines, London – Associate of the Royal School of Mines – Member Institution of Mining and Metallurgy – Chartered Engineer***

Over 35 years in the mining industry including: management of production operations, design, feasibility and construction management of new operations, both open pit and underground.

**** P. O'Shaughnessy – Process Engineer – Chrome – Associate of the Royal School of Mines, Imperial College, London – B.Sc. (Eng.) (Hon's) Metallurgical Engineering – Member of the Institution of Mining and Metallurgy, Chartered Engineer – Chartered Engineer (UK) – European Engineer Group 1 Feani Register Europe – Professional Engineer, Ontario Canada – Professional Engineer , New York, US***

25 years in operations, engineering design, consulting and as plant manager within the ferroalloy industry.

In addition, the following consultants performed desk based studies:

M. Howard – Environmental Specialist – B.Sc. (Honours), Geography and Biology, University of North London

20 years experience as an environmentalist with assignments including: environmental impact assessments, design of artificial wetlands for effluent treatment, development of catchment management plans, environmental risk assessments and development of water management systems for mines.

A. Cross – Smelter Expert and Peer Reviewer – BSc. Chemical Engineering – Member of the Institute of Chemical Engineers

28 years of experience in metallurgical and process industries including pyrometallurgy, smelter gas collection and treatment, hydrometallurgy and sulphuric acid manufacture.

B. Lott – Project Director – MA (1st Class Honours), Mechanical Sciences – Chartered Engineer – Member, Institution of Mechanical Engineers – Member, Institute of Management – Fellow, Institute of Directors – Fellow, Institution of Mining and Metallurgy – Industrial Management Certificate

Over 30 years' international experience in the engineering and management of mining and process plant projects including several years' residence in Australia, US, Zambia and Germany.

Note: * People who inspected operations.

Annex B – Scope of work/limitations and exclusions/materiality

Scope of work

IMC carried out the following scope of work for the Competent Person's Report (CPR):

- Introductory meetings with Xstrata South Africa chrome and vanadium directors and management to understand the business plan;
- Site visits and collection of data. Consultants marked * in Annex A visited the assets relevant to their disciplines and inspected:
  - ➢ geological maps and plans;
  - ➢ mining operations including equipment;
  - ➢ infrastructure including transport systems, maintenance facilities;
  - ➢ chrome ore processing plants;
  - ➢ ferrochrome furnaces;
  - ➢ vanadium processing plants; and
  - ➢ ferrovanadium production facility.
- At the chrome mines a comprehensive data-room was established to provide the chrome team with the necessary documentation to examine. At the vanadium operations, documentation was provided by each site. In both cases this included:
  - ➢ monthly production and cost reports;
  - ➢ budgets; and
  - ➢ feasibility studies.
- At each asset a technical review was undertaken, which included the following elements:
  - ➢ data suitability;
  - ➢ geology and mining hazards;
  - ➢ resources and reserves;
  - ➢ chrome and vanadium mining operations;
  - ➢ chrome ore processing to concentrate;
  - ➢ chrome concentrate smelting to ferrochrome;
  - ➢ vanadium ore processing to vanadium pentoxide;
  - ➢ vanadium pentoxide processing to ferrovanadium;
  - ➢ environmental issues (desktop review of documentation);
  - ➢ capital and operating costs;
  - ➢ review of budget forecasts; and
  - ➢ valuation of reserves.

The CPR covers Xstrata South Africa's chrome and vanadium operations that are materially relevant to the valuation of the reserves estimated according to the JORC Code. IMC produced its valuation model based on actual 2001 production data and Xstrata South Africa 2002 to 2004 budget data.

Limitations and exclusions

The CPR is based mainly on information provided by Xstrata South Africa, made available to IMC before 17 December 2001. Xstrata AG has advised IMC of any material change, or event likely to cause material change to its budgets as of 4 March 2002.

The work undertaken for this report is a technical review of the information obtained by IMC together with such inspections as IMC considered appropriate. It specifically excludes all aspect of legal issues, commercial and financial matters, land titles, agreement, excepting where such aspects may directly influence technical, operational or cost issues.

IMC has not independently forecast product prices to be achieved, relying rather on independent forecasts and discussions with management.

Materiality

The chrome and vanadium mining, processing and smelting assets were examined to identify any significant technical and operating risks. Where risks for an asset are likely to impact on the forecast of production, capital and operating cost by less than 10%, they are not considered material.

Figure 2-1 – Geology of the Bushveld Complex, East and West, indicating locations of the principal mines

