Sibley Basin

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National Instrument 43-101Technical Report

Big Daddy chromite deposit
McFaulds Lake Area, Ontario, Canada
Porcupine Mining Division, NTS 43D16
Mineral Resource Estimation
Technical Report

Prepared For

KWG Resources Inc.

By

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1. Summary

The property is located in North-western Ontario, approximately 280 km north of the town of Nakina. It consists of approximately 1,241 hectares covered by 7 unpatented mining claims held in a joint venture by Canada Chrome Mining Corporation (30%) from Cliffs Natural Resources (70%). Canada Chrome Mining Corporation is a 100% owned subsidiary of KWG Resources Inc.

The area is underlain by Archean volcanics and ultramafic rocks intruded by a Granodiorite complex. The Big Daddy chromite deposit is hosted by a multi-phase layered ultramafic intrusion consisting of peridotite, olivine cumulates including dunite, chromite, pyroxenite and gabbro. The chromite mineralisation consists of fine grained disseminated to massive accumulations of chromite grains typically in a peridotite to olivine cumulate matrix. There are multiple layers of significant chromite accumulation.

Exploration to date has consisted of geophysics followed by diamond drilling designed to trace the Big Daddy chromite zone approximately 1.2km along strike and approximately 490m down dip. The ultimate objective is to define a chromite deposit that can be economically extracted using a combination of open pit and underground mining techniques. As there has been a Preliminary Economic Assessment completed this is considered an advanced exploration project.

Using the drill hole data available as of June 1, 2012, an Ordinary Kriged block model was created for the Big Daddy chromite deposit. The volume modelled is 1.3km long and is down to a depth of approximately 490m below surface. A significant proportion of all resources present have a high enough confidence in the estimate that they can be classified as Measured and Indicated Resources with the remainder being Inferred Resources. The following table provides the breakdown based on CIM resource classifications, using a cut-off of 20% Cr_2O_3.

Classification	Tonnes (millions)	%Cr_2O_3
Measured Resources	23.3	32.1
Indicated Resources	5.8	30.1
Meas. & Ind. Resources	29.1	31.7
Inferred Resources	3.4	28.1

Notes:

1. CIM Definition Standards were followed for classification of Mineral Resources.
2. The Mineral Resource estimate uses drill hole data available as of June 1, 2012.
3. The cut-off of 20% Cr_2O_3 is the same cut-off used for the Kemi deposit as reported by Alapieti et al. (1989).
4. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

Using this 20% cut-off, there are 29.1 million tonnes at a grade of 31.7% Cr_2O_3 of Measured and Indicated Resources which preliminary metallurgical testing indicates should be easily upgradable through gravity concentration. And there are 3.4 million tonnes at a grade of 28.1% Cr_2O_3 of Inferred Resources. No mineability and dilution studies have been applied to these resources and therefore they may not all be economically recoverable.

The drill hole spacing is typically 50 metres with several off-azimuth holes. As a result there is good confidence in the lateral continuity of the mineralization to a degree that a significant proportion of the defined resources can be classified as Measured and Indicated Resources at this time.

It is recommended that further drilling be done to infill areas that currently are poorly sampled, and to extend the limits down dip as the mineralization is still open on this direction. The estimated cost of this program is $3.5 million.

1.1.Cautionary Note

The deeper portions of the volume modelled and the extremities are poorly tested as a result of the sparse drilling in these areas by drilling. As such the poorly sampled areas can only be classified as Inferred Resources. Further infill and deeper drilling is required.

This estimate is effective as of June 3, 2012 and is reflective of all data available as of that date.

2. Introduction

The property is currently a joint venture between Canada Chrome Mining Corporation (30%), Cliffs Chromite Far North Inc. (30%) and Cliffs Chromite Ontario Inc. (40%). Canada Chrome Mining Corporation is a 100% owned subsidiary of KWG Resources Inc. (KWG). Cliffs Chromite Far North Inc. and Cliffs Chromite Ontario Inc. are both 100% owned subsidiaries of Cliffs Natural Resources Inc. (Cliffs). Cliffs was the project operator until March 31, 2012.

The purpose of this report is to document a resource estimate of the Big Daddy chromite deposit, in the McFaulds Lake area of north western Ontario, originally commissioned by Cliffs Natural Resources (Cliffs). This report will support documents which may be required by Canadian regulatory authorities, to better inform shareholders about company activities, and potentially to support possible future financing efforts.

Sibley Basin Group Geological Consulting Services Ltd. (SBG) was retained by Mr. Maurice Lavigne, Vice President of Exploration and Development for KWG Resources Inc. (KWG) to prepare this report detailing work done by Cliffs Natural Resources on behalf of the joint venture.

Cliffs, as project operator up to March 31, 2012, compiled and supplied the drill hole data set with final drill hole validation by SBG. Alan Aubut, P.Geo., on behalf of SBG, visited the McFaulds Lake exploration camp of the previous project manager, Billiken Management Services Inc. (Billiken), on March 23, 2010 accompanied by P. Chance of Billiken. While there drill core was examined, and logging and sampling procedures were reviewed. Digital files with which to generate a drill hole database file, including all assays, were provided by Cliffs.

3. Reliance on Other Experts

For sections 11 (Sample Preparation, Analyses and Security) and 12 (Data Verification) the author has relied on the methods, processes and conclusions provided in the report "*NI 43-101 Technical Report on the Mineral Resource estimate for the Big Daddy Chromite Deposit, McFaulds Lake Area, James Bay Lowlands, Northern Ontario*" as prepared by Micon International Ltd., for Spider Inc. and KWG Resources Inc. in 2010 (Gowans et al, 2010a). A copy of this report was provided by the issuer, KWG Resources Inc. to SBG for reference in preparing this report.

4. Property Description and Location

The Big Daddy chromite deposit is located on a property previously held under an option agreement between KWG Resources (30%) and Cliffs Natural Resources (70%). KWG has now met all of their obligations and the project is now a joint venture between all parties.

The property is situated in the Porcupine Mining Division in area BMA 527861 (G-4306) and is located approximately 80km east of the community of Webequie (see Figure 1). The property consists of 5 unpatented mining claims totalling 76 units covering approximately 1,209 ha, along with two single

claim units (~32 ha), each excised from two adjacent Cliffs claims (see Figure 3). The claim locations are "as staked" and are based on GPS-derived locations of claim posts. The current status of all the claims is presented in Table 1. Figure 2 shows the property relative to all other claims in the McFaulds Lake area.

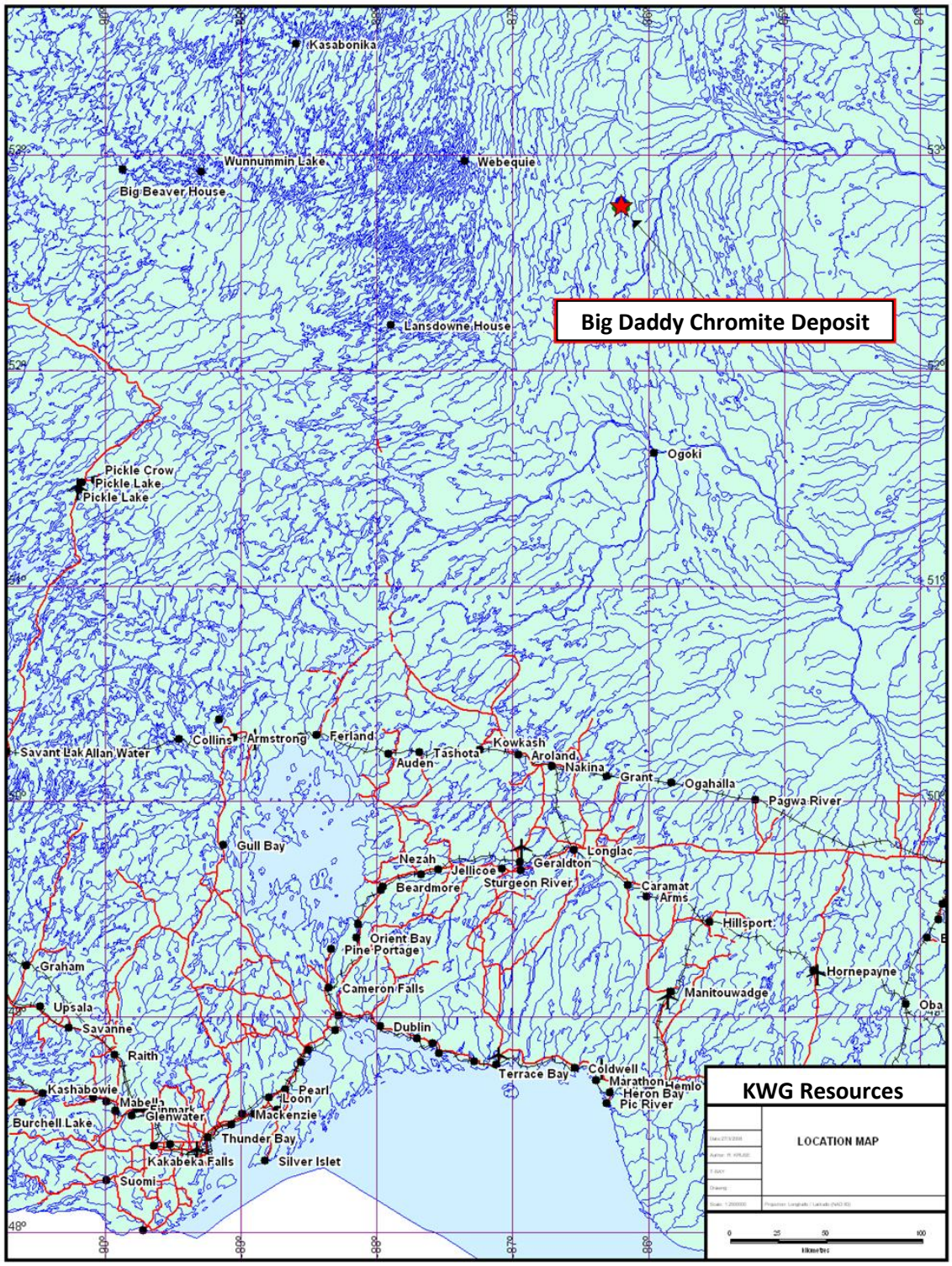

Figure 1 Map showing the location of the Big Daddy property.

4.1.Property History and Underlying Agreements

- Claims 3011028, 3011029, 3012250 to 3012253 inclusive were recorded by Richard Nemis (the "Nemis Claims"), on April 22, 2003.

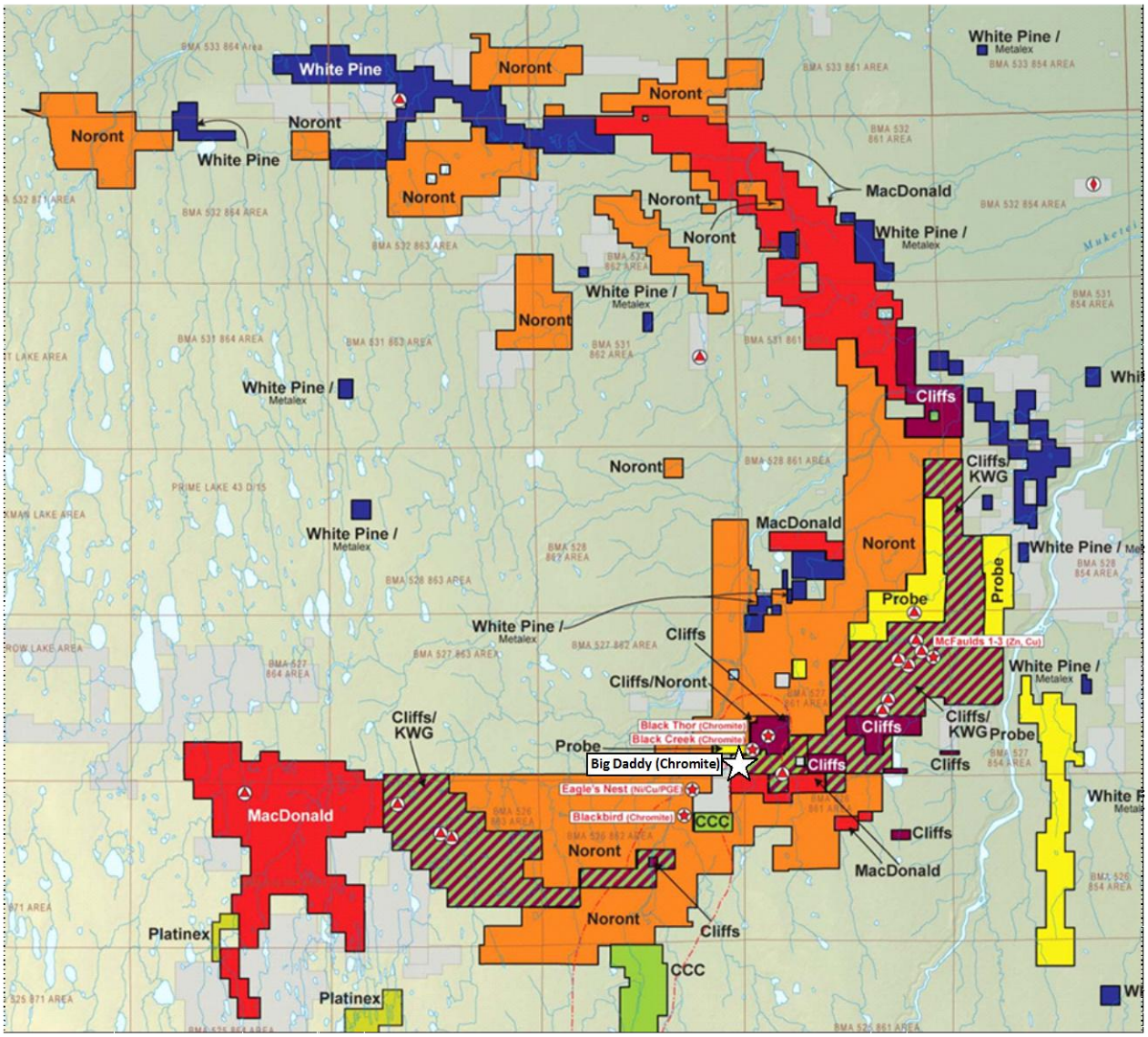

Figure 1 Claim map of the McFaulds's Lake Area (©Intierra Pty Ltd. 2011).

4.2.Property History and Underlying Agreements

- Claims 3011028, 3011029, 3012250 to 3012253 inclusive were recorded by Richard Nemis (the "Nemis Claims"), on April 22, 2003.
- On June 17, 2003 Richard Nemis agreed to sell a 100% interest in the Nemis Claims to Freewest Resources Canada Inc. (Freewest), now a 100% owned subsidiary of Cliffs Natural Resources, for $10,800 and a 2% NSR royalty. The claims were transferred to Freewest on August 14, 2003.
- Freewest recorded claims 3008269, 3008793 and 3008268 on August 11, 2003.

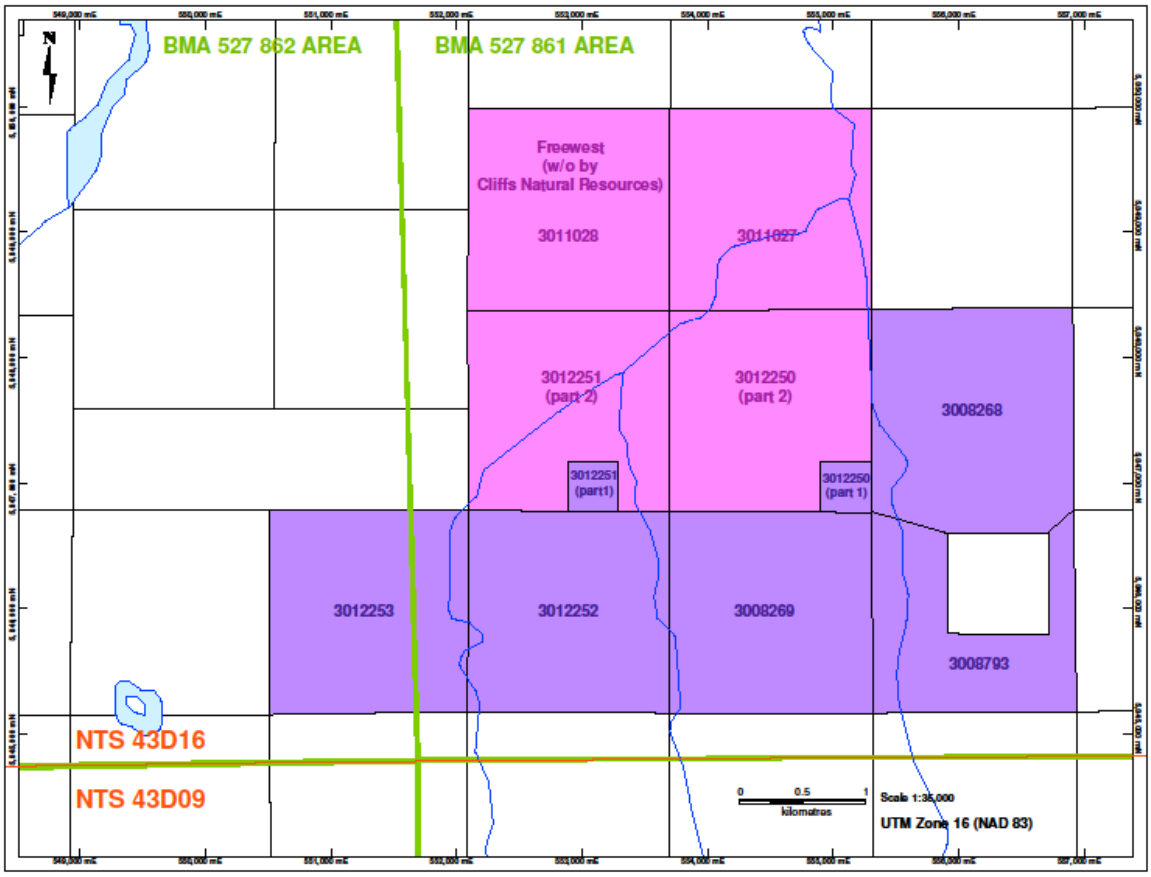

Figure 2 KWG-Cliffs Option Agreement Property Map (purple) as of June 11, 2012.