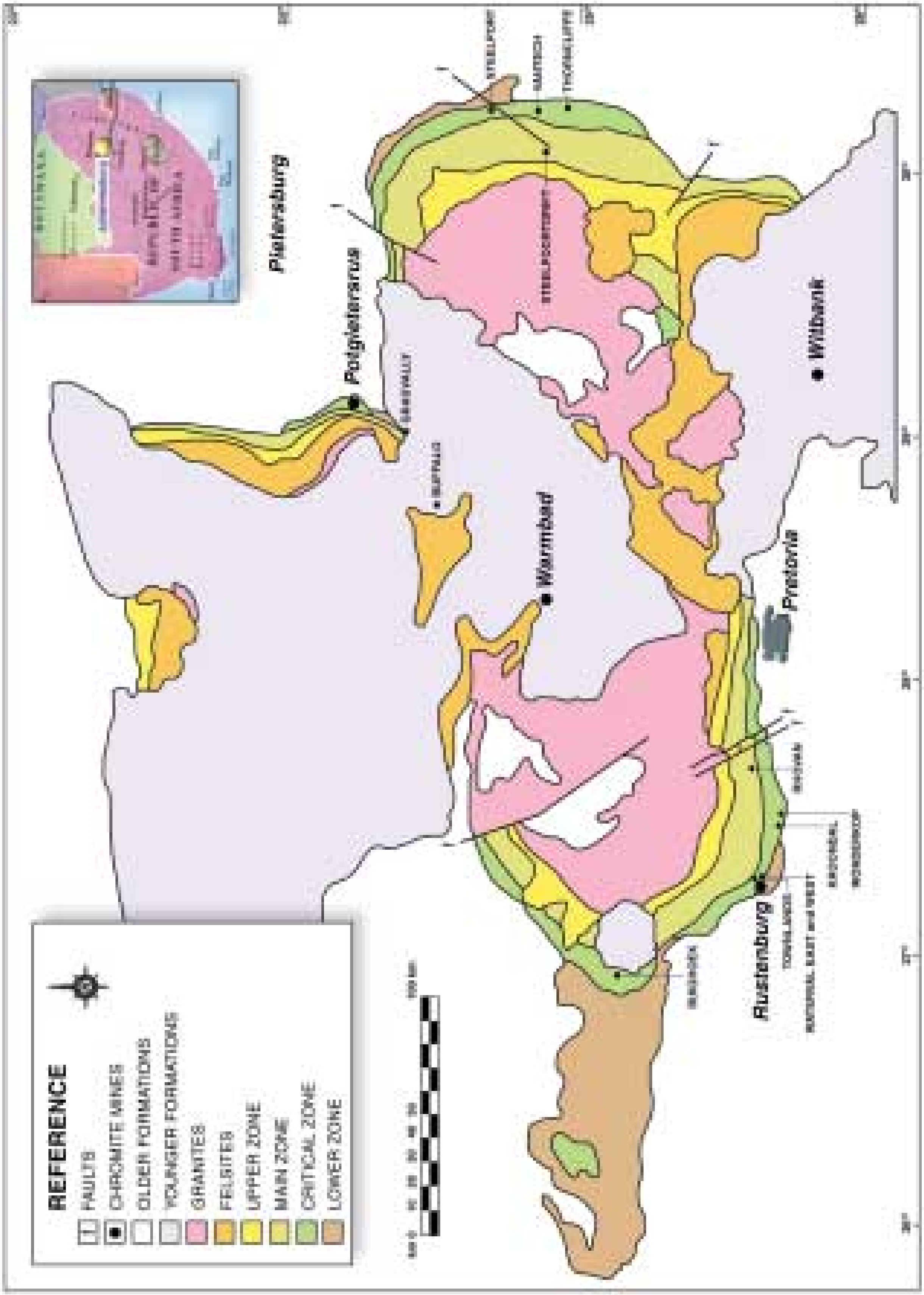


Figure 3-1 – Plan showing the relationship between Waterval East and Waterval West mines

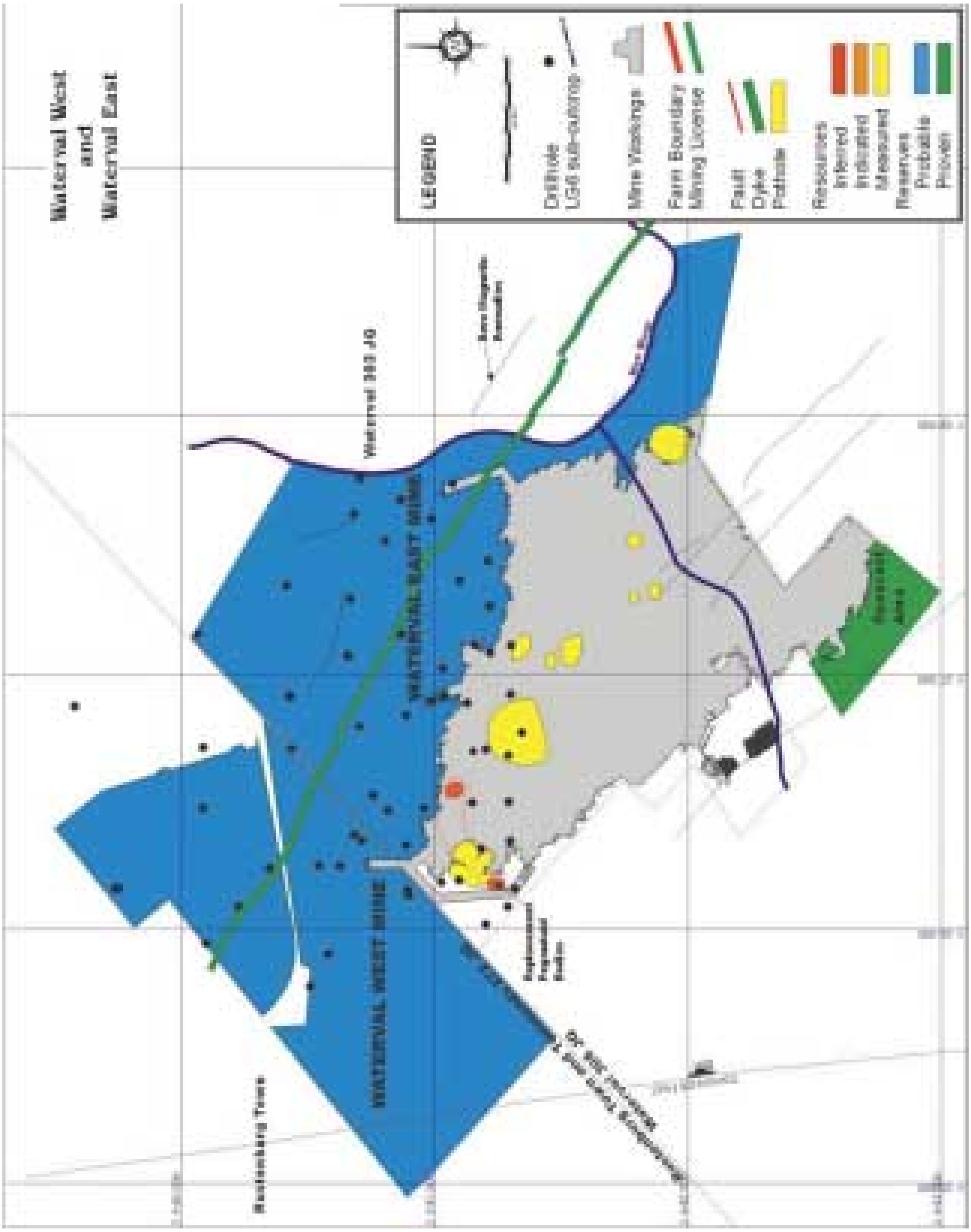


Figure 3-2 – The area initially to be exploited by Waterval West mine (Townland Area B2)

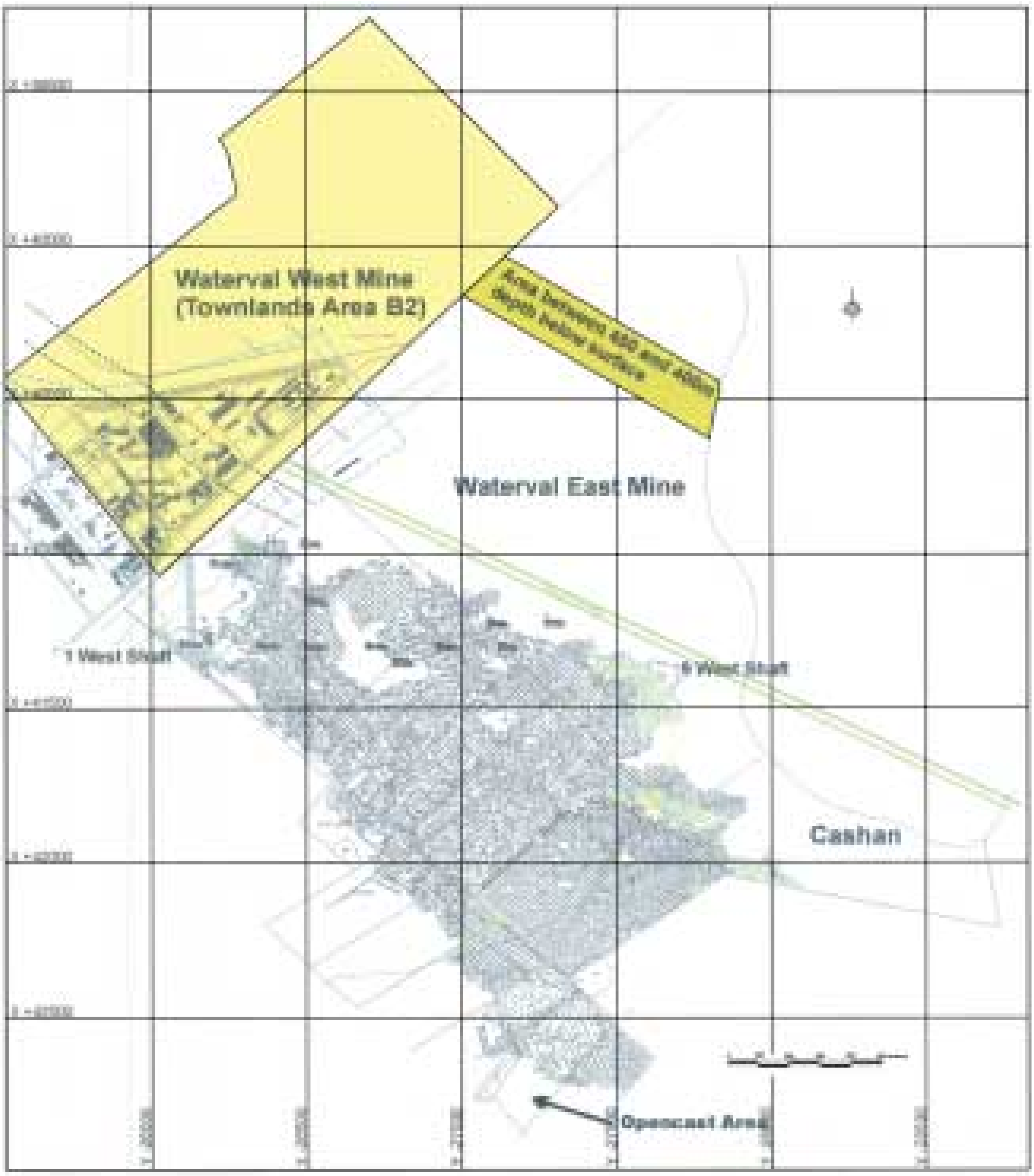


Figure 3-3 – Location map of the Thorncliffe and Vantech mines in the Eastern Bushveld