Claim No	Units	Area[1]	Due Date	Recorded	Work Req'd	Total Work	Total Reserve	Present Work Assigned	NSR
P 3012253	16	249	2013-Apr-22	2003-Apr-22	$6,400	$51,200	$92,573	$43,200	2%
P 3012252	16	258	2013-Apr-22	2003-Apr-22	$6,400	$51,200	$0	$0	2%
P 3008269	16	257	2013-Aug-11	2003-Aug-11	$6,400	$51,200	$27,029	$60,945	0%
P 3008793	12	202	2013-Aug-11	2003-Aug-11	$4,800	$38,400	$0	$0	0%
P 3008268	16	243	2013-Aug-11	2003-Aug-11	$6,400	$51,200	$0	$13,803	0%
	76	1,209				$243,200	$119,602	$117,948	
P 3012250[2]	1	16[3]	2013-Apr-22	2003-Apr-22	$6,400	$51,200	$0	$0	2%
P 3012251[2]	1	16[3]	2013-Apr-22	2003-Apr-22	$6,400	$51,200	$0	$4,160	2%
		32				$102,400	$0	$4,160	
	78	1,241							

1 – Measured based on GPS-derived locations of claim corner posts.

2 - Assessment work is for entire claim which must be maintained to retain the optioned portions.

3 – Nominal areas based on descriptions of the optioned parcels and locations of relevant claim corner posts.

Table 1 Claim status of the Big Daddy property (as of June 11, 2012).[1]

[1] While claims 3012250 and 3012251 are 16 unit claims only 1 unit from each is part of the current option property.

- On December 5, 2005 KWG and Spider, as equal partners, entered into an option agreement with Freewest to earn a 50% interest in claims 3012253, 3012252, 3008269, 3008793 and 3008268 along with two single claim units (~32 ha) excised from adjoining Freewest (now Cliffs) claims 302250 and 3022251 for exploration expenditures of $1,500,000 by 31 October 2009.
- On July 21, 2009 KWG purchased half of the Nemis NSR (i.e., 1% NSR royalty) which was conveyed to 7207565 Canada Inc., a subsidiary of KWG.
- Spider and KWG will alternate as operator on an annual basis until the option is exercised. Spider was operator until March 31, 2010 after which KWG assumed operatorship for the next year (April 1, 2010 to March 31, 2011). After that operatorship will revert back to Spider for the following year.
- Freewest acknowledged that KWG and Spider had already each earned a 25% interest in the property as of September 10, 2009, and warranted that there are no encumbrances on the property beyond the NSR royalty.
- September 10, 2009 Freewest, KWG and Spider amended the original option agreement by allowing KWG and/or Spider to earn a combined additional 10% interest in the property through annual expenditures of $2,500,000 each within three years ending March 31, 2012 with them earning 3% in each of the first two years and 4% in the last year. This additional 10% may also be earned should one or both parties spend a minimum of $5,000,000 and deliver a positive feasibility study to Freewest by March 31, 2012.
- In June, 2010 Cliffs Natural Resources made an all cash offer to purchase Spider and completes the acquisition in July, 2010.
- By March 31st of 2012, KWG had completed all of its requirements under the September, 2009 amended agreement to bring their interest to 30% in the property. KWG and Cliffs now share the property under a joint venture.

4.3. Parties to the Agreements

KWG Resources Inc. is a junior exploration company in which Cliffs Natural Resources Inc. holds an approximately 16.6% interest. Cliffs has elected not to have board representation.

Cliffs Chromite Far North Inc. is a wholly owned subsidiary of Cliffs Natural Resources Inc. and has as its assets all of the former assets of Spider. Cliffs Chromite Ontario Inc. is a wholly owned subsidiary of Cliffs Natural Resources Inc. and has as its assets all of the former assets of Freewest.

5. Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1. Accessibility

Access to the property is by charter air service, available from Nakina, 280 km to the south-southwest, or Pickle Lake, 295 km to the west-southwest. Access for surface exploration activities such as diamond

drilling is by helicopter in the spring, summer and fall. During the winter access is possible using tracked vehicles, including snowmobiles.

During the summer the majority of rivers and creeks in the area are navigable by canoe and/or small motor boats.

The closest all weather road is at Nakina, however there is a winter road system that services the First Nation communities of Marten Falls, Webequie, Lansdowne House, Fort Albany, and Attawapiskat. It is possible that this system can be extended to provide access to the McFaulds Lake area.

5.2.Climate

The climate of the James Bay Lowlands area is dominantly a typical continental climate with extreme temperature fluctuations from the winter to summer seasons. But during the summer months this can be moderated by the maritime effects of James and Hudson Bays. Environment Canada records (http://climate.weatheroffice.gc.ca/climateData/canada_e.html) show that summer temperatures range between 10°C and 35°C, with a mean temperature of 13°C in July. Winter temperatures usually range between -10°C and -55°C with an average January temperature of -23°C. Lakes typically freeze-up in mid-October and break-up is usually in mid-April. The region usually receives approximately 610 mm of precipitation per year, with about 1/3 originating as snow during the winter months. On a yearly basis the area averages about 160 days of precipitation per year.

5.3.Local resources

Other than stands of timber there are no local resources available on or near the property.

All equipment and supplies have to be air-lifted and directed through the nearby native communities such as Webequie, Marten Falls, Lansdowne House and Attawapiskat. The nearest First Nation community is Webequie. It has a well maintained all season runway, a hospital, a public school, mail and telephone service, as well as a community store and a hotel. Webequie is also accessible during the winter months by a winter road.

5.4.Infrastructure

Currently there is no infrastructure in the immediate project area. The closest all weather road is at Nakina, and there is a winter road system that services the nearby First Nation communities of Marten Falls, Webequie, Lansdowne House, Fort Albany, and Attawapiskat. It is possible that this system can be extended to provide access to the McFaulds Lake area. All of the local First Nation communities are serviced by air and have all weather air strips. Power to these First Nation communities is provided by diesel generators while Nakina is connected to the Ontario hydro-electric power grid. Nakina is also the closest terminal on the Canadian National Railway (CNR) system.

5.5.Physiography

The project area is located along the western margin of the James Bay Lowlands of Northern Ontario within the Tundra Transition Zone consisting primarily of string bog and muskeg whereby the water table is very near the surface. Average elevation is approximately 170 m above mean sea level. The property area is predominantly flat muskeg with poor drainage due to the lack of relief. Glacial features

are abundant in the area and consist of till deposits, eskers, and drumlins, all of which are typically overlain by marine clays from the Hudson Bay transgression. Currently, the region is still undergoing postglacial uplift at a rate of about 0.4 cm per year (Riley, 2003). The project area is located between the drainage basins of the Attawapiskat and Muketei Rivers. The Muketei River is a tributary of the larger Attawapiskat River that flows eastward into James Bay.

The bog areas consist primarily of sphagnum moss and sedge in various states of decomposition. The southern portion of the property is partially covered by forested areas. Trees are primarily black and white spruce (Picea glauca and mariana), tamarack (Larix laricina), with minor amounts of trembling aspen (Populus tremuloides), balsam poplar (Populus balsamifera) and white birch (Betula papyrifera). In the northern portion of the property, trees are restricted to narrow bands along rivers and creeks and on well drained raised beaches. Willows (Salix) and alders (Alnus) are present along creeks and in poorly drained areas (Tuchsherer et al, 2009).

6. History

6.1.General

The first geological investigation of the James Bay Lowlands and the McFaulds Lake area was by Robert Bell of the Geological Survey of Canada (GSC). He and his crew traversed and mapped the shores of the Attawapiskat River from James Bay and past the McFaulds Lake area (Bell, 1887). Subsequently, in 1906 and between 1940 and 1965, the GSC and the Ontario Department of Mines (ODM) initiated further regional geological programs aimed at determining the petroleum potential of the Hudson Bay and James Bay sedimentary basins, and determining the potential for hydrocarbons in the Moose River Basin area.

Prior to the 1990's, the James Bay lowlands were sparsely explored. The few companies doing exploration in the area included Consolidated African Selection Trust (Armstrong et al., 2008) and Monopros Ltd., the Canadian exploration division of Anglo-American DeBeers. Most of the active exploration at that time was restricted to the region near Nakina where access is facilitated by road and train.

Modern day exploration in the McFaulds Lake area only began in the early 1990's as a result of diamond exploration. In 1989 Monopros Ltd. began exploration near the Attawapiskat kimberlites, which resulted in the discovery of the Victor pipe. The Spider/KWG joint venture resulted in the discovery of the Good Friday and McFayden kimberlites in the Attawapiskat cluster, as well as the 5 Kyle kimberlites (Thomas, 2004). This activity led the way for other diamond exploration companies, i.e., Canabrava Diamond Corporation, Condor Diamond Corp., Dumont Nickel Inc., Dia Bras Exploration Inc., Greenstone Exploration Company Ltd., and Navigator Exploration Corp. (Tuchsherer et al, 2009).

In the early 2000's copper mineralization was discovered by DeBeers Canada Inc. in the McFaulds Lake area. This discovery was subsequently drill defined by Spider/KWG and named the McFaulds No. 1

volcanogenic massive sulphides (VMS) deposit. Further copper mineralization was found at the McFaulds No. 3 VMS deposit (Gowans and Murahwi, 2009).

Richard Nemis arranged to have staked claims in the McFaulds Lake area, including the ones hosting the Big Daddy chromite deposit. He optioned the claims to Freewest who then optioned the claims to Spider Resources and KWG Resources in 2005. The first chromite mineralization found was by Spider/KWG in hole FW-06-03, in 2006.

The discovery of the Eagle One nickel massive sulphide deposit by Noront Resources in 2007 resulted in the most recent staking rush. Over the next two years the Black Bird, Black Creek, Black Thor and Black Label chromite deposits were found as well as the Thunderbird vanadium deposit.

6.2.Discovery history

In April of 2003 John der Weduwen staked claims 3012250 to 3012253 and then transferred 100% to Richard Nemis who then optioned the claims to Freewest Resources Canada Inc. (Freewest). In late July-early August of 2003 Scott Morrison staked claims 3008268, 3008269 and 3009793 and then transferred 100% to Freewest. Freewest completed the following work over the property between 2003 and 2005:

- Airborne EM and magnetic surveys.
- Line cutting.
- Ground HLEM, VLF and magnetic surveys.
- Diamond drill hole FW-04-01 was drilled to a depth of 190m to test an EM anomaly. No mineralisation of any note was intersected.

In December 2005, Spider Resources and KWG Resources signed an option agreement with Freewest covering the current property. In January of 2006 3 holes were drilled to test various geophysical anomalies. Hole FW-06-03 intersected two bands of massive chromite. The first band, from 153.27m to 154.3m, assayed 34.49% $Cr_2O_3$and the second, from 158.8m to 159.65m, assayed 31.97% Cr_2O_3. It is this zone of chromite mineralisation that is now referred to as the Big Daddy chromite deposit, subject of this report.

7. Geological Setting and Mineralization

7.1.Regional geology

The James Bay Lowlands regional geology can be subdivided into the following domains: Precambrian Basement Complex, Paleozoic platform rocks, and Quaternary cover.

7.1.1. Precambrian Basement Complex

The Big Daddy property is located within the eastern portion of the Molson Lake Domain (MLD) of the Western Superior Province of the Canadian Shield (see Figure 4). Age dating has shown that there are two distinct assemblages: the Hayes River assemblage with an age of about 2.8 Ga, and the Oxford Lake assemblage with dates of about 2.7 Ga. Numerous mafic intrusions have been documented in the domain, such as the Big Trout Lake intrusion (Percival, 2007).

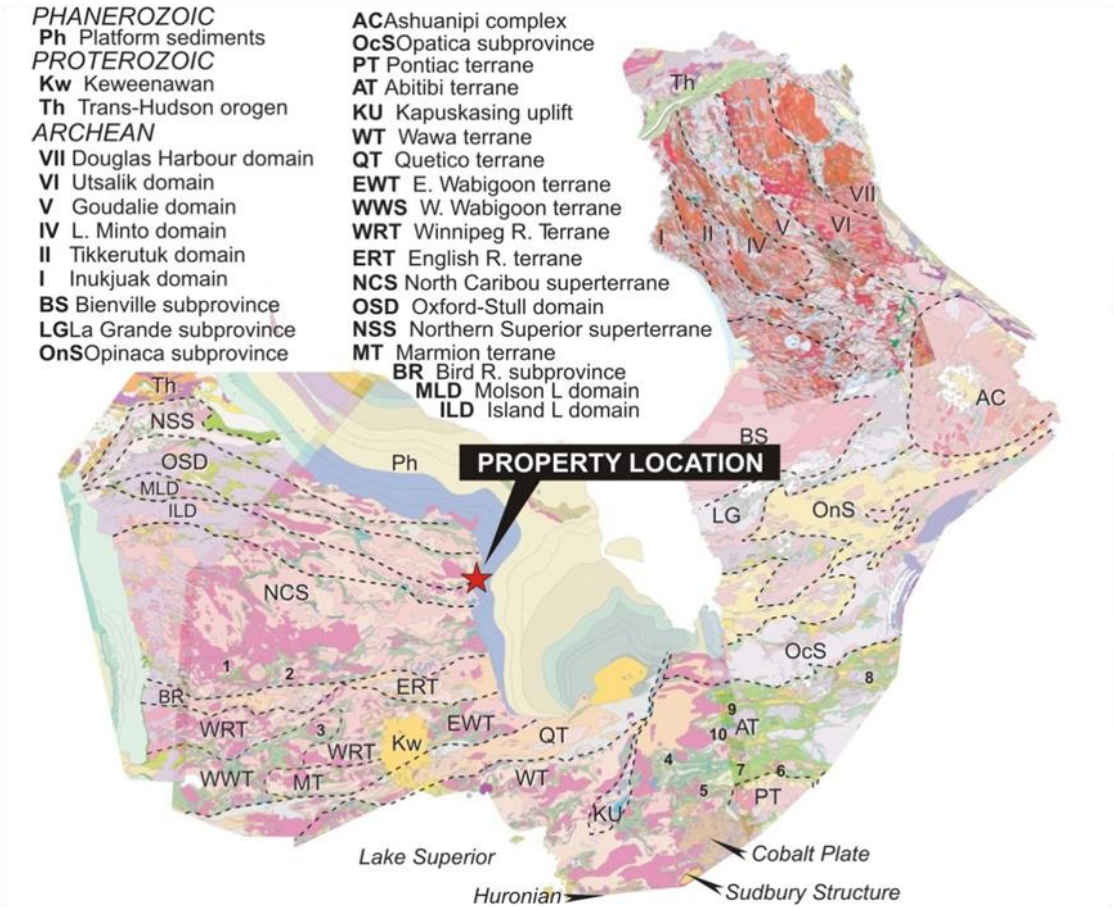

Figure 4 Geological map of the Superior Province showing tectonic domains

The domain is also intruded by numerous plutons of tonalitic, granodioritic, and granitic compositions.

In the McFaulds Lake area of the James Bay lowlands there is very poor outcrop exposure. As a result an aeromagnetic compilation and geological interpretation map was completed by Stott in 2007. Important geological features observed by Stott (2007) are:

- West- and northwest-trending faults show evidence of right-lateral transcurrent displacement.
- Northeast-trending faults show left-lateral displacement.
- In the northern half of the Hudson Bay Lowlands area Archean rocks are overprinted by the Trans-Hudson Orogen (ca. 2.0 – 1.8 Ga).
- Greenstone belts of the Uchi domain and Oxford-Stull domain merge under the James Bay Lowlands.
- The Sachigo subprovince contains a core terrain, i.e., the North Caribou Terrain and “linear granite-greenstone” domains on the south and north flanks, that record outward growth throughout the Neoarchean.
- Major dextral transcurrent faults mark the boundary between the Island Lake and Molson Lake domains.
- Proterozoic (1.822 and 1.100 Ga) carbonatitic complexes intruded and reactivated these faults.

- The area has undergone a doming event. Uplifted lithologies include a regional scale granodioritic gneissic complex to the NW of the property.