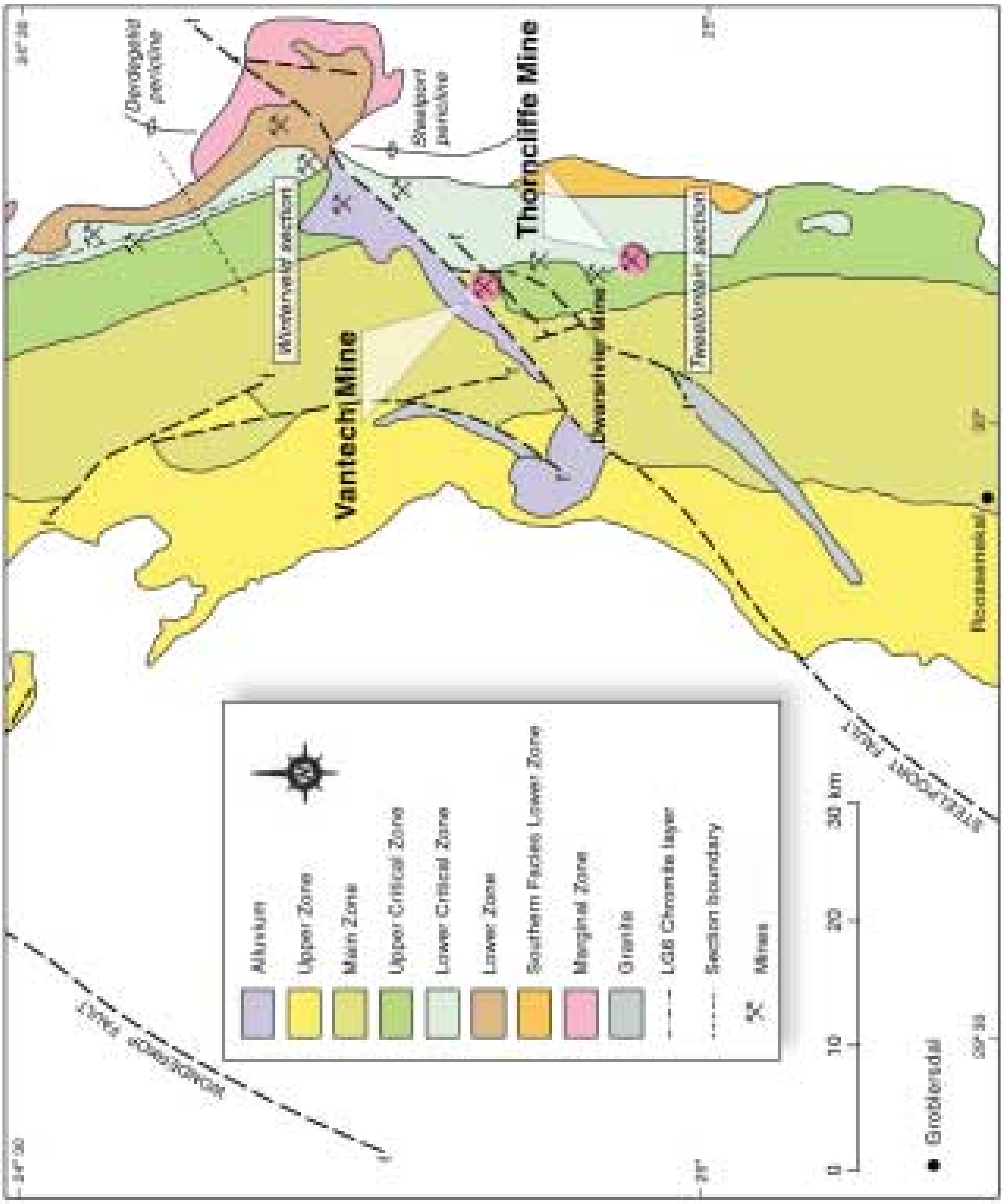


Figure 3-4 – Geology of the Western Bushveld area

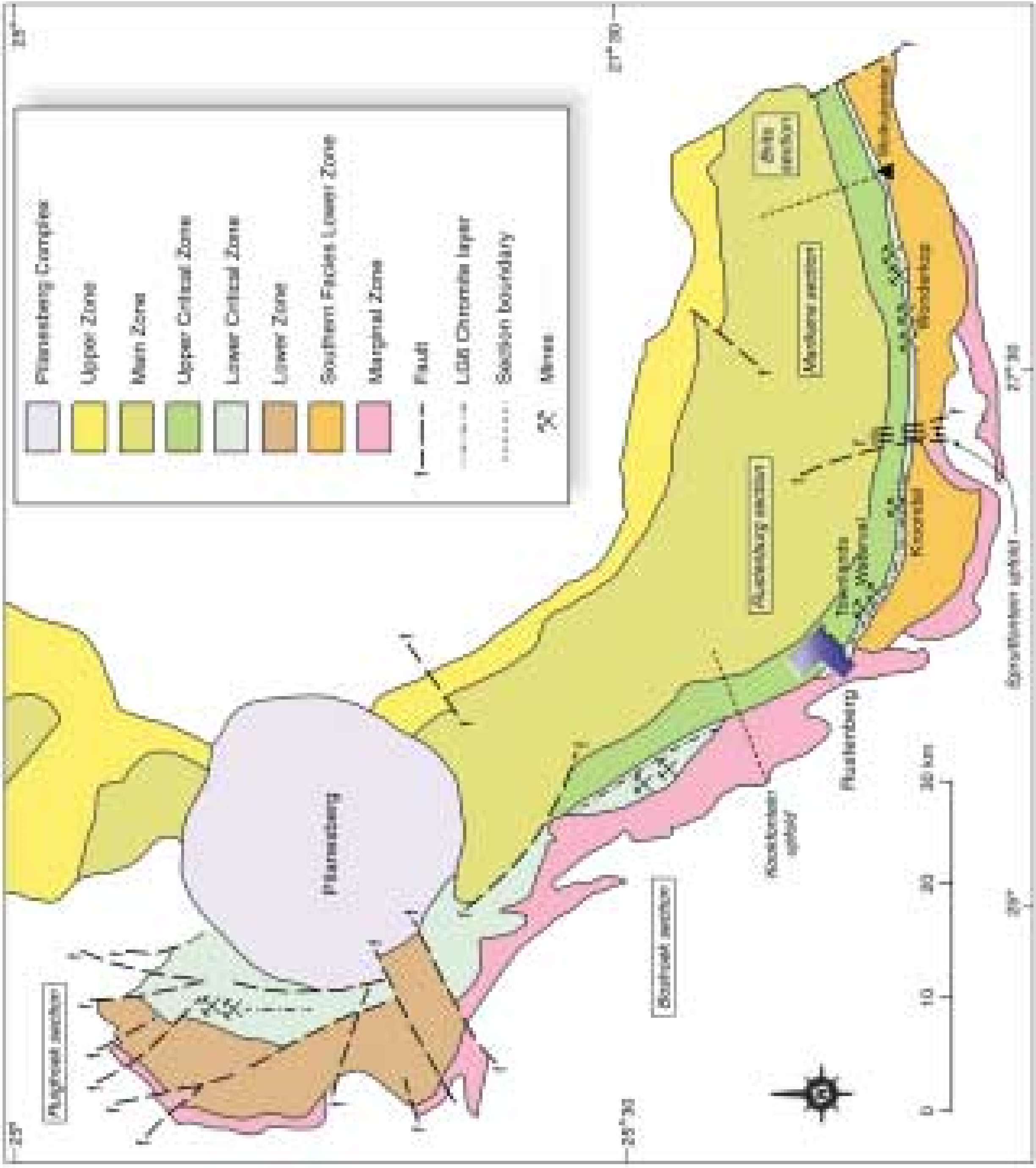


Figure 3-5 -Locations of chrome mines in the southwestern Bushveld area

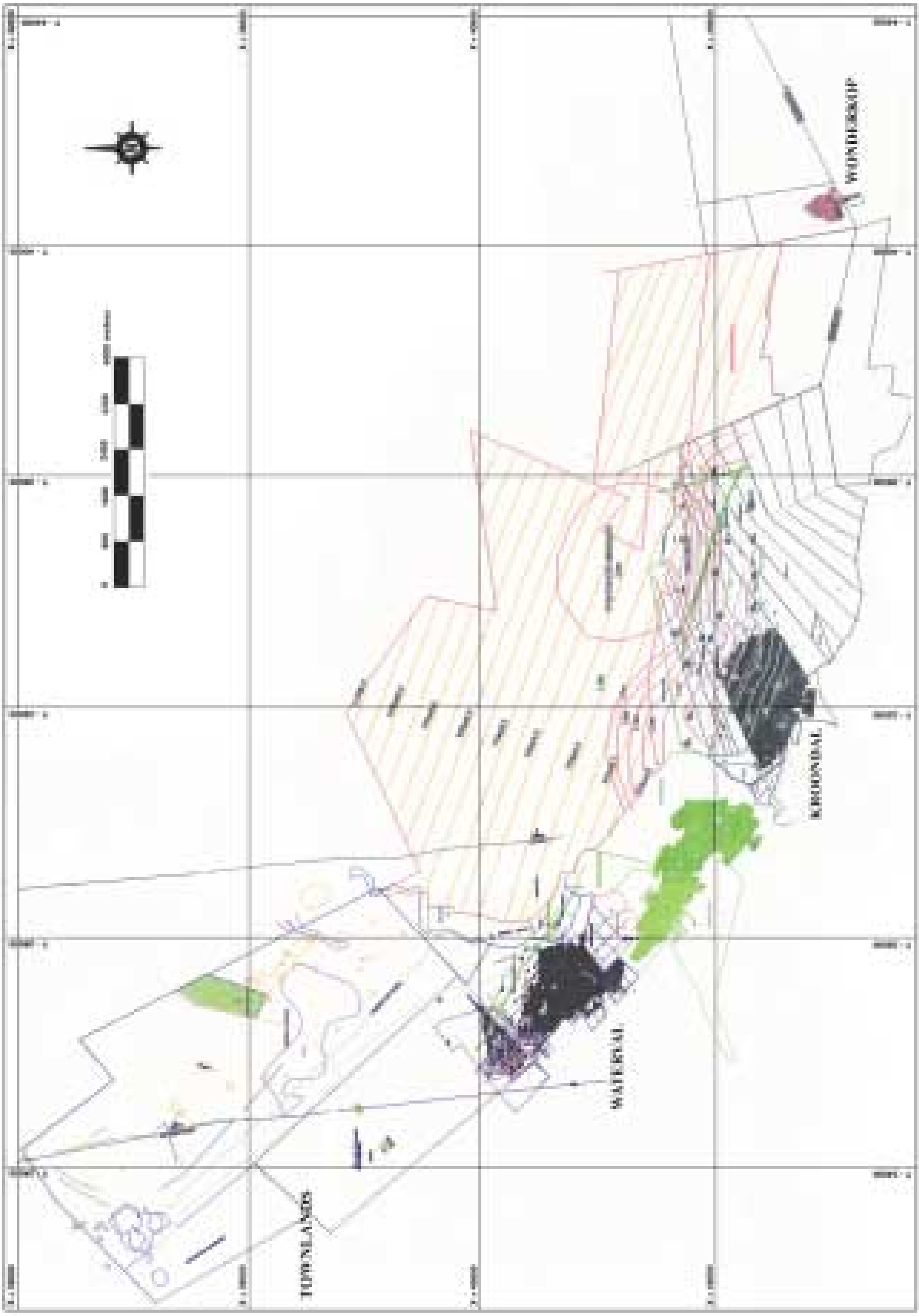


Figure 3-6 – Townlands lease areas, indicating proposed drillhole locations to establish resources in the Townlands A area

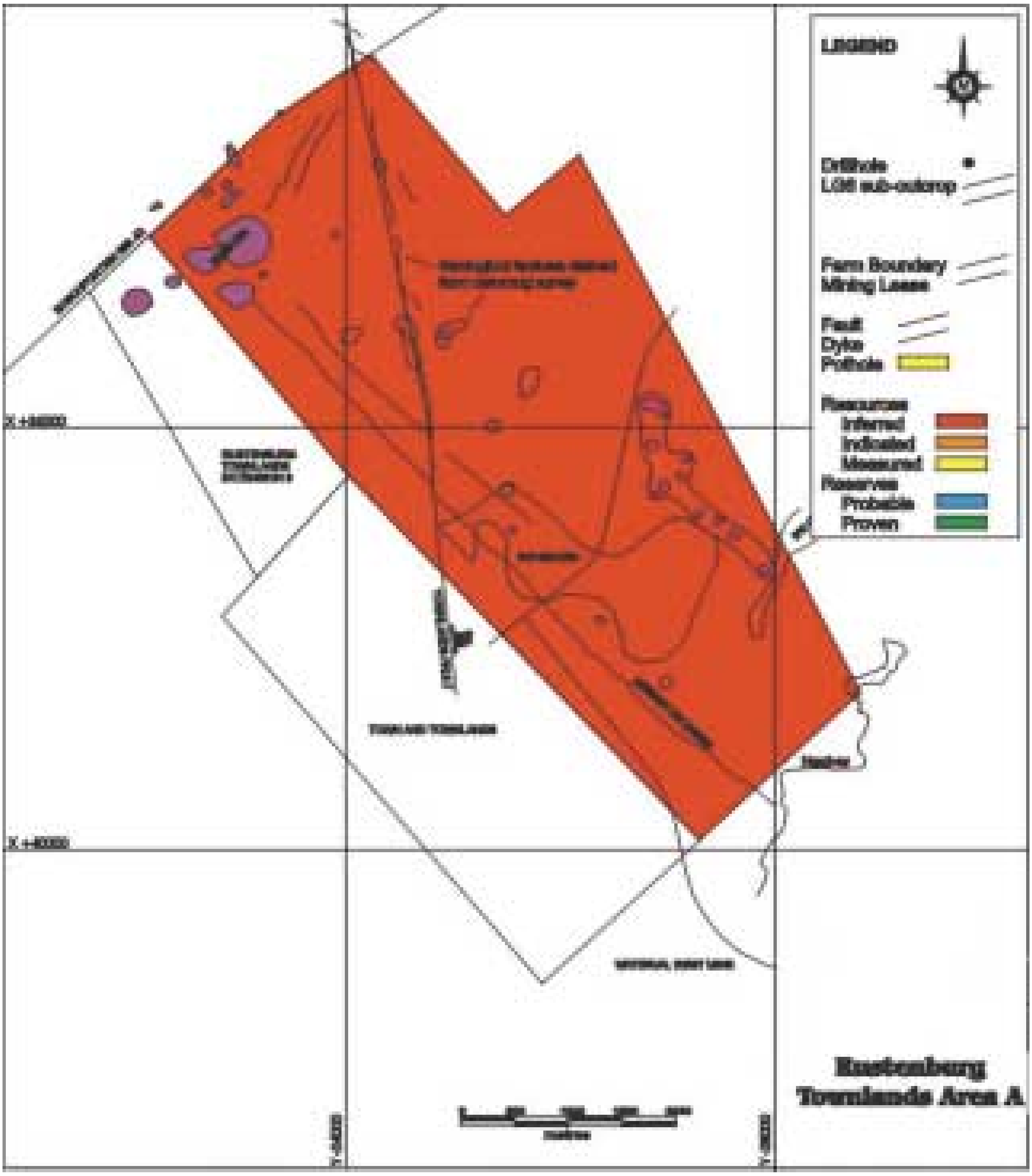


Figure 3-7 – Kroondal mine area plan showing the lease areas being exploited through the mine