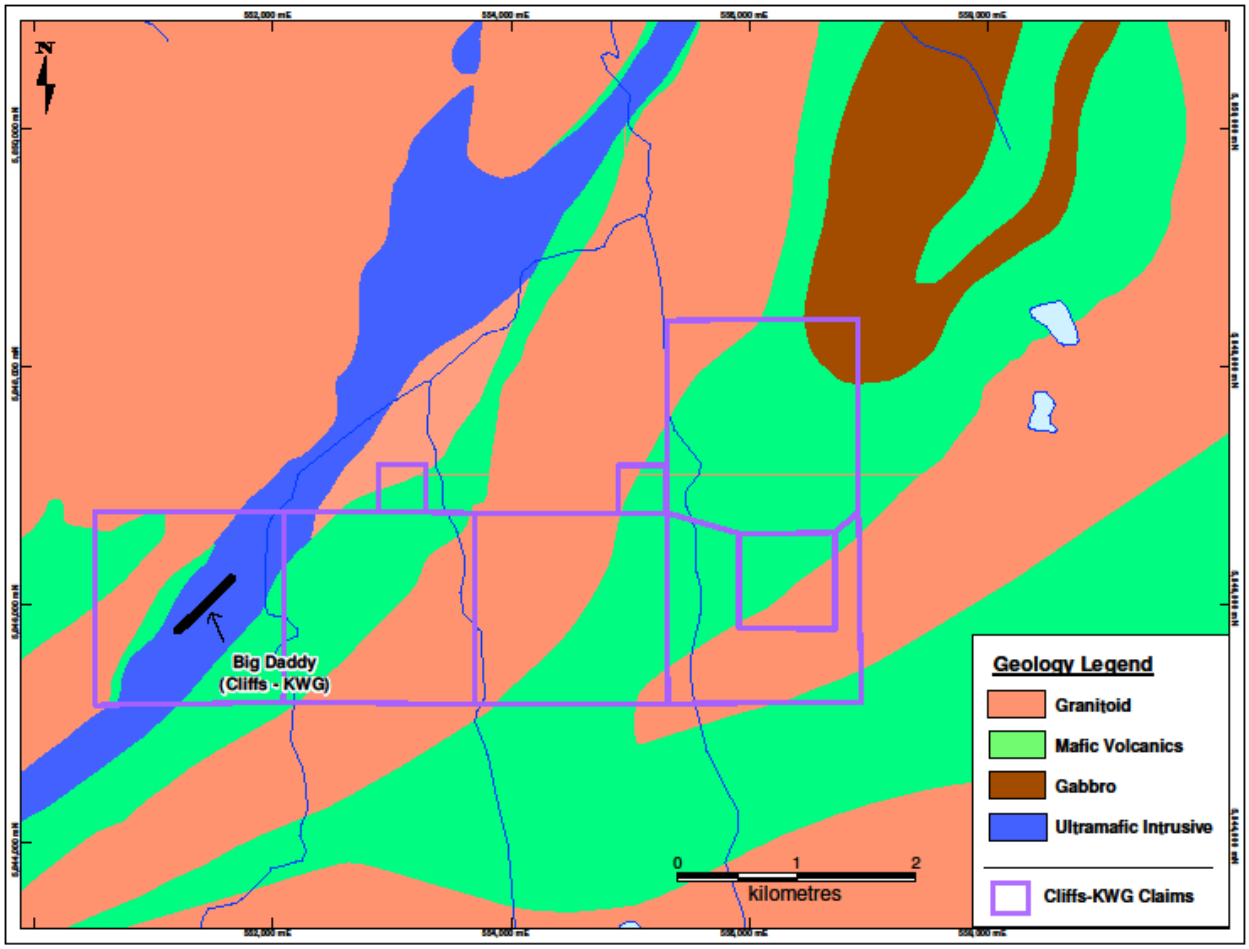

Figure 5 Local Geology of the McFaulds Lake Area.

7.1.2. Paleozoic Platform Rocks

The Paleozoic Platform rocks of the James Bay Lowlands consist primarily of upper Ordovician age (450 Ma to 438 Ma) sedimentary rocks. The sedimentary pile thickens significantly to greater than 100 m to the east and north but is only intermittently present in the immediate property area. It is comprised mainly of poorly consolidated basal sandstone and mudstone overlain by muddy dolomites and limestones.

7.1.3. Quaternary Cover

The area is mantled by a thin, but persistent, layer of glacial and periglacial till and clay deposits.

7.2.Local Geology

Because of the limited bedrock exposure not much can be directly inferred about the geology of the Big Daddy property. The overburden varies in thickness from about 3m to 10m. It consists of a mixture of glacial outwash with abundant gravel to cobble sized pieces of unconsolidated tan coloured fossiliferous limestone, granitic rocks, as well as minor ultramafic rocks.

Most of the property geology can be indirectly inferred from the recent diamond drilling campaign and geophysical surveys. From these sources, it is interpreted that the property is underlain by: volcanics, ultramafic rocks and late felsic intrusive rocks (see Figure 5).

7.2.1. Volcanics

Volcanic lithologies present are typical of most greenstone belts of the Superior Province. They consist of foliated mafic to felsic volcanic flows and pyroclasitic units, with intercalated schist, gabbro, iron-formation, and greywacke.

7.2.2. Ultramafic Rocks

The volcanics are intruded by a large multi-cyclic ultramafic complex consisting primarily of dunite, peridotite, chromitite, pyroxenite, gabbro, leucogabbro, and gabbronorite. These lithologies are variably altered, primarily in the form of serpentinization of olivine with talc, tremolite, chlorite, kammererite, stichtite, and magnetite also being present.

The geological package is vertical or dips very steeply towards the SE. In part, it is fully overturned and dips steeply to the NW.

The Big Daddy chromite deposit is hosted within the multi-cyclic ultramafic intrusion and is best defined on the Freewest property to the north. The lower cycle consists dominantly of peridotite with minor accumulations of olivine adcumulate and chromite. The second cycle shows more differentiation with appreciable enrichment of chromite. The third cycle has a basal zone of significant chromite enrichment. Overlaying the chromite-rich portions of the complex is a pyroxenite unit that drilling indicates has eroded away portions of the upper chromite horizon (i.e. hole FW-09-26). The pyroxenite horizon is overlain by olivine adcumulates, peridotite and gabbro. The ultramafic complex host to the chromite mineralisation is up to 500 metres thick and has been traced for over 15 kilometres along strike.

7.2.3. Felsic Intrusive Rocks

Felsic intrusive rocks, intersected in drilling just to the north-west of the Big Daddy chromite deposit, are comprised mostly of granite and quartz-diorite. The granite is grey-white, coarse-grained, hypidiomorphic and granular, consisting of quartz, feldspar, and biotite crystals. The granite is typically gradational into a quartz-diorite. The contact with the ultramafic and volcanic rocks is sharp and irregular.

7.2.4. Faulting

Drilling has intersected faults identified by slickensides, mylonitization, and intense brecciation of the host lithologies. Magnetic and gravity surveys indicate that there are major fault displacements to the northeast and southwest.

7.3 Mineralisation

To date only one type of mineralization has been found on the Big Daddy property: chromite. The Chromite mineralization is potentially economic and is hosted by the Big Daddy chromite deposit.

7.3.1 Chromite Mineralization

The Big Daddy chromite deposit is the south-west extension of the Black Thor and Black Creek deposits and was the first chromite deposit discovered in the area. The chromite is stratiform and is hosted by a large ultramafic to mafic layered intrusion. Various types of chromite mineralization have been observed including disseminated chromite (1 to 20% chromite), semi-massive chromite and massive chromite (Chromitite). The main chromitite layer is up to 60 metres thick and has been traced on the Big Daddy property over 1.4 kilometres along strike. The chromite is present as small grains typically 100 to 200 µm and hosted typically by peridotite and, in the higher grade portions, by dunite. The grains are present as euhedral chromite, intensely fractured chromite grains, chromite grains with internal gangue veinlets and chromite grains with spherical gangue inclusions (SGS Minerals Services, 2009).

8. Deposit Types

Various economic mineral deposit types are known to exist in the James Bay Lowlands of Northern Ontario. These include: magmatic Ni-Cu-PGE, magmatic chromite mineralization, volcanogenic massive sulphide mineralization and diamonds hosted by kimberlite.

The ultramafic/mafic rocks found on the Big Daddy property have been explored primarily for magmatic chromite mineralization. Chromite mineralization occurs as stratiform bands within a large layered intrusion and shows major similarities with the Kemi intrusion of Finland.

At Kemi, chromite is hosted by a layered intrusion composed of peridotite and pyroxenite cumulates with chromite layers. The intrusion is interpreted to be funnel-shaped with the cumulate sequence thickest at the centre. There is a continuous chromite layer that has been traced 15 km along strike and varies in thickness from a few millimetres to as much as 90 metres in the central portion of the intrusion. Using a cut-off of 20% there were 40 million tonnes of open pit reserves grading 26.6% Cr_2O_3 with a Cr/Fe ration of 1.53 (Alapieti, et al., 1989).

9. Exploration

Prior to 2011 all exploration activities on the property had been either supervised or sub-contracted to Billiken Management Services Inc. (Billiken) on behalf of Spider, the project operator. Billiken provided all geological personnel, camp facilities, camp management and supervised or provided all other support services during that time period.

In 2009 ground gravity (see Figure 6) and magnetic gradient surveys were completed over the west end of the property. Details on the exploration done up to March of 2009 can be found in Gowans and Murahwi (2009). Up to 2010 a total of 55 drill holes had been drilled on the property testing VMS and chromite targets.

In 2010 KWG acted as operator for the project. They completed 2 holes testing the down dip extension of the chromite mineralisation and 4 holes for metallurgical sampling purposes.

Cliffs, due to its acquisition of Spider Resources in 2010, assumed the role of operator beginning on April 1, 2011. They have drilled an additional 50 holes, including 8 metallurgical holes, and 42 infill holes.

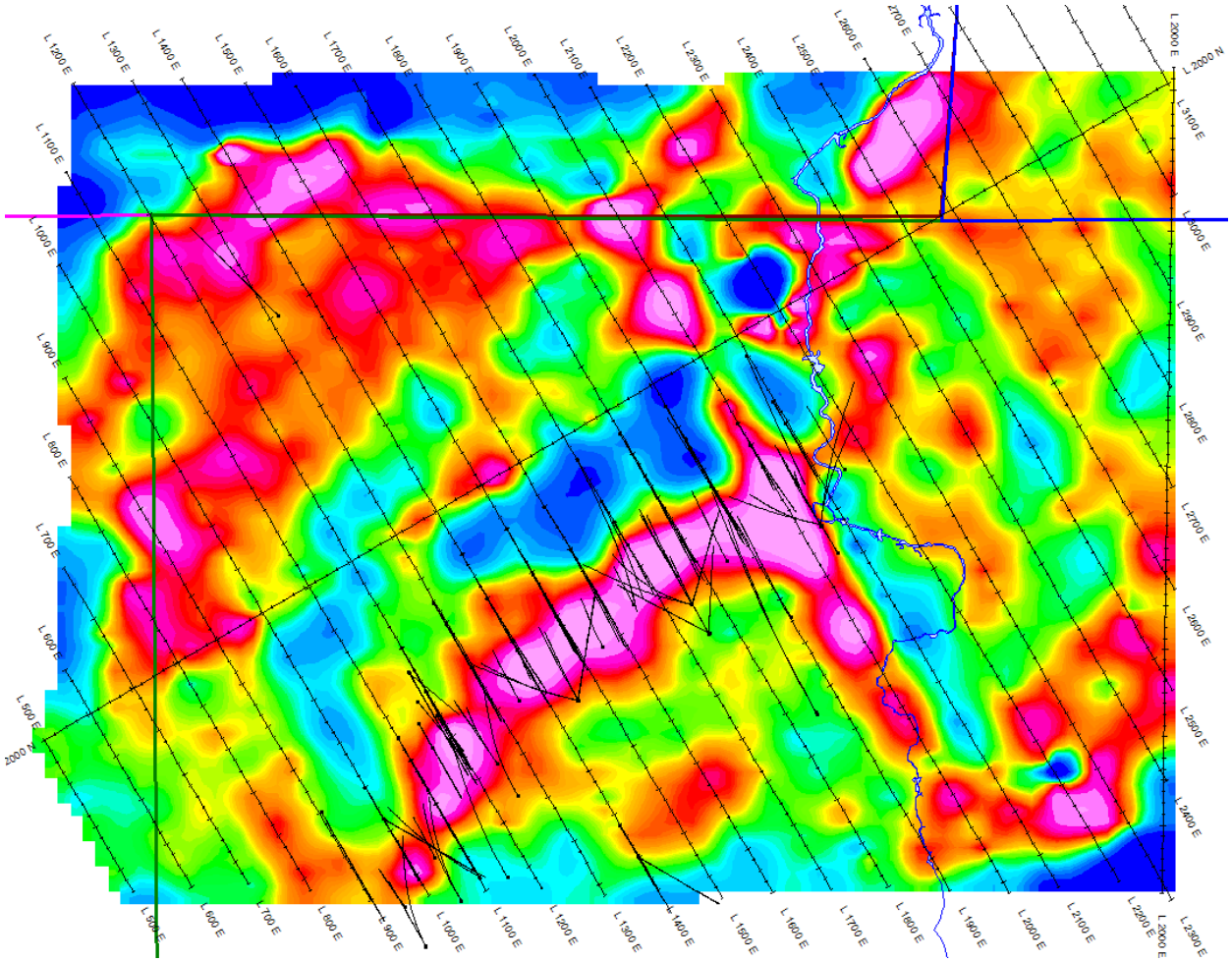

Figure 6 Map showing the gravity survey (residual) and diamond drilling for Big Daddy.

10. Drilling

To date 112 BQ and NQ-sized holes totalling 31,015 metres have been drilled on the property, not all of which have tested the Big Daddy chromite deposit. Down-hole orientation surveys were completed on all holes. See Appendix 1 for details on the holes that are in or close to the Big Daddy chromite deposit.

Typical sample length was 1 metre. All data used for resource estimation was composited to a standard sample length of 1m.

11. Sample Preparation, Analyses and Security

Gowans et al (2010a) describes the sample preparation, analytical methods and security used for the first 48 holes drilled to test the Big Daddy chromite deposit. Subsequent work conducted by KWG Resources and Cliffs Natural Resources have utilised the same protocols and lab (Activation Labs).

11.1. QA/QC Procedure

A description of the QA/QC program implemented for the first 48 holes of the Big Daddy, and implemented by KWG Resources and Cliffs Natural Resources for all subsequent drilling can be found in Gowans et al (2010a).

12. Data Verification

Assay results were verified internally by Billiken staff, for the first 48 holes and by Cliffs Natural Resources staff for all subsequent holes.

A review of the data by the author (see section 14.1.1.6. and Appendix 2) showed no issues. The data is considered valid, representative and suitable to be used for resource estimation.

13. Mineral Processing and Metallurgical Testing

To date there have been four mineral processing studies done: one by World Industrial Minerals (2008) one by SGS Minerals Services (2009) and two by Xstrata Process Support (Barnes, 2011a and 2011b).

13.1. World Industrial Minerals Testing

13.1.1. Methods Used

World Industrial Minerals used quarter splits of 8 samples from two holes (FW-08-05 and FW-08-07). They wet crushed the samples to -70 mesh using a laboratory rod mill and then separated the material using a 140 mesh screen. Material that passed the 140 mesh screen was then passed through a flotation circuit. The over size (+140 mesh) was sent to a gravity circuit.

The floatation separation was done using two approaches:

- Flotation of the waste minerals from the chromite using a cationic collector.
- Desliming and anionic-collector flotation of the chromite from the waste minerals.

The gravity separation process used a laboratory-scale shaking table.

13.1.2. Results

The bench testing successfully produced a product that exceeds the minimum 40% Cr_2O_3 grade threshold that the market prefers. The final concentrate has a Cr:Fe ratio of 2.07. Results of the study are summarised in Table 2.

Sample	Grade, %Cr2O3	37.4
Floatation	Cr2O3 % recovery	27.6
	Product Grade, %Cr2O3	43.0
Gravity	Cr2O3 % recovery	46.7
	Product Grade, %Cr2O3	49.0
Overall	Cr2O3 % recovery	74.4
	Product Grade, %Cr2O3	46.6

Table 2 Summary of World Industrial Minerals testing results.

13.2. SGS Mineral Services Testing

13.2.1. Methods Used

SGS Mineral Services completed gravity separation tests on 133 core reject samples divided into 8 metallurgical samples and microprobe work to assess the quality of the chromite grains on 20 samples.

The composite samples used for the gravity test work are: MET2 (17 core samples from hole FW-08-06), MET3 (17 core samples from hole FW-08-23), MET4 (17 core samples from hole FW-08-15), MET5 (16 core samples from hole FW-08-18), MET6 (17samples from hole FW-08-13), MET7 (16 core samples from hole FW-08-22), MET8 (17 core samples from hole FW-08-14), and MET9 (16 core samples from hole FW-08-12). Each metallurgical sample was processed independently of the others.

Sample preparation consisted of the following:

- Crushed to -860µm (20 mesh)
- Split into 3 size fractions: >300 µm, 300-75 µm, <75 µm
- The two coarser fractions were first processed using low-intensity magnetic separation to remove magnetic iron minerals and then passed over a Wilfey shaking table with the concentrate then processed using a Mozley mineral separator or a superpanner, depending on sample size. Tailing were then ground to -75 µm and then combined with the third fraction.
- The -75 µm fraction was also first processed using low-intensity magnetic separation to remove magnetic iron minerals and then passed over a Wilfey shaking table followed by the Mozley mineral separator or superpanner.

13.2.2. Results

The microprobe work shows that the Cr_2O_3 content of the chromite grains varies from 43.6% to 51.9% and that the Cr:Fe ratio varies from 1.0 to 1.9.

The results of the gravity separation work are summarised in Table 6 which shows grade and recoveries for different product grades. Where product grades could not be attained entries are blank. Entries are also blank where the feed grade was higher than the product grade.

The report made the following conclusions based on the results summarised by Tables 3 and 4:

	Feed		Grade >45% Cr_2O_3			Grade >40% Cr_2O_3			Grade >30% Cr_2O_3		
	Assay, %	Ratio	Cr_2O_3, %		Ratio	Cr_2O_3, %		Ratio	Cr_2O_3, %		Ratio
Sample	Cr_2O_3	Cr:Fe[2]	Grade	Recov.	Cr:Fe	Grade	Recov.	Cr:Fe	Grade	Recov.	Cr:Fe
2	4.42	0.35							32.1	14.5	0.76
3	7.96	0.56				40.6	3.66	1.17			
4	12.3	0.76				41.5	21.7	1.22			
5	20.4	1.17	45.5	56.7	1.49	43.0	72.7	1.47	32.9	93.5	1.27
6	35.4	1.35	45.2	71.5	1.37	44.4	85.8	1.36			
7	42.9	1.88	48.4	88.2	1.88						
8	40.0	1.96	47.5	93.6	1.98						
9	34.8	1.43	45.1	62.7	1.44	41.6	93.7	1.44			

Table 3 SGS Gravity separation recovery results summary.