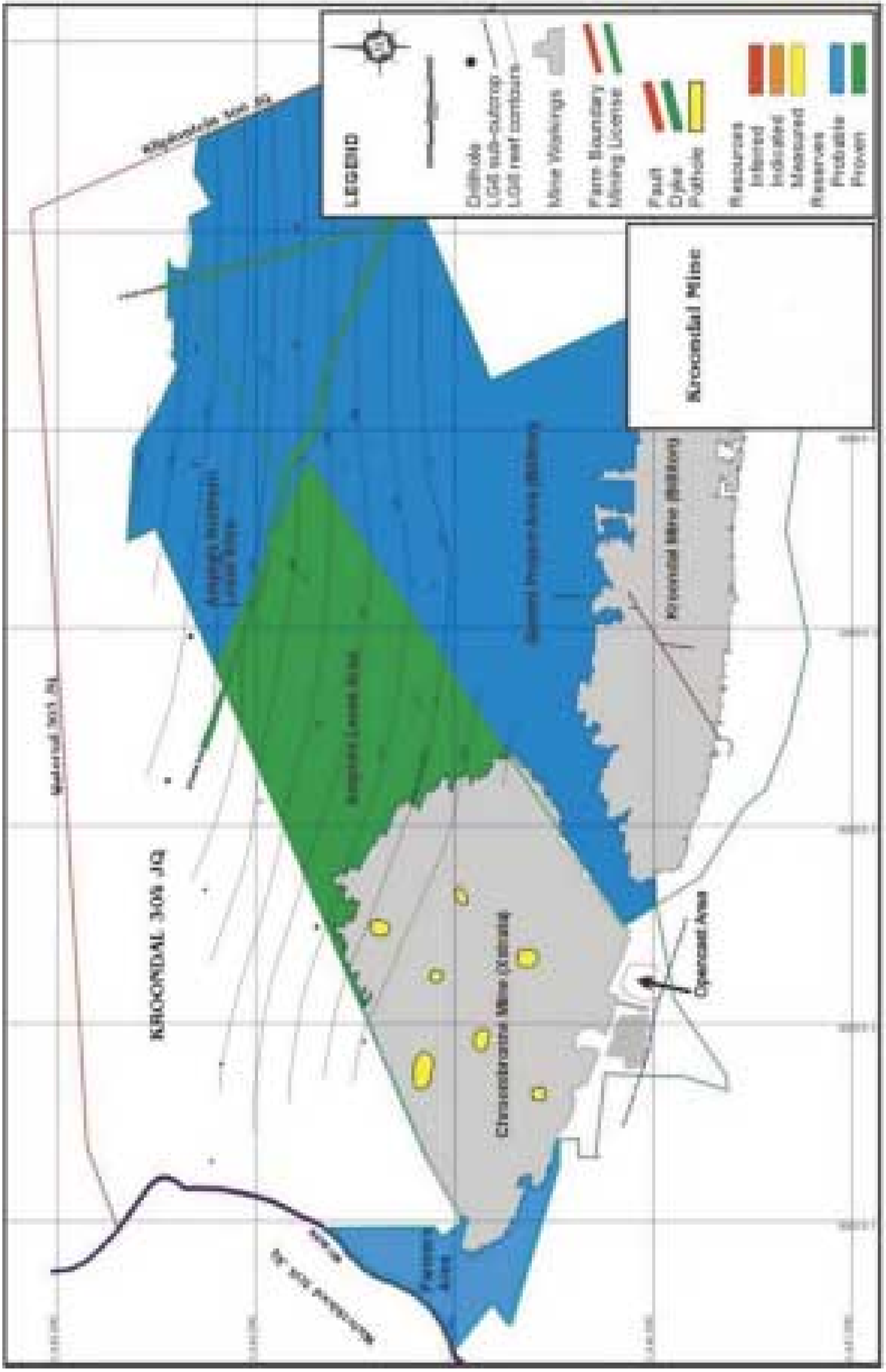


Figure 3-8 – Chrome holdings in Thorncliffe 374KT and adjacent farms

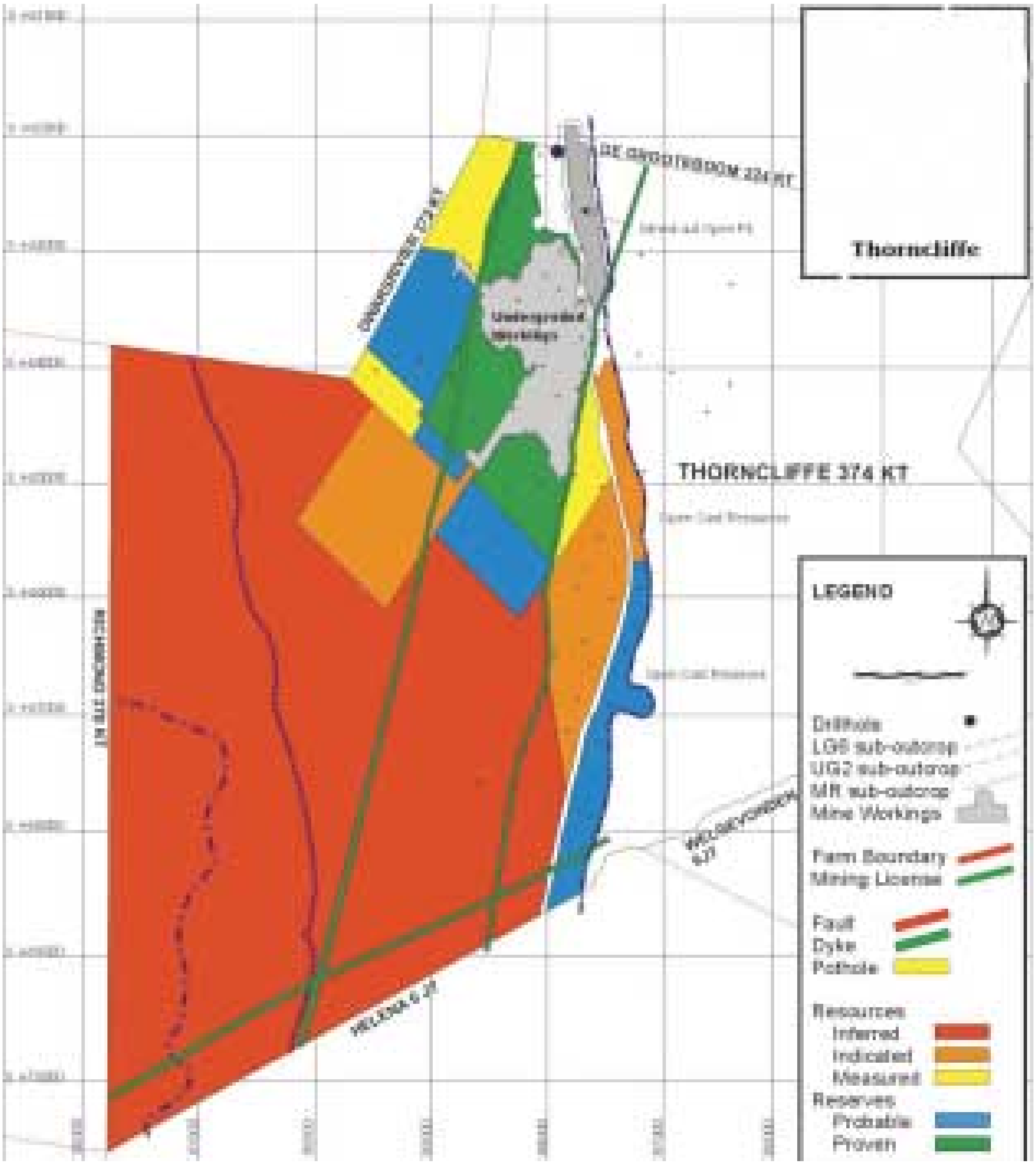


Figure 5-1 – Rhovan mining licence

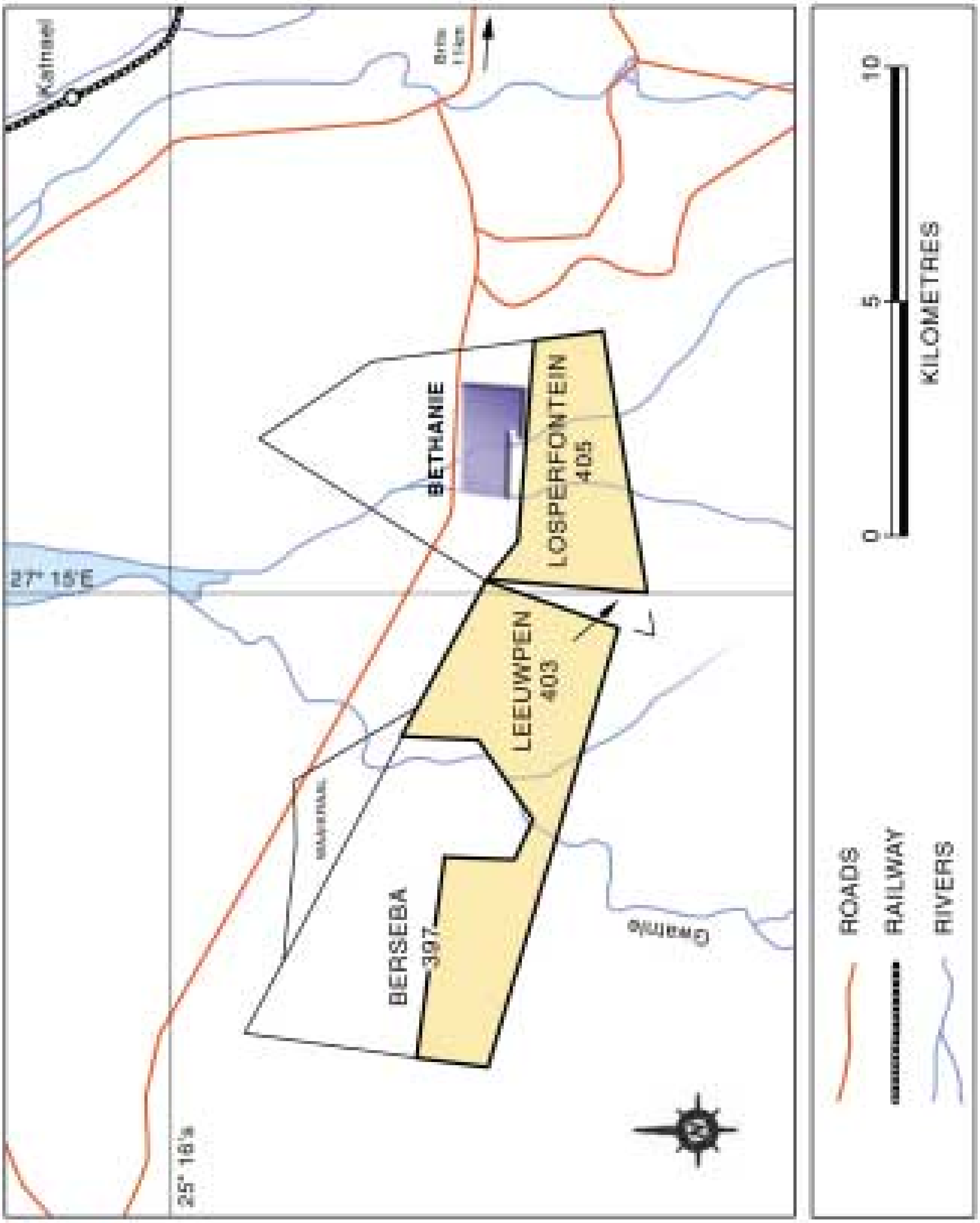


Figure 5-2 – Rhovan Opencast reserves and resources

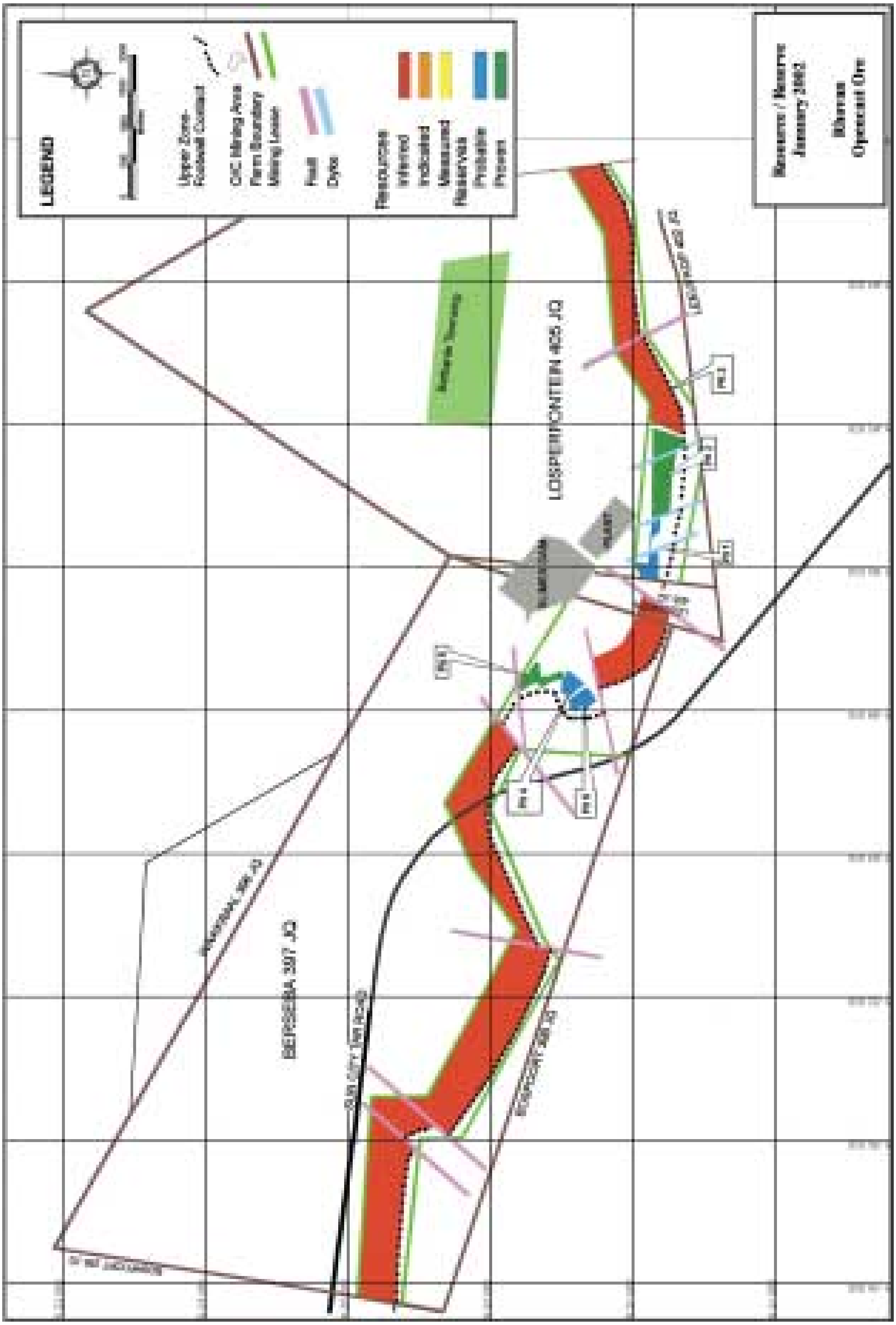