	Feed		**+75 µ Grav Conc**			**-75 µ Grav Conc**			**Low-Intensity Magn.**		**High-Intensity Magnetics**		
	Assay, %	**Ratio**	**Cr_2O_3, %**		**Ratio**	**Cr_2O_3, %**		**Ratio**	**Cr_2O_3, %**		**Cr_2O_3, %**		**Ratio**
Sample	**Cr_2O_3**	**Cr:Fe[3]**	**Grade**	**Recov.**	**Cr:Fe**	**Grade**	**Recov.**	**Cr:Fe**	**Grade**	**Recov.**	**Grade**	**Recov.**	**Cr:Fe**
2	4.42	0.35	37	5.93	0.83	34.8	4.34	0.77	14	56.2	7.05	16.8	0.32
3	7.96	0.56	42.5	1.57	1.28	41.4	1.79	1.09	11.2	92.2	1.96	2.06	0.29
4	12.3	0.76	41.2	11.4	1.26	42.7	7.55	1.19	16.2	65.7	7.2	8.21	0.67
5	20.4	1.17	44.8	22.4	1.47	46.8	25.5	1.49	14.9	7.2	20.5	13.5	1.17
6	35.4	1.35	44.3	35.2	1.36	45.7	41.5	1.37	23	0.32	40.8	8.87	1.37
7	42.9	1.88	49	51.6	1.89	50.3	4.1	1.89	32.5	0.53	47.6	32	1.9
8	40	1.96	47.3	52.9	2.02	51.2	16.9	2.1	28.3	0.63	46.4	23.2	1.88
9	34.8	1.43	46.3	33.2	1.43	47.5	10.7	1.39	28.2	0.78	42	15	1.37

Table 4 SGS Recoveries from the various treatment streams.

- Samples 2, 3 and 4 did not attain a high-grade concentrate.
- The low-grade samples had low recoveries of chromite.
- For the low grade samples (2, 3 and 4) the low-intensity magnetic separation recovered much of the chromite.
- For samples 5 through 9 the chromite recovery is proportional to the feed grade.
- Sample 7 has silicates (talc, chlorite, serpentine) locked with the chromite as coatings, webbing or as fracture filling.

Two samples (6 and 9) were further tested using Dense Media separation and Magnetic separation as two forms of pre-concentration. Neither method proved to be effective.

[2] Cr:Fe is calculated from bulk chemistry and therefore is not indicative of the actual chromite Cr:Fe ratio.
[3] Cr:Fe is calculated from bulk chemistry and therefore is not indicative of the actual chromite Cr:Fe ratio.

13.3. Xstrata Process Support

13.3.1. Crushing and Screening

13.3.1.1. Methods Used

Crushing tests were completed on 400 kg of core samples from the Big Daddy chromite deposit. The test involved a single pass jaw crushing with the jaws set at 1”. The crusher product was then screened at 1” and then a full screen analysis was performed on the median bucket to estimate fines generation (Barnes, 2011b).

13.3.1.2. Results

The sample material was found to be extremely competent with no tendency to friability. Less than 10% of the crushed material was less than 10mm, well below 30% minus 10mm specified for marketable “lumpy” ore, and only 4% converted to minus 6mm fines. It is expected that there should be a high yield of direct shipping grade lumpy chromite ore.

13.3.2. Metallurgical Testing

13.3.2.1. Methods Used

Using core samples provided by KWG Resources the core was crushed and screened, then spin-riffled to ensure representative samples. A chemical analysis was completed to characterize the sample, followed by thermal analysis, batch smelting tests and thermochemical modelling (Barnes, 2011a).

13.3.2.2. Results

The results indicated that the material is highly reducible considering its high chromium content and, during smelting, produces a high grade alloy at high chromium recovery, providing essential operating parameters are satisfied.

Analysis of the smelting results indicates that a reductant requirement of at least 19.5% Carbon equivalent is required to ensure optimum chromium recovery. The smelting is somewhat less sensitive to the flux addition rate, but 9% CaO equivalent is considered the safe minimum. Smelting temperatures of 1625-1650°C appear optimum for best results.

It was concluded that the Big Daddy ore can be expected to return chromium recoveries of 92-93% into a high carbon ferrochrome alloy grading around 58-60% Cr, with 6-8% C, 1% Si and the balance being iron.

Smelting power requirements, while subject to issues such as operating conditions, furnace configuration and size and selection of process technology, are relatively modest considering the grade of alloy produced. Based on the various models tested it is estimated power required will be about 3.5 - 3.8 MWh per ton of alloy produced.

No issues of concern were uncovered either in modelling or during batch smelt testing. Thermal analysis resulted in excellent reducibility even considering the high Cr:Fe ratio in the ore.

It was concluded that the high grade Bid Daddy chromite ore should provide an excellent feedstock for smelting to high carbon ferrochrome alloy grading 58-60% Cr.

14. Mineral Resource and Mineral Reserve Estimates

14.1. Mineral Resource Estimation

14.1.1. Resource Estimation Methodology

14.1.1.1. Software Used and Data Validation

The software used in the modelling process, including data preparation is Datamine® Studio 3, Release 3.21.7164.0.

Core-drilling data was supplied as Microsoft Excel files and CSV files that included collar information, assays, lithology information and down hole survey information. The data has been validated by the author. Once validated this information was imported into Datamine® as five tables: a collar file, an assay file, a lithology file, and 2 survey files. Using the Datamine® HOLES3D routine 2 desurveyed drill hole files, *bd_lgholes.dm* (used for estimating the Big Daddy chromite deposit), and *bd_utmholes.dm* (for displaying in world UTM coordinate space) were created. The drill hole files were last updated on June 3, 2012.

The Datamine® desurveying routine, HOLES3D, does a rigorous set of validation checks including checking for duplicate borehole numbers, missing survey data and overlapping sample intervals. If present, it generates a summary report with a list of all errors encountered. These files were checked to determine if any errors occurred. Once it had been confirmed that no errors were present the drill hole files were then used for subsequent steps.

Using a polynomial regression on a total of 2216 specific gravity (SG) measurements a best fit line calculated. The results of this polynomial regression for Cr_2O_3 and SG are shown in Figure 7. The resultant formula has a correlation coefficient of 0.9129 yet the regression line could do a better job of matching the densest part of the data trend. As a result the SG values were clipped to 0.3 units above and below this initial trend line and then a new trend line was determined (see Figure 8).

This new trend line has a correlation coefficient of 0.9628 and better matches the densest parts of the data set. The resultant formula for this new trend line is:

$$SG = 0.0003x^2 + 0.0192x + 2.6629 \qquad \text{Eq. 14.1}$$

Using this formula SG values were then calculated for all samples in the drill hole file, based on Cr_2O_3 content. If no Cr_2O_3 assay was available SG was set to a default value of 2.6629.

14.1.1.2. Geological Domains

Experienced geologists had coded each rock unit based on core logging description. All of the holes are inclined and most intersected at least some portion of the mineral zone of interest. Construction of the

resource block model was controlled by building wire frames that were then used to isolate related samples. No cut-off was used to limit the extent of these mineral envelopes. The envelope for the mineral domain (see Figure 8) extend from an elevation of 169 metres above sea level (the approximate bedrock surface) down to a maximum depth of 319 metres below sea level, a total depth of 488 metres below surface, just below the deepest drilling to date. The mineralisation is open to depth along its entire strike length. While it is not a geological envelope the mineral envelope does honour the local geology as much as possible.

A total of 84 holes have been used for this resource estimate out of a total of 112 holes drilled on the property. Holes were excluded because they did not intersect the mineral zone, were not assayed and thus could not provide suitable information, or were excluded because there were questions as to their location.

Initial data are contained within a set of Microsoft Excel tables and CSV files that were updated with additional assay data June 1, 2012.

The base relationship between UTM and Local Grid coordinates was established using hole FW-09-33.

14.1.1.3. Drill Hole Database

There were two survey files: one with information just for the collar, and the second for all additional down hole readings. These two survey files were combined to make one file for the local grid workspace and one for the UTM work-space.

The collar file was then processed using the Datamine® CDTRAN routine to convert UTM coordinates to local coordinates creating the files “utm_collars.dm” and “lg_collars.dm”. This transformation was done using the relationship that hole FW-09-33 has local grid coordinates of 1500E and 1800N and this corresponds to 551382E and 5845792N in UTM coordinates and that the local grid is rotated 30° west relative to true north.

As the down hole survey values stored in the database are in world (UTM) space a copy was made such that the azimuths were transformed to local grid space by rotating clockwise 30°. In addition a lookup table was used to convert lithology codes to a more simplified set creating the file “lith.dm”.

Using the polynomial regression previously described, the assay table was processed using EXTRA to calculate SG values. Where no Cr_2O_3 values are present SG was set to a default value of 2.663 and Cr_2O_3 was set to 0. The output file name is “assays1.dm”.

Two drill hole files were then created; one in local grid space and the other in world (UTM) space. Using the appropriate collar, survey, assay and lithology files the Datamine® process HOLES3D was used to create two de-surveyed 3D drill holes files: “bd_utmholes.dm” and “bd_lgholes.dm”. Only the latter file was used for grade estimation as it is much easier to work with orthogonal data (local grid) rather than rotated data.

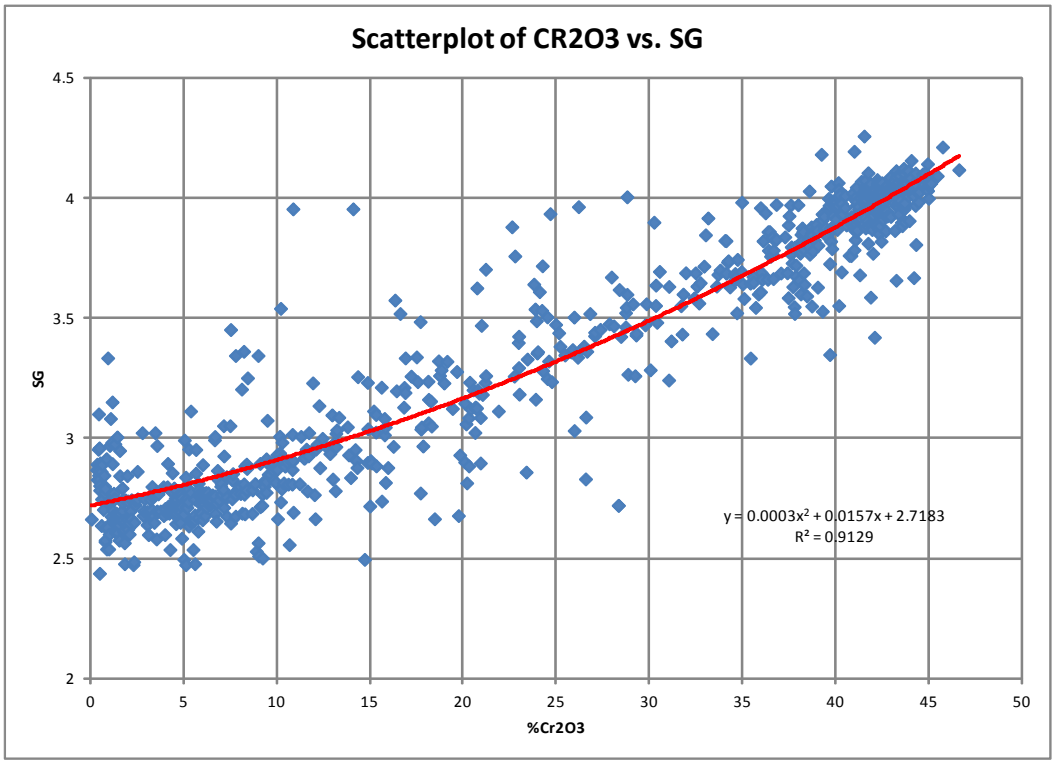

Figure 7 Initial Polynomial regression analysis of SG vs. % Cr_2O_3 for Big Daddy.

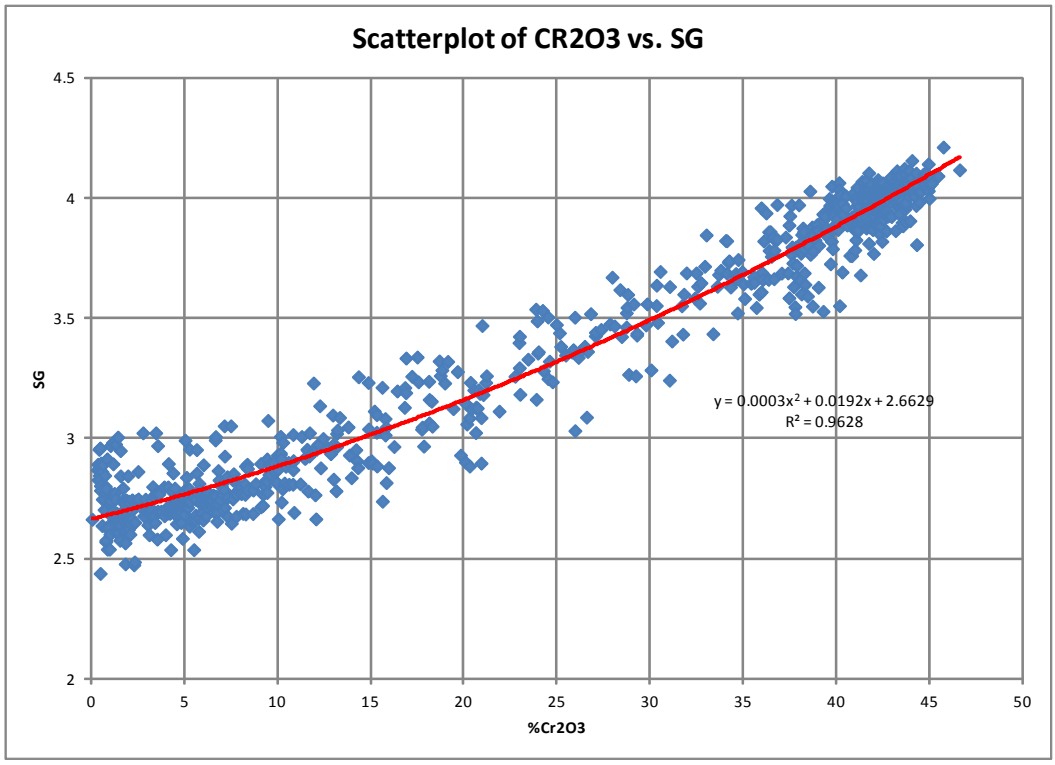

Figure 8 Polynomial regression analysis of SG vs. % Cr_2O_3 for Big Daddy, after trimming.

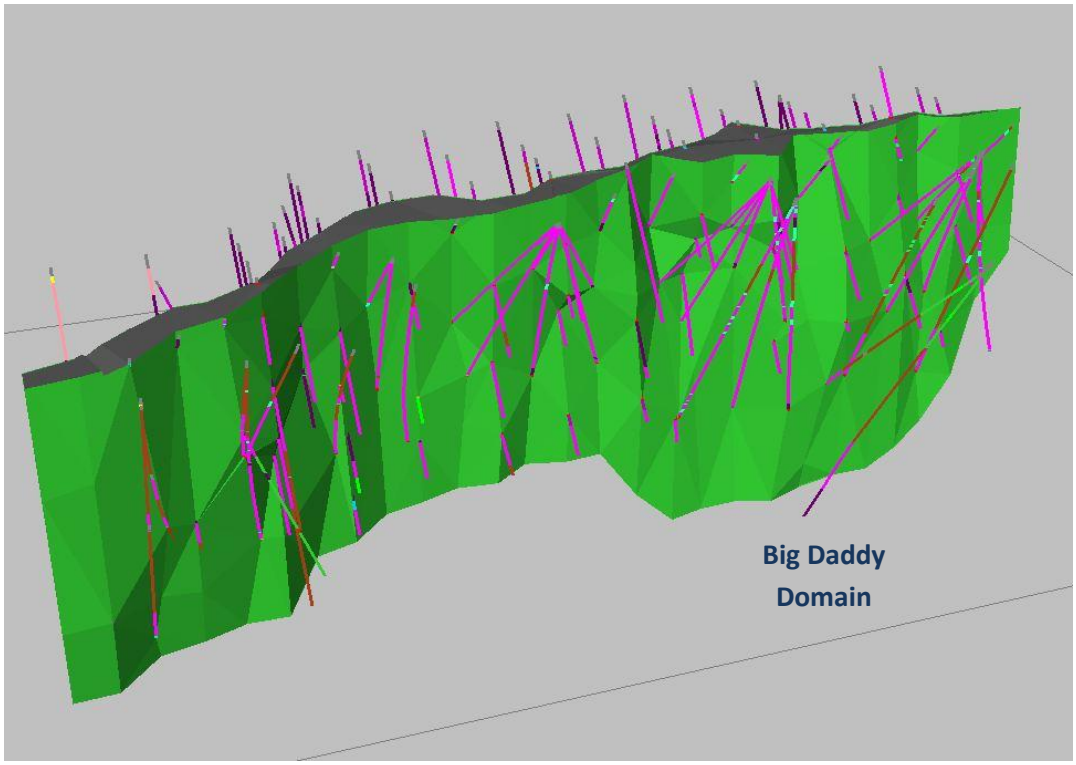

Figure 9 Isometric view of the Big Daddy geological domain used.

A visual review was made of the drill hole file "bd_lgholes.dm" and 9 holes that did not have assays were removed. In addition hole FW-08-19 was removed as it did not correlate with any of the other holes on section 1200. A summary of all of the holes used for this resource estimate are presented in Appendix 1 as are a surface plan showing hole locations (Figure 16) and an example section: 1800 East (Figure 17).

The resultant file, "bd_lgholes.dm" contains information for 99 drill holes totalling 30,589 metres and with 6,117 samples with Cr_2O_3 assays. This file was used for collecting samples for estimation of the Big Daddy Domain.

Some of the earlier holes drilled only have data analysed using INAA (Induced Neutron Activation Analysis) rather than analysed using the more reliable XRF (X-Ray Fluorescence) method, especially for higher grades. Thus XRF data have been used if available and INAA if that data type is the only one present for Cr_2O_3.

14.1.1.4. Sample Selection

Working in cross section a set of mineral zone lines, or strings, was defined for the domain. These strings were drawn to enclose the Big Daddy chromite zones by snapping to the drill holes. The strings from each set were then used to construct a mineral envelope wire frame for the domain (see Figure 9). The envelope extends from 169 metres above mean sea level (approximately the bedrock surface) down to 319 metres below mean sea level, just above the deepest drilling to date (this hole did not intersect any

chromite mineralisation). The borehole samples located within the mineral envelopes were captured using a custom script.

14.1.1.5. Compositing

The captured samples have an average sample length of 1.2 metres (see Figure 10). It is expected that mining at Big Daddy likely will be by open pit. A block size that will allow a reasonable amount of selectivity using that mining method is approximately 10m x 10m x 12m. As 1 metre represents a multiple of these blocks dimensions and is very close to the average sample length it was settled on as being the most appropriate length when compositing for uniform support.

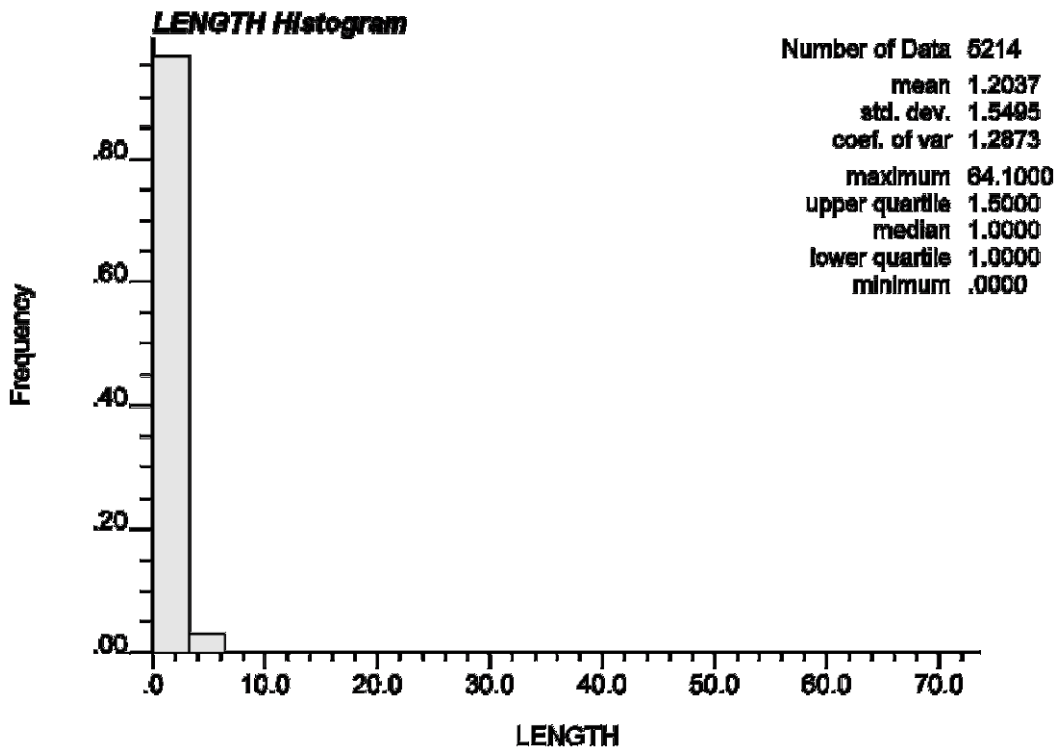

Figure 10 Histogram of sample length.

Composited samples are weighted by Specific Gravity as it is a close approximation of density (mass per unit volume). The samples were composited to standard 1 m intervals using the Datamine® process COMPDH. The COMPDH process starts the composites at the beginning of the selected data interval and leaves any remainder at the end of the interval. This results in most holes having one sample with a length less than the established composite length, within the domain. For grade estimation purposes, drill composites are treated like point data (i.e. their length is not used), thus the need to composite to a standard sample length to eliminate any sample bias. And to avoid bias from a very short sample being treated the same as a standard sample any that were less than 40% of the composite length were rejected.

14.1.1.6. Exploratory Data Analysis

A review of the composited drill hole samples within the mineral envelopes was done, primarily using GSLib routines (Deutsch and Journel, 1998) to create histograms for all primary elements and X/Y scatter plots of element pairs (see Appendix 2). Features watched for are outliers and irregularities in the element statistics. Univariate summary statistics for all elements are presented in Table 5 and a correlation matrix is presented in Table 6. For the latter a correlation coefficient of 0.7 or higher indicates a good linear relationship between the bivariate components. A positive coefficient indicates that with increasing concentration of one element there is a sympathetic increase in the other. A negative coefficient indicates that as one element increases the other decreases.

The Cu and Ni assays include several outliers possibly due to rare sulphide mineralisation. The scatter plot of Cu vs. Ni does not indicate any correlation between the two and the correlation matrix (Table 2) confirms this with an extremely low correlation coefficient.

For the precious metals Au is generally very low although there are several outliers: 8.8, 4.0, 3.2, 1.5 and 1.2 g/t. Pd and Pt have a weak correlation with one another.

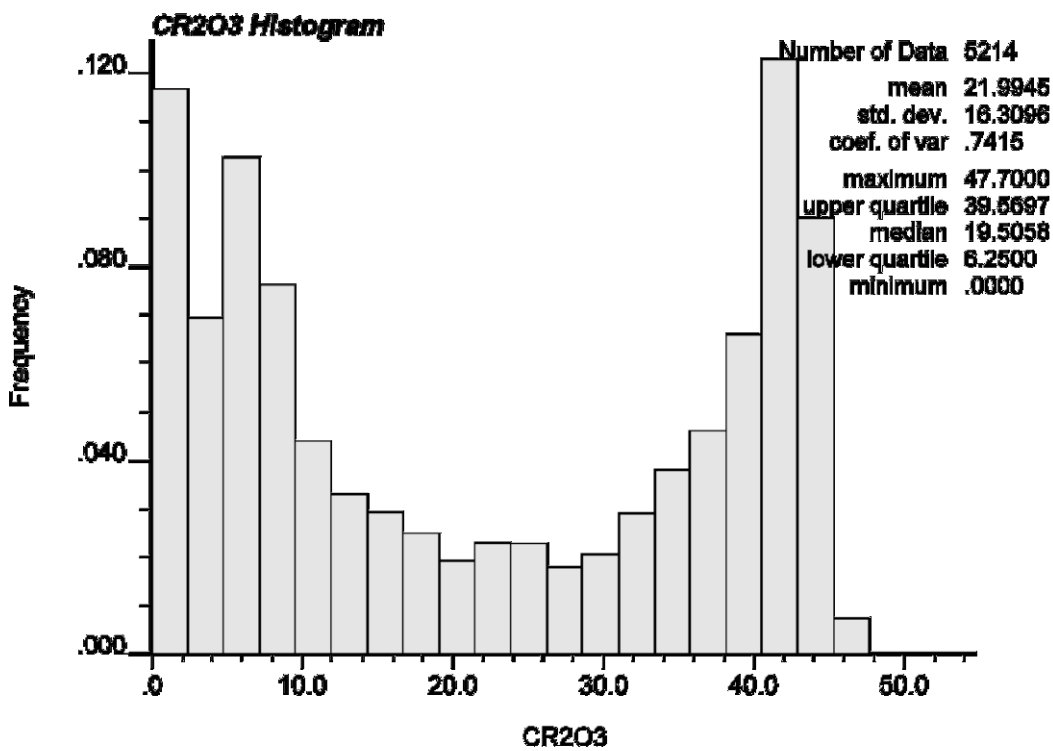

Figure 11 Histogram of Cr_2O_3 for Big Daddy

Cr_2O_3, the oxide of interest, does not have any spurious values with a maximum value of 47.7%. The histogram for Cr_2O_3 (Figure 11) is generally a broad bimodal distribution with relatively equal representation of all fractions from approximately 10% Cr_2O_3 to about 36% Cr_2O_3 and with peaks at around 6% and 42%.

Exploratory Data Analysis found no issues with the drill hole database that would invalidate their use for resource estimation purposes. But it was obvious from the data that Au, Ni and Cu are too low and show too much scatter and little correlation with Cr_2O_3 to be considered candidates for estimation.

14.1.1.7 Unfolding

Mineral deposits typically vary in thickness along strike due to the non-uniform nature of the original deposition environment. Primary and secondary structural modifications also produce variations in strike and dip as well as thickness. The Cartesian coordinate system makes modelling of the natural geological chemical distribution within a mineral deposit difficult. To ensure that all interpolation takes place within a given geological domain, the domain is unfolded to a planar slab to make variogram calculation and grade interpolation easier. After interpolation has been carried out, the samples are re-arranged to their original positions. This unfolding process first requires the generation of unfold strings that are used by Datamine® as a guide. These strings also include between section and within section tag strings to further constrain the unfolding process.

FIELD	NSAMPLES	MINIMUM	MAXIMUM	MEAN	VARIANCE	STANDDEV	SKEWNESS	KURTOSIS
AU (ppb)	5215	0	1540.00	6.18	534.02	23.11	48.57	3113.83
PT (ppb)	5215	0	1550.00	134.41	14202.61	119.17	1.68	9.85
PD (ppb)	5215	0	3400.00	156.19	46205.33	214.95	4.61	39.97
NI (%)	5215	0	0.60	0.05	0.01	0.07	1.22	1.47
CU (%)	5215	0	2.74	0.02	0.00	0.06	10.75	336.98
CR2O3 (%)	5215	0	47.70	19.62	302.48	17.39	0.25	-1.67

Table 5 Summary Univariate Statistics

	AU	PD	PT	CU	NI	CR2O3
AU	1					
PD	0.087	1				
PT	0.067	0.6587	1			
CU	0.526	0.0137	-0.083	1		
NI	0.094	0.073	-0.004	-0.100	1	
CR2O3	0.023	0.212	0.599	-0.132	-0.073	1

Table 6 Correlation Matrix

The unfolding routine used is based on a "proportional" concept under which hanging wall and footwall surfaces of the domain are made flat and parallel to one another. The true along strike and down dip distances are retained but the across dip distances are first normalised to the distance across as a proportion of the total distance. Then this normalised value is multiplied by the average thickness of the mineral domain.

After being composited to uniform sample lengths, the samples were unfolded using a custom script. Using another custom script the unfold string file was processed further. This routine checks and validates the strings. The composited sample files and the validated unfold string file are then used as

input to the Datamine® UNFOLD routine. The output files contain the samples in unfolded co-ordinate space. All subsequent processing was done on these files and utilized the new coordinate system consisting of UCSA, UCSB and UCSC (Across the Dip, Down the Dip and Along the Strike).

14.1.1.8 Grade Variography

Prior to doing grade variography a custom script was used to prepare a variogram map for the Cr_2O_3 for the Big Daddy domain (see Figure 12) in order to check for a rotation in the primary direction of anisotropy. Directional variograms were calculated in 15° increments in the unfolded plane of the mineral zone.

The variogram map does not indicate any significant rotation (plunge). The sample variance (~295) is reached at a range of approximately 150 metres down dip (UCSB) and at about 100 metres along strike (UCSC). Due to the nature of the drilling (primarily on 50 metre centres) both directions are reasonably well defined.

The lack of a rotation (no plunge to the mineralisation) means that there is no need to accommodate a rotation when calculating directional variograms.

The experimental grade variograms were calculated for the unfolded composited data sets using a custom script and are shown in Figure 13.

Typically, with inclined drilling, the down dip direction of the variogram is usually well defined due to the abundant sampling of the distance spectrum. This is indeed the case for the Big Daddy data set. While it was noted with the variogram map that the sill should be reached at a range of about 150 metres in actual fact it is reached at about 75 metres as the experimental variogram curve is suppressed, likely due to less variance (good continuity of grades) in this direction. While not as clean, the along strike variogram is still reasonably well defined with a range of about 120 metres.

The across dip (across the thickness of the mineral zone) is not as well defined and reflects the nature of the mineralisation in that there are bands of high-grade chromite mixed with bands of low-grade chromite. Even so, there is enough data to have reasonable confidence in the curve used to model this direction. The individual variograms for all 3 directions are shown in Appendix 3.

In summary, there is a reasonable degree of confidence in the curves used to model all three primary variogram directions.

The ranges derived from the variogram models are shown in Table 7.

14.1.1.9 Block Size Determination

The block size used for resource estimation is usually a function of SMU, or Smallest Mining Unit and is determined by taking into consideration the type of equipment that may be used during mining as it has a direct impact on the degree of selectivity that can take place. There is no point using a block size smaller than the smallest unit that can be physically mined selectively (usually a blast round). For this deposit, due to the geometry and relatively low dollar value per unit volume it is most likely that extraction would be by open pit or large tonnage underground mining methods to keep unit costs to a minimum.

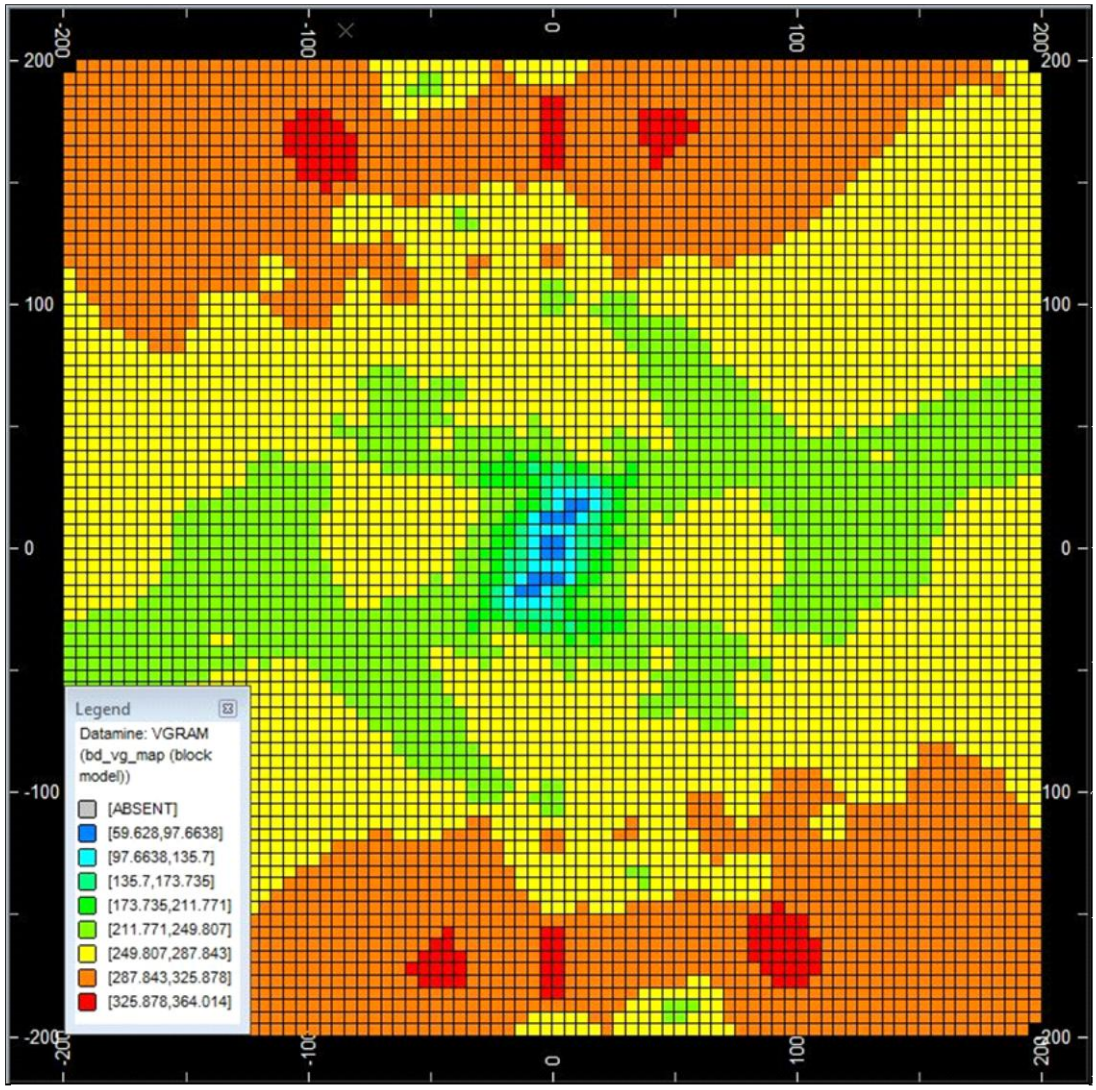

Figure 12 Variogram map for the unfolded Big Daddy data.

Another factor that needs to be considered is the degree of sampling detail. If samples are large and/or spaced far apart a small block size would be inappropriate.

After consultation with mine planning engineers for the nearby Black Thor deposit a block size of 10 metres by 10 metres by 12 metres was chosen as this meets the above criteria.

A custom script was used to create the empty prototype model and then fill it with blocks using the mineral envelopes for each domain wire frame creating 3 sub-models. And then each sub-model was regularised creating FILLVOL and VOIDVOL fields containing the volume for each block inside or outside the mineral domain wire frame.

14.1.1.10 Nearest Neighbour Block Model

A Nearest Neighbour (NN) estimated model was created for each domain in order to determine the declustered mean for our data. This mean can then be used to validate the kriged global estimates as all methods of estimation should produce essentially the same global mean, if done correctly. The declustered mean is also used in assessing smoothing and, if necessary, calculating a variance correction of the kriged models.

Summary statistics comparing the nearest neighbour model to the sample file are presented in Table 8.

Variogram Models – McFauld's Lake	Cr2O3
Nugget	**34.22**
1st spherical structure range A	8
1st spherical structure range B	22
1st spherical structure range C	36.66
1st spherical structure sill	**71.62**
2nd spherical structure range A	14
2nd spherical structure range B	53
2nd spherical structure range C	66
2nd spherical structure sill	**68.23**
3rd spherical structure range A	28
3rd spherical structure range B	75
3rd spherical structure range C	120
3rd spherical structure sill	**120.52**
Total sill	*294.59*

Table 7 Variogram Model Parameters.

FILENAME	FIELD	NRECORD	NSAMPLE	MINIMUM	MAXIMUM	MEAN	%Diff	VARIANCE	SKEWNES	WGTFIELD
BD_DATA1U	CR2O3	6284	6284	0.00	47.70	19.69		295.6883	0.25	LENGTH
NN_BD_MOD	CR2O3	25548	25548	0.00	47.70	20.49		296.9710	0.16	TONNES

Table 8 Sample file and Nearest Neighbour model summary statistics

A visual inspection on a section-by-section and plan-by-plan basis comparing the input sample file with the resultant nearest neighbour file showed good correlation with the drill holes and proper spreading of the grade.

The output Big Daddy Nearest Neighbour file name is nn_bd_mod.dm.

14.1.1.11 Ordinary Kriging Block Model

The purpose of block modelling is to provide a globally unbiased estimate based on discrete sample data. Geostatistical methods rely on mathematically modelling the autocorrelation of a regionalized variable, using variography. Then using these mathematical models weights are derived. These weights are applied to the samples used to derive the estimates while at the same time minimizing the estimation variance. A common method of estimation is Ordinary Kriging. It uses the variogram models

to initially derive the weights to be used for each estimate but then, to reduce bias, has all weights sum to 1. In addition, Ordinary Kriging does not require that the mean of the data be known.

The parameter files needed for Ordinary Kriging were constructed. A nested search strategy was used (see Appendix 4). This was then followed by the using of a custom script to actually carry out the Ordinary Kriging process. Each cell in the block model was discretised using a matrix of 3 x 3 x 3 points in the ABC (unfolded) coordinate system. The Kriging functions were interpolated at each discretisation point using the same search volume as the nearest neighbour interpolation, based on the grade variogram results. In case of local low sample density, a nested search was implemented.

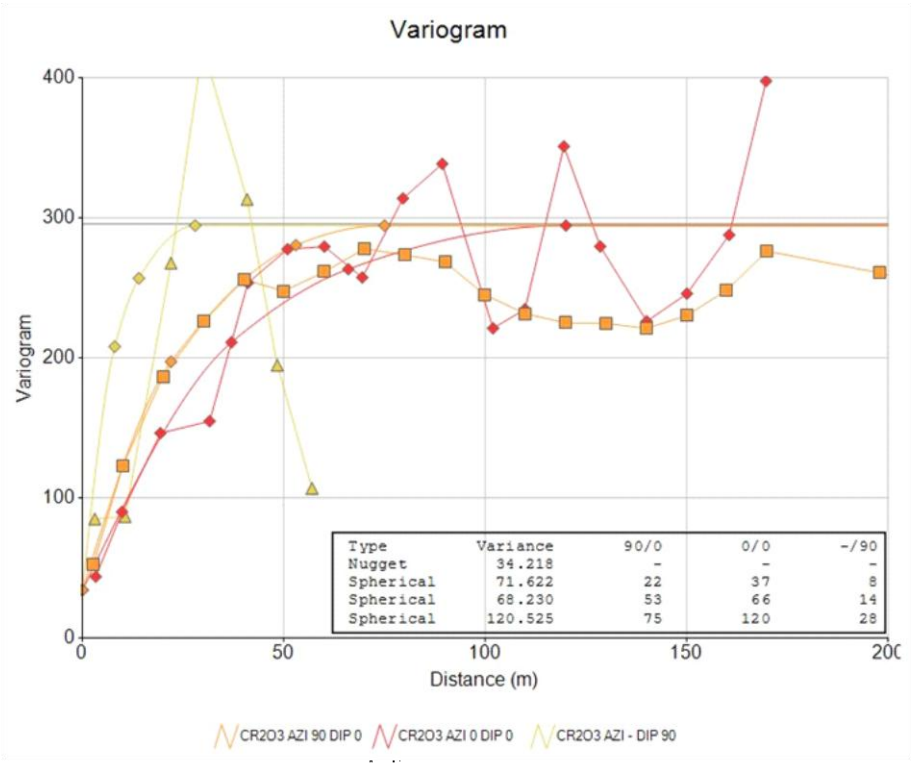

Figure 3 Experimental variograms and fitted models for Big Daddy - Cr_2O_3.

For the resultant model, prior to applying a variance correction, ok_bd_mod.dm 57.5% of the blocks were estimated in the first search, 19.5% in the second and 23.0% in the third. The latter may suffer from poor local estimation and potentially larger conditional bias.

14.1.1.12 Block Model Validation

Verification of grade estimation is carried out in two ways: visually, and statistically.

In the case of a visual check, interpolated estimates are loaded into sections and plans along with the original borehole data. Using contrasting colour schemes grades were tested. Any major discrepancy between the original information and the estimated block was analyzed for possible processing error. Sample plans and sections illustrating this visual check are provided in Appendix 5.

Major discrepancies were also looked for between the statistics of the sample composites, nearest neighbour model (declusterised statistics) and the ordinary kriged model. Specific statistics checked include reproduction of the global mean, as established by nearest neighbour modeling, and ensuring that all blocks were estimated (see Table 9). No significant global or local bias was identified.

FILENAME	FIELD	NRECORDS	NSAMPLES	MINIMUM	MAXIMUM	MEAN	%Diff	VARIANCE	SKEWNESS	WGTFIELD
BD_DATA1U	CR2O3	6284	6284	0.00	47.70	19.69		295.6883	0.25	LENGTH
NN_BD_MOD	CR2O3	25548	25548	0.00	47.70	20.49		296.9710	0.16	TONNES
OK_BD_MODEL	CR2O3	25548	25548	0.00	46.52	19.40	-1%	156.7761	0.39	TONNES
	SCR2O3	25548	25548	0.00	44.08	19.33		138.2244	0.32	TONNES

Table 9 Sample file, Nearest Neighbour and OK model summary statistics, before and after variance correction.

14.1.1.13 Volume Variance Correction

The "averaging" process that goes on during interpolation within the block model tends to reduce the variance from its original level. Overall the mean for the entire population remains unaffected. However, since a cut-off grade is used to separate the above- and below-cut-off populations, their specific means are now affected due to this homogenization, or smoothing, of individual estimates. The interpolated mean can be lower or higher than the original mean depending upon whether the cut-off grade is above or below the original mean.

Regression methods such as Kriging may result in an over-smoothing or under-smoothing of the grade variability producing a block grade distribution with a variance that is lower or higher than expected. This expected variance can be calculated using Krige's relationship which states that the dispersion variance for the samples within the deposit is the sum of the dispersion variance of samples within the blocks and the dispersion variance of the blocks within the deposit (for a more detailed explanation see Appendix 7).

Table 9 compares the corrected (CR2O3) and uncorrected values (SCR2O3) from the final block model file, ok_bd_model.dm. It can be seen that the variance of each sub-model has been increased and therefore more in line with the expected variance with respect to block size. As should be expected, the mean remains essentially unchanged by the transformation. The smoothing ratio (1.21) is well within expected limits (>0.5 or <4).

14.1.1.14 Model Verification

Validation procedures were carried out on the estimated block models including visually checking the sample file against estimated blocks. The sample grades were found to reasonably match the estimated block grades in the model.

A global statistical comparison of the global means of all estimations method was done. The difference between all the global means was found not to exceed approximately 5%, to be expected if the process was done correctly.

Other statistical checks that were done include the use of Swath plots (see Appendix 6). Swath plots compare the moving average of the mean for both models and the sample file using panels, or "swaths" through the mineral envelope. As this is best done if the data are within a rectilinear volume the unfolded coordinates were used to define the swaths. The result is a curve for each data set. The curves for the models should inter-weave with the sample curve and the two model curves should be sympathetic with one another with no major deviations from one another. No issues were noted.

Classification	Tonnes (millions)	%Cr2O3	Cut-off
Measured Resources	29.5	29.0	15% Cr2O3
Indicated Resources	7.9	26.7	
Meas. & Ind. Resources	37.4	28.5	
Inferred Resources	4.8	25.0	
Measured Resources	23.3	32.1	20% Cr2O3
Indicated Resources	5.8	30.1	
Meas. & Ind. Resources	29.1	31.7	
Inferred Resources	3.4	28.1	
Measured Resources	17.6	35.2	25% Cr2O3
Indicated Resources	3.8	34.0	
Meas. & Ind. Resources	21.5	35.0	
Inferred Resources	1.8	33.3	
Measured Resources	12.8	38.1	30% Cr2O3
Indicated Resources	2.6	37.4	
Meas. & Ind. Resources	15.4	38.0	
Inferred Resources	1.1	37.7	

Table 2 Summary of Classification of In-Situ Resources, at different cut-offs, for the Big Daddy chromite deposit

Notes:

1. CIM Definition Standards were followed for classification of Mineral Resources.
2. The Mineral Resource estimate uses drill hole data available as of June 1, 2012.
3. The cut-off of 20% Cr_2O_3 is high-lighted as that is the same cut-off used for the Kemi deposit as reported by Alapieti et al. (1989).
4. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.

14.2. Mineral Resource Reporting

14.2.1. Resource Classification – Big Daddy chromite deposit

The variograms are well defined in all directions. As a result resource classification can be assigned based on what search a block was estimated with. Thus, if estimated during the first search, as it has the most rigorous criteria then these blocks would be classified as Measured Resources. And if estimated during the second search which uses less rigorous criteria for selecting samples then they would be

classified as Indicated Resources. Those blocks estimated during the third search use the least rigorous criteria and therefore would be classified as Inferred Resources. See Appendix 8 for resource classification definitions.

Using a 20% cut-off, there are a total of 29.1 million tonnes at a grade of 31.7% Cr_2O_3 of Measured and Indicated Resources which should be easily upgradable through gravity concentration. These resources are blocks above cut-off and have had no mineability criteria applied to them.

There is good confidence in the lateral continuity of the mineralization and so these resources can be used for a pre-feasibility or feasibility mining study. Table 10 presents tonnes and grade for each Resource Classification using various cut-offs for the Big Daddy chromite deposit.

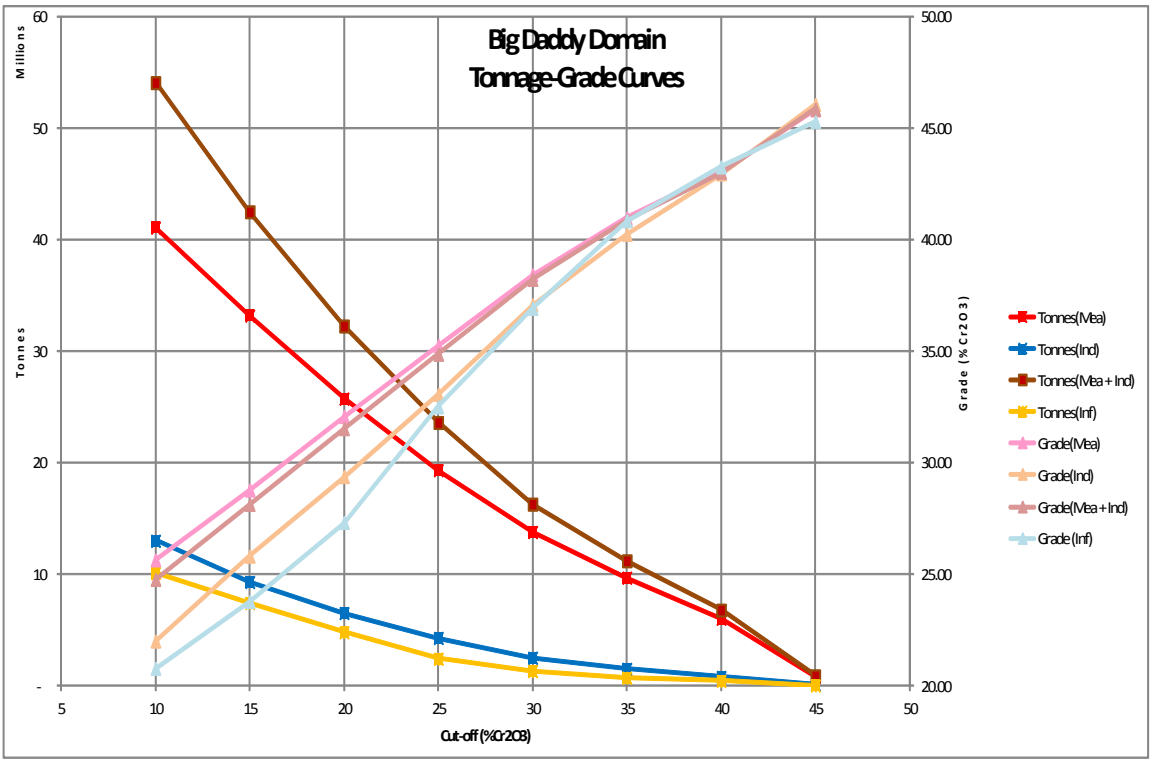

Figure 4 Cr_2O_3 Tonnage-Grade curves for the Big Daddy chromite deposit.

Figure 14 presents the Cr_2O_3 tonnes-grade curves for the Big Daddy chromite deposit and helps illustrate the effect of different cut-offs on available resources. The mining and processing methods chosen will determine what proportion can be converted to reserves as these do not take into consideration mineability and dilution.

14.2.2. Risks and Opportunities

14.2.2.1. Risks

While a significant part of the drilling done to date is primarily on 50 metre centres, there are portions, primarily at depth and at the north and south end where the drilling is too sparse to adequately characterize the mineral continuity within the plane of the chromite mineralization.

While higher-grade areas exist at depth and along strike they are poorly defined as a result of the sparse drilling in these locations.

14.2.2.2. Opportunities

Further drilling down dip and along strike could identify and expand the presence of the chromite-bearing horizon, in particular higher-grade material.

The mineral zone is completely open to depth. Thus there is an excellent opportunity to expand resources significantly with deeper drilling.

15. Mineral Reserve Estimates

To date no pre-feasibility or feasibility study has been completed, thus there are currently no reserves defined.

16. Mining Methods

To date no pre-feasibility or feasibility study has been completed, thus a decision has yet to be made on what mining method will be used, although the Preliminary Economic Assessment described in section 22 indicates that at least initially mining likely will be by open pit.

17. Recovery Methods

Other than the preliminary metallurgical studies identified in section 13 there have not been any milling studies completed and therefore no recovery methods identified.

18. Project Infrastructure

Other than the existence of an exploration camp on the nearby Noront property servicing the exploration programs being conducted by Cliffs there is no project infrastructure in place as yet.

19. Market Studies and Contracts

To date no pre-feasibility or feasibility study has been completed, thus there is no current market study completed or sales contracts signed.

20. Environmental Studies, Permitting and Social or Community Impact

To date, while base line environmental sampling has been undertaken, there have been no environmental studies completed. No permits, beyond the scope of work permits covering diamond drilling, have been applied for, nor have there been any social or community impact studies done.

21. Capital and Operating Costs

To date no pre-feasibility or feasibility study has been completed, thus there are no current estimates of capital and operating costs.

22. Economic Analysis

A Preliminary Economic Assessment (PEA) has been completed by NordPro Mine and Project Management Services Ltd. (Buck et al, 2011). They determined that mining likely would be by open pit at a nominal rate of 8000 tonnes per day. Project pre-production capital expenditures are estimated to be about $784 million and Life-of-Mine operating costs at $130 per tonne.

	Pre-Tax	After-Tax
Undiscounted Gross Revenue	$12.64 billion	$12.64 billion
Undiscounted Cashflow	$ 6.30 billion	$ 4.30 billion
NPV (8%)	$ 2.48 billion	$ 1.58 billion
NPV (10%)	$ 2.01 billion	$ 1.25 billion
IRR	42.0%	31.8%
Payback Period	2.5 years	2.5 years
NSR Royalty(undiscounted)	$126 million	$126 million

Table 11 Expected project returns for the Big Daddy chromite deposit from PEA (Buck et al, 2011)..

The associated financial analysis, estimated to be +/- 40%, is shown in Table 11.

The projected cash flow for the project is positive in year 3 with payback in 2.5 years. These estimates are very sensitive to capital expenditures for a railway from the mine site to Nakina, to chromite prices and product transport costs.

The PEA recommended among other things, that the project be advanced to the Feasibility Study phase, that additional drilling be done to confirm the amount and extent of high grade chromite ore.

23. Adjacent Properties

There are three properties of note that are in the vicinity of the Big Daddy property. These are the Noront property that contains the Eagle 1 and Eagle 2 nickel deposits and the Blackbird chromite deposit, the Probe Mines property hosting the Black Creek chromite deposit immediately adjacent to the Big Daddy property and the Cliffs Natural Resources property to the northeast that hosts the Black Thor and Black Label chromite deposits (see Fig. 15 for location).

23.1. Noront Eagle 1, Eagle 2 and Blackbird deposits

The discovery of the Noront Eagle 1 deposit was announced on August 28, 2007. The discovery hole, NOT-07-01, intersected 36 meters of massive sulphide grading 1.84% Ni, 1.53% Cu, 1.14 g/t Pt, 3.49 g/t Pd, 0.13 g/t Au, and 4.8 g/t Ag. A second hole, NOT-07-05, that was drilled below NOT-07-01, intersected 68.3 m of massive sulphide grading 5.9% Ni, 3.1% Cu, 2.87 g/t Pt, 9.87 g/t Pd, 0.61 g/t Au,

and 8.5 g/t Ag. This discovery led the way to an unprecedented staking rush in the James Bay lowlands of Northern Ontario.

The Noront Eagle 1 deposit is located approximately 5 km SW of the Big Daddy chromite property. It is a magmatic sulphide deposit that is hosted by ultramafic rocks and is believed to be well located within a conduit system. The deposit consists of massive sulphides, net textured sulphides, sulphide breccias, semi-massive sulphide, but no disseminated sulphides. Sulphide minerals include pyrrhotite, pentlandite, and chalcopyrite (Armstrong et al. 2008).

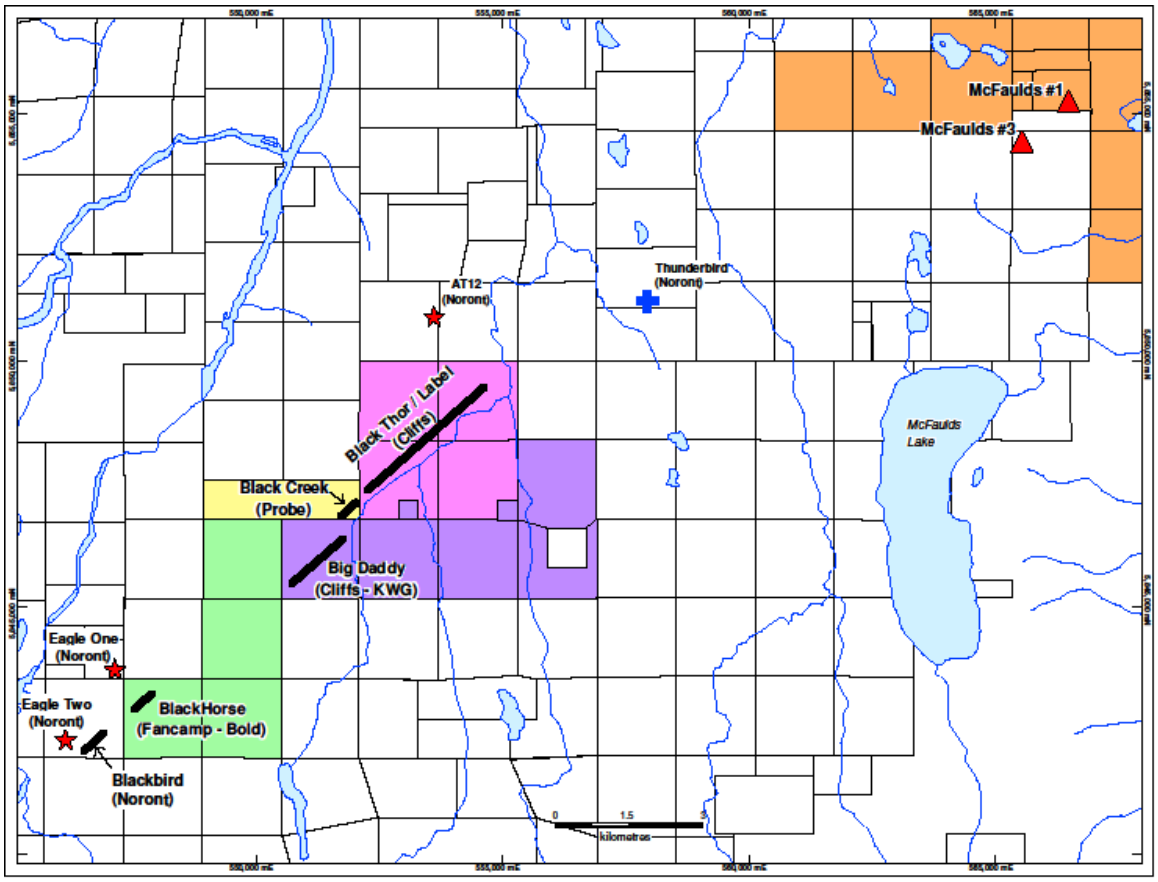

Figure 15 Location of Big Daddy chromite deposit and adjacent discoveries.

The Eagle Two deposit was discovered in February 2008. This deposit is located 2 km south-west of the Eagle One deposit. It is hosted by shear zones that strike parallel to the contact between the ultramafic rocks and the felsic plutonic host rocks. No resource estimate has yet been published for the Eagle Two deposit.

Noront has located two chromite deposits, similar in mineralization to the Black Thor deposit. They are located approximately 3 km along strike from the Big Daddy chromite deposit. The Blackbird chromite deposits (Blackbird 1 and 2) are hosted by a peridotite unit within a layered mafic to ultramafic body. Chromite mineralisation occurs as disseminated chromite, semi-massive chromite with intercalated

olivine crystals, banded chromite interfingered with peridotite and as massive chromite commonly interlayered with dunite and harzbergite. Resource estimates have been completed by Micon (Gowans et al, 2010b and Murahwi et al, 2012).

23.2. Black Creek Chromite Deposit

The Black Creek chromite deposit (Murahwi et al, 2011) lies between the Big Daddy chromite deposit to the south west and the Black Thor/Black Label deposits to the north east. It is a faulted extension of the same stratigraphy consisting of a well fractionated ultramafic body hosting a zone of disseminated to massive chromite up to 65 metres thick within dunite and overlain by pyroxenite.

23.3. Black Thor and Black Label Chromite Deposits

The Black Thor Chromite Zone has been traced on the Freewest property for a length of 2.6 km. It is the most extensive chromite bearing body on the property. It strikes SW – NE and has an overturned sub-vertical dip towards the NW ranging between 70 and 85 degrees. The zone typically contains two chromitite layers (upper and lower) that can range in thickness from 10's of meters to over 100 m (i.e. BT-09-37). The layers are separated by a band of disseminated chromite in peridotite/dunite (Tuchsherer et al, 2009; Aubut, 2010).

Host lithologies consist of serpentinized peridotite, serpentinized dunite, dunite, and peridotite. Chromite is present as intermittent chromite beds, finely to heavily disseminated chromite in dunite/peridotite, and semi-massive to massive chromitite. Because of its lateral continuity and uniformity the chromite mineralisation was likely deposited in a quiescent magmatic environment. The Black Thor Chromite Zone is typical of most large layered igneous intrusions such as the Kemi deposit in Finland (Alapieti et al, 1989).

Within the Black Label deposit chromite is generally present as fine to heavily disseminated crystals in peridotite, chromitite bearing magmatic breccias, semi-massive bands and as massive chromitite. Silicate fragments, in the form of rip up clasts and as ovoid blebs have been observed in the zone and indicate the chromite was emplaced in a highly dynamic magmatic environment unlike the Black Thor Deposit (Tuchsherer et al, 2009; Aubut, 2010).

The Black Label Chromite Zone has been traced by drilling over 2.2 km along strike. It is locally cross-cut and interrupted by a pyroxenitic body. It lies stratigraphically below the Black Thor chromite zone. Chromite is generally present as fine to heavily disseminated crystals in peridotite, chromitite bearing magmatic breccias, semi-massive bands and as massive chromitite. Silicate fragments, in the form of rip up clasts and as ovoid blebs have been observed in the zone and indicate the chromite was emplaced in a highly dynamic magmatic environment (Tuchsherer et al, 2009; Aubut, 2010).

24. Other Relevant Data and Information

Details on drill results and other pertinent information can be found on the following web sites:

http://www.kwgresources.com, and http://www.cliffsnaturalresources.com.

25. Interpretation and Conclusions

In 2010 Micon published a resource estimate for the Big Daddy, using a cut-off of 15%. They identified 26.4 million tonnes grading 39.37% Cr_2O_3 of Indicated resources and a further 20.5 million tonnes grading 37.47% Cr_2O_3 (Gowans et al, 2010a). Using the same cut-off of 15% Cr_2O_3 the current model identifies 37.4 million tonnes grading 28.5% Cr_2O_3 of Measured and Indicated resources and 4.8 million tonnes at a grade of 25.0 % Cr2O3 of Inferred resources.

The current estimate has more tonnes of Measured and Indicated resources, reflecting the additional drilling done in the intervening two years, but at a lower grade. In addition, the current model has much less Inferred resources, also at a lower grade.

The differences lie in the fact that the previous model was much more tightly constrained as only samples above a 15% cut-off were used and the mineral domain was extended approximately 250 metres below the deepest drilling.

The use of a cut-off for sample selection results in a higher grade as too little internal dilution was included due to this artificial boundary introducing a significant grade bias. The nature of the mineralisation is such that mining, especially by bulk methods such as open pit, will not have the selectivity implied by the use of this artificial boundary.

The extension of the mineral domain well beyond available drilling is not industry standard practice. As more recent drilling has proven this was not a prudent thing to do. For example a subsequent hole, FW-11-64 drilled on section 1850 East to undercut previous chromite intersections higher in the section did not intersect the mineral zone thus cutting it off at a depth of approximately 487 metres below surface and well above the bottom of the Micon mineral envelope. The current model uses a much more conservative approach by seldom extending the mineral domain approximately 50 metres below existing drill holes.

Using industry-standard block modelling techniques a resource model was created covering the Cliffs/KWG Big Daddy chromite deposit. Querying this model, using a 20% Cr_2O_3 cut-off, there is a total in-situ Measured and Indicated resources within the Big Daddy chromite deposit of 29.1 million tonnes grading 31.7% Cr_2O_3. This material potentially could be mined by open pit, but no mineability criteria have been applied. The confidence in this estimate is such that a pre-feasibility or feasibility mining study can be done using this data.

26. Recommendations

To fully evaluate underground mining, and to properly define the limits of open pit mining, additional drilling is required to extend the limits of the resource down dip.

Table 18 presents a budget for a 15,000 metre drilling program that should provide enough information to extend the current resources down to a depth of 365 metres.

Item	*Description*	*Amount*
Diamond Drilling	15,000m	$1,600,000
Fuel	Fuel for drilling and other support services	$ 550,000
Support	Assaying, supplies, transportation, etc.	$1,000,000
Contingencies	10%	$ 315,000
Total		$3,465,000

Table 3 Proposed Exploration Budget for Infill Drilling

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Certificate of Qualifications

I, Alan James Aubut, do hereby certify the following:

- I am the author of this National Instrument 43-101 technical document titled "*National Instrument 43-101Technical Report, Big Daddy chromite deposit, McFaulds Lake Area, Ontario, Canada, Porcupine Mining Division, NTS 43D16, Mineral Resource Estimation Technical Report*", dated June 17, 2012.
- I am a graduate of Lakehead University, in Thunder Bay, Ontario with the degree of Honours Bachelor of Science, Geology (1977).
- I am a graduate of the University of Alberta, in Edmonton, Alberta with the degree of Master of Science, Geology (1979).
- I hold an Applied Geostatistics Citation through the Faculty of Extension of the University of Alberta, in Edmonton, Alberta.
- I have been actively practicing geology since 1979.
- I have been practicing mineral resource estimation since 2000.
- I am currently a member in good standing of the Association of Professional Geoscientists of Ontario.
- From 2000 to 2009 I was a member in good standing of the Association of Professional Engineers and Geoscientists of Manitoba.
- I am a member of the Society of Economic Geologists.
- I operate under the business name of Sibley Basin Group Geological Consulting Services Ltd., a business independent of Spider Resources and do not expect to become an insider, associate or employee of the issuer.
- The business address of Sibley Basin Group Geological Consulting Services Ltd. is:

  Sibley Basin Group
  PO Box 304
  300 First St. West
  Nipigon, ON
  P0T 2J0

The work described in this report is based in part on a field visit to the McFaulds Lake exploration camp used by then operator Spider Resources on March 23, 2010 at which time drill core was examined as well as pertinent documentation. Spider Resources, through Billiken Management Services Inc., supplied text and Excel tables of drill hole information current to March 28, 2010. Cliffs Chromite Far North Inc. supplied a copy of subsequent drill hole data current to June 1, 2012. It was these data that were used for the current project. The resource estimate generated with this data is effective as of June 3, 2012.

Alan Aubut

Alan Aubut

June 27, 2012

Appendix 1 – Summary of Diamond Drilling

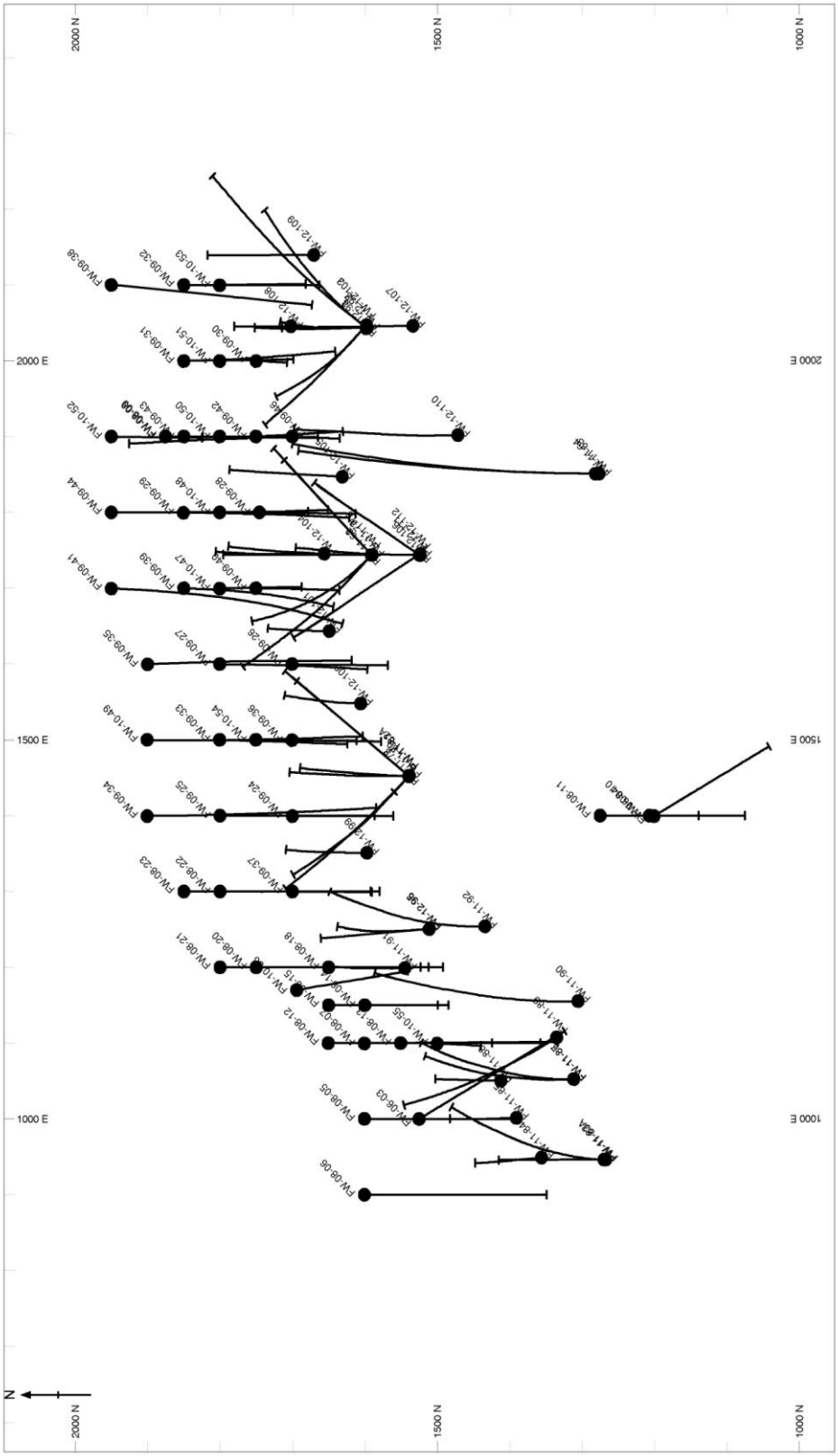


Figure 5 Plan of Big Daddy Diamond Drilling (local Grid Coordinates). North shown is Grid North (330° Astronomic).

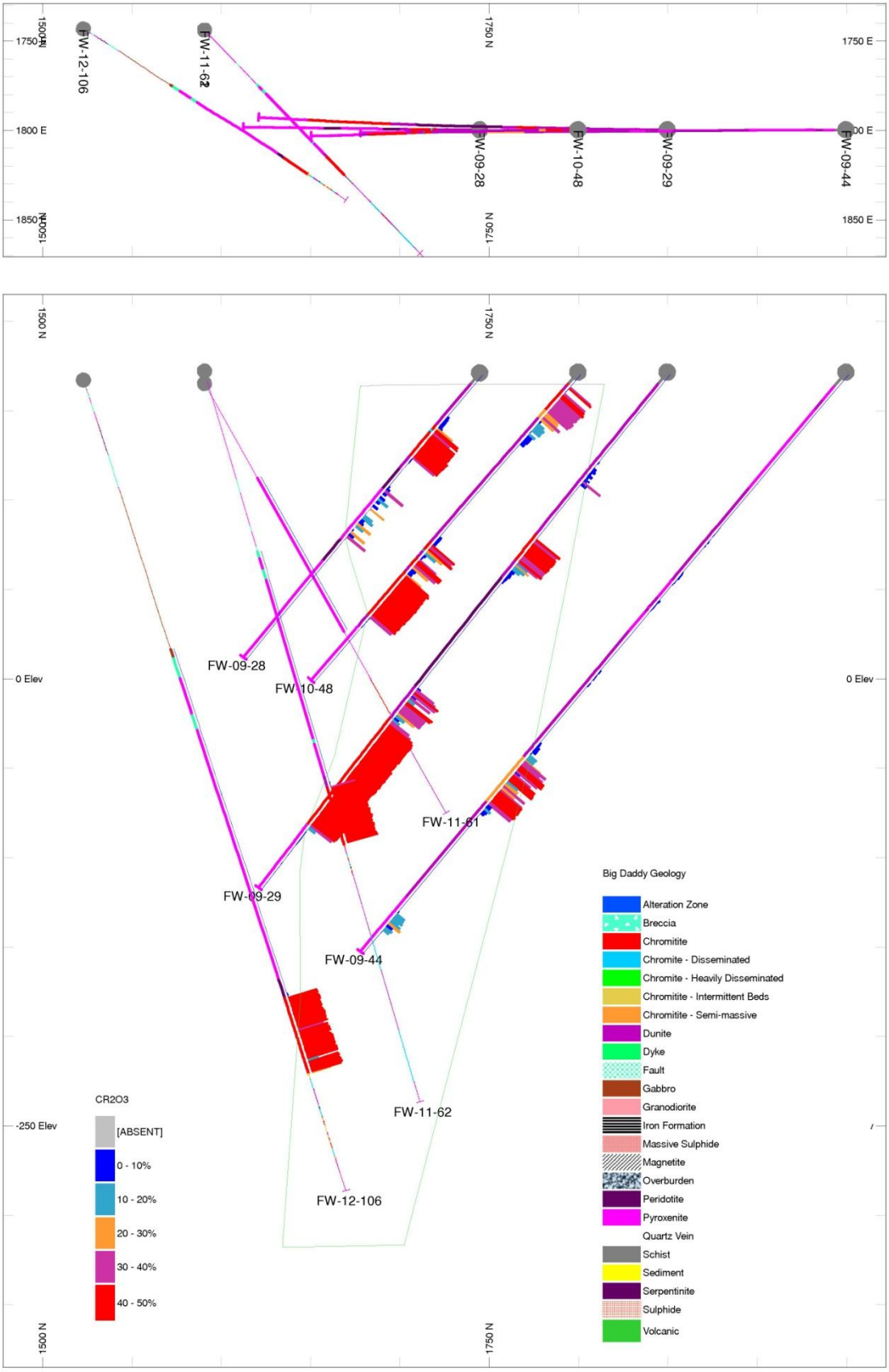


Figure 17 Sample cross section (1800E) for the Big Daddy Deposit. The green line is a slice through the mineral envelope used to select samples.

Table 4 Drill Hole Collar Locations

BHID	UTM-East	UTM-North	Elevation	Grid North	Grid West	LENGTH	AZI UTM	DIP
FW-06-02	554031.0	5844203.7	172.4	3000.0	-900.0	172.4	197.0	130.0
FW-06-03	551086.5	5845303.8	174.0	1000.0	1525.0	174.0	353.5	120.0
FW-06-04	551595.4	5845222.4	170.8	1400.0	1200.0	170.8	254.0	120.0
FW-08-05	551049.0	5845368.8	174.7	1000.0	1600.0	174.7	327.0	150.0
FW-08-06	550962.4	5845318.8	173.8	900.0	1600.0	173.8	384.0	150.0
FW-08-07	551135.6	5845418.8	172.9	1100.0	1600.0	172.9	405.7	149.6
FW-08-08	551690.9	5846057.0	171.3	1900.0	1875.0	171.3	270.0	150.0
FW-08-09	551690.9	5846057.0	171.6	1900.0	1875.0	171.6	176.0	154.8
FW-08-10	551591.9	5845228.4	170.9	1400.0	1207.0	170.9	312.0	150.0
FW-08-11	551557.9	5845287.3	170.7	1400.0	1275.0	170.7	306.0	150.0
FW-08-12	551110.6	5845462.1	173.1	1100.0	1650.0	173.1	354.0	149.9
FW-08-13	551160.6	5845375.5	172.8	1100.0	1550.0	172.8	297.0	150.0
FW-08-14	551178.9	5845443.8	173.6	1150.0	1600.0	173.6	189.0	150.0
FW-08-15	551153.9	5845487.1	172.1	1150.0	1650.0	172.1	240.0	150.0
FW-08-16	551514.3	5844482.8	174.0	960.0	600.0	174.0	372.0	315.0
FW-08-17	551514.3	5844482.8	174.0	960.0	600.0	174.0	376.0	315.0
FW-08-18	551197.2	5845512.1	171.4	1200.0	1650.0	171.4	255.0	150.0
FW-08-20	551147.2	5845598.7	174.0	1200.0	1750.0	174.0	375.0	150.0
FW-08-21	551122.2	5845642.0	172.3	1200.0	1800.0	172.3	447.0	150.0
FW-08-22	551208.8	5845692.0	172.2	1300.0	1800.0	172.2	330.0	150.0
FW-08-23	551183.8	5845735.3	172.4	1300.0	1850.0	172.4	424.0	150.0
FW-09-24	551345.4	5845655.4	171.6	1400.0	1700.0	171.6	219.0	150.1
FW-09-25	551295.4	5845742.0	172.0	1400.0	1800.0	172.0	339.5	148.6
FW-09-26	551518.6	5845755.4	171.4	1600.0	1700.0	171.4	207.0	150.7
FW-09-27	551468.6	5845842.0	171.5	1600.0	1800.0	171.5	321.0	150.7
FW-09-28	551669.3	5845894.4	171.0	1800.0	1745.0	171.0	207.0	150.7

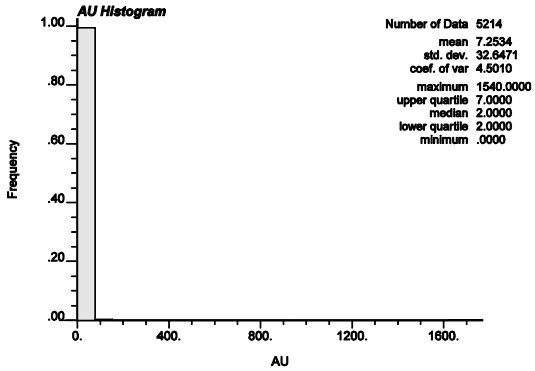
BHID	UTM-East	UTM-North	Elevation	Grid North	Grid West	LENGTH	AZI_UTM	DIP
FW-09-29	551616.8	5845985.3	171.3	1800.0	1850.0	171.3	368.0	152.5
FW-09-30	551840.0	5845998.7	170.4	2000.0	1750.0	170.4	77.0	153.2
FW-09-31	551790.0	5846085.3	171.1	2000.0	1850.0	171.1	339.0	150.5
FW-09-32	551876.6	5846135.3	169.8	2100.0	1850.0	169.8	291.5	150.1
FW-09-33	551382.0	5845792.0	172.7	1500.0	1800.0	172.7	267.0	150.9
FW-09-34	551245.4	5845828.6	171.8	1400.0	1900.0	171.8	468.0	150.3
FW-09-35	551418.6	5845928.6	171.7	1600.0	1900.0	171.7	429.0	148.9
FW-09-36	551432.0	5845705.4	172.6	1500.0	1700.0	172.6	192.0	152.4
FW-09-37	551258.8	5845605.4	172.2	1300.0	1700.0	172.2	171.0	150.4
FW-09-38	551826.6	5846221.9	171.2	2100.0	1950.0	171.2	423.0	154.1
FW-09-39	551530.2	5845935.3	171.9	1700.0	1850.0	171.9	328.0	150.9
FW-09-40	551580.2	5845848.7	171.2	1700.0	1750.0	171.2	175.0	150.0
FW-09-41	551480.2	5846021.9	171.8	1700.0	1950.0	171.8	490.5	152.3
FW-09-42	551753.4	5845948.7	171.0	1900.0	1750.0	171.0	133.5	149.2
FW-09-43	551703.4	5846035.3	171.1	1900.0	1850.0	171.1	330.0	149.7
FW-09-44	551566.8	5846071.9	171.4	1800.0	1950.0	171.4	523.0	149.7
FW-09-45	550907.8	5844213.4	174.0	300.0	670.0	174.0	228.0	135.0
FW-09-46	551778.4	5845905.4	171.1	1900.0	1700.0	171.1	351.0	329.1
FW-10-47	551555.2	5845892.0	171.2	1700.0	1800.0	171.2	177.0	149.1
FW-10-48	551641.8	5845942.0	171.4	1800.0	1800.0	171.4	265.0	150.2
FW-10-49	551332.0	5845878.6	172.1	1500.0	1900.0	172.1	456.0	150.2
FW-10-50	551728.4	5845992.0	171.2	1900.0	1800.0	171.2	265.0	150.6
FW-10-51	551815.0	5846042.0	170.3	2000.0	1800.0	170.3	156.0	148.8
FW-10-52	551653.4	5846121.9	171.1	1900.0	1950.0	171.1	195.0	150.8
FW-10-53	551901.6	5846092.0	169.5	2100.0	1800.0	169.5	182.0	149.3
FW-10-54	551407.0	5845748.7	172.4	1500.0	1750.0	172.4	210.0	150.4
FW-10-55	551185.6	5845332.2	173.7	1100.0	1500.0	173.7	95.0	153.1

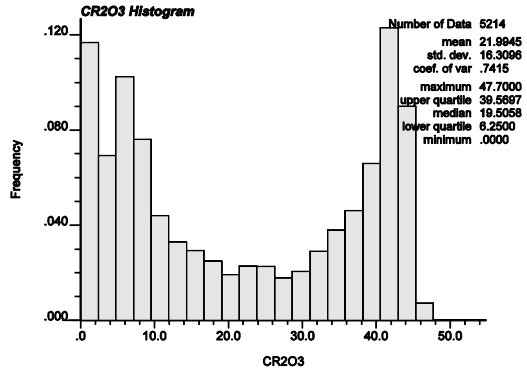
BHID	UTM-East	UTM-North	Elevation	Grid North	Grid West	LENGTH	AZI_UTM	DIP
FW-10-56	551149.2	5845535.2	173.3	1170.0	1694.0	173.3	241.0	140.7
FW-11-61	551698.0	5845733.0	165.0	1744.2	1590.9	165.0	309.0	16.0
FW-11-62	551698.0	5845733.0	172.0	1744.2	1590.9	172.0	444.0	16.0
FW-11-63	551948.0	5845514.0	169.2	1851.2	1276.2	169.2	650.0	330.0
FW-11-64	551945.5	5845518.2	169.2	1851.1	1281.1	169.2	710.0	330.0
FW-11-73	551698.4	5845732.0	169.6	1744.0	1589.8	169.6	291.0	330.1
FW-11-74	551698.4	5845732.0	172.0	1744.0	1589.8	172.0	387.0	330.0
FW-11-75	551698.4	5845732.4	167.7	1744.2	1590.2	167.7	342.0	283.2
FW-11-76	551698.4	5845732.4	172.0	1744.2	1590.2	172.0	390.0	283.2
FW-11-77	551471.0	5845542.0	172.0	1452.1	1539.0	172.0	282.0	9.0
FW-11-78	551471.0	5845542.0	172.0	1452.1	1539.0	172.0	416.0	9.0
FW-11-79	551472.2	5845541.6	167.3	1452.9	1538.0	167.3	231.0	329.5
FW-11-80	551472.2	5845541.6	173.0	1452.9	1538.0	173.0	372.0	329.5
FW-11-81	551472.2	5845542.0	169.8	1453.1	1538.4	169.8	42.9	283.3
FW-11-81A	551471.0	5845542.0	172.0	1452.1	1539.0	172.0	336.0	284.0
FW-11-82	551472.2	5845542.0	172.0	1453.1	1538.4	172.0	432.0	283.3
FW-11-83	551168.5	5845055.6	170.7	946.9	1269.0	170.7	390.0	329.6
FW-11-83A	551169.0	5845054.0	173.0	946.5	1267.4	173.0	458.0	330.0
FW-11-84	551127.1	5845131.6	171.2	949.1	1355.5	171.2	180.0	325.8
FW-11-85	551155.1	5845188.0	171.6	1001.5	1390.4	171.6	132.0	329.9
FW-11-86	551239.0	5845144.8	171.4	1052.6	1311.0	171.4	345.0	328.9
FW-11-87	551239.0	5845144.8	173.0	1052.6	1311.0	173.0	458.7	328.9
FW-11-88	551187.0	5845231.0	173.0	1050.6	1411.7	173.0	129.0	330.0
FW-11-89	551274.9	5845192.8	169.7	1107.6	1334.6	169.7	436.0	299.0
FW-11-90	551331.1	5845191.2	170.4	1155.5	1305.1	170.4	402.0	328.7
FW-11-91	551249.5	5845420.0	170.7	1199.3	1544.1	170.7	145.0	328.9
FW-11-92	551352.0	5845352.0	169.2	1254.0	1433.9	169.2	405.6	329.0

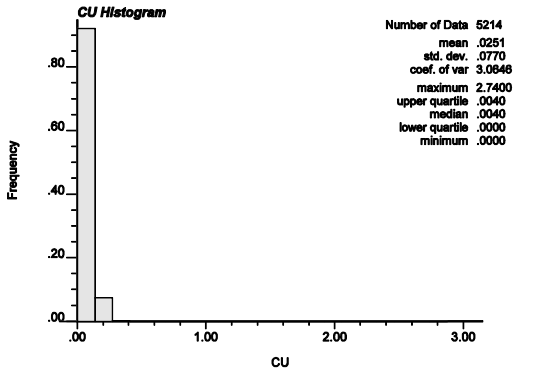
BHID	UTM-East	UTM-North	Elevation	Grid North	Grid West	LENGTH	AZI_UTM	DIP
FW-12-93	551953.9	5845888.4	166.0	2043.5	1597.5	166.0	390.0	6.7
FW-12-94	551953.9	5845888.4	166.0	2043.5	1597.5	166.0	426.0	6.7
FW-12-95	551310.8	5845416.8	169.8	1250.7	1510.7	169.8	213.0	325.3
FW-12-96	551310.8	5845416.8	169.8	1250.7	1510.7	169.8	306.0	325.3
FW-12-97	551954.8	5845887.6	166.0	2043.9	1596.4	166.0	231.0	330.1
FW-12-98	551954.8	5845887.6	166.0	2043.9	1596.4	166.0	309.0	330.1
FW-12-99	551354.6	5845541.6	168.0	1351.1	1596.8	168.0	159.0	329.1
FW-12-100	551521.3	5845647.6	170.7	1548.4	1605.3	170.7	165.0	330.2
FW-12-101	551582.0	5845733.0	170.0	1643.7	1648.9	170.0	135.0	330.0
FW-12-102	551957.1	5845890.0	166.0	2047.1	1597.3	166.0	285.0	284.6
FW-12-103	551957.1	5845890.0	166.0	2047.1	1597.3	166.0	408.0	284.6
FW-12-104	551666.9	5845790.0	170.0	1745.7	1655.8	170.0	207.0	329.7
FW-12-105	551767.5	5845819.2	170.0	1847.5	1630.8	170.0	222.0	330.8
FW-12-106	551731.3	5845674.0	167.0	1743.5	1523.2	167.0	486.0	0.0
FW-12-107	551988.6	5845834.0	170.0	2046.3	1533.1	170.0	450.0	329.9
FW-12-108	551903.6	5845979.6	167.0	2045.5	1701.7	167.0	117.0	329.5
FW-12-109	552001.1	5845999.6	167.0	2140.0	1670.2	167.0	210.0	329.9
FW-12-110	551894.5	5845708.4	167.6	1902.0	1471.4	167.6	462.0	329.5
FW-12-111	551731.3	5845675.2	170.0	1744.1	1524.2	170.0	444.0	329.9
FW-12-112	551733.1	5845675.2	169.2	1745.7	1523.3	169.2	510.0	296.2

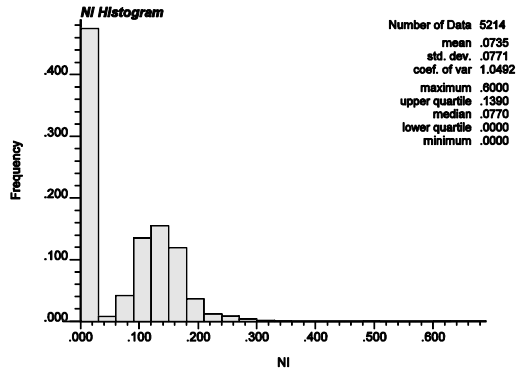
Appendix 2 – Exploratory Data Analysis

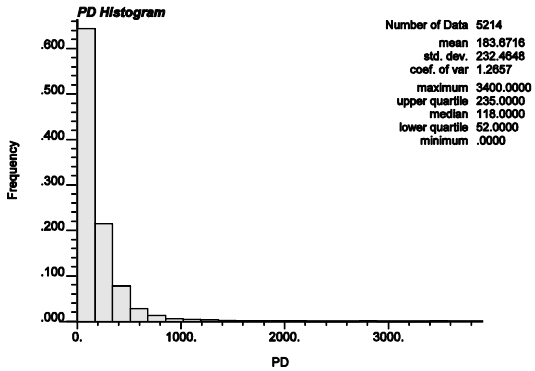
Histograms

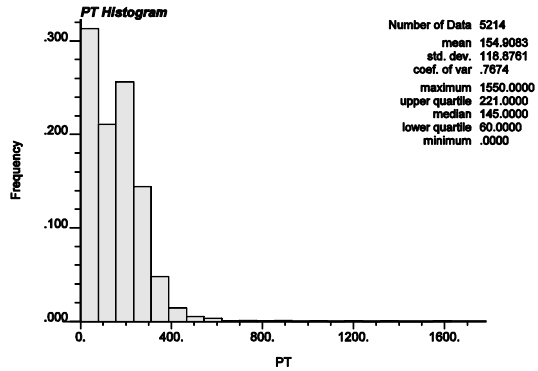




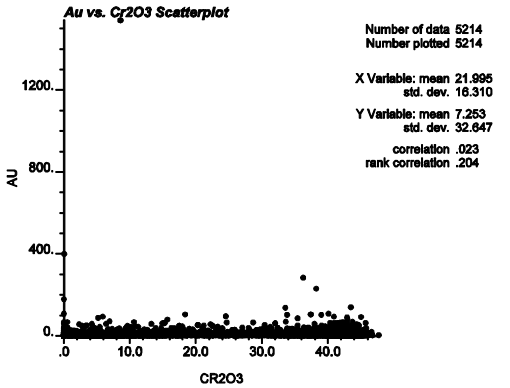


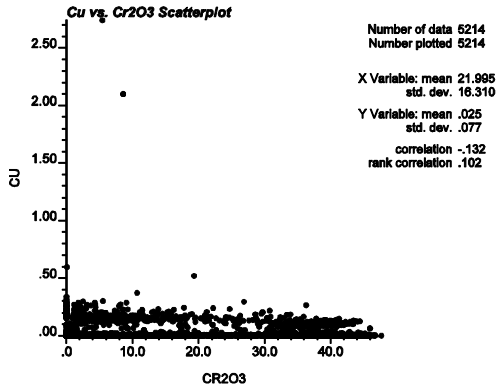


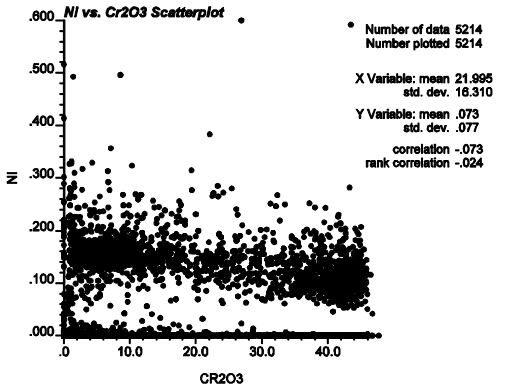