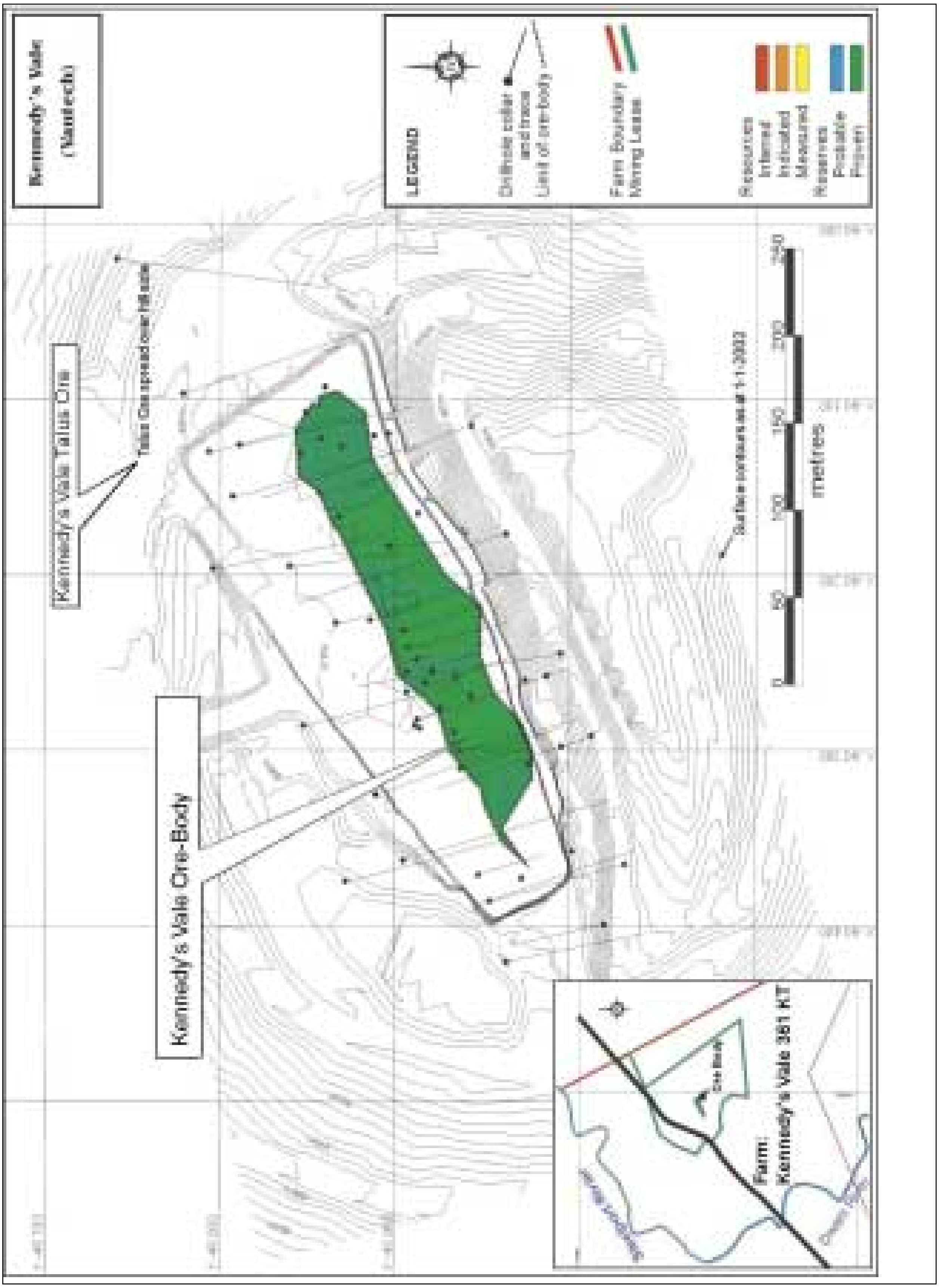


Figure 5-4 – Kennedy's Vale reserves



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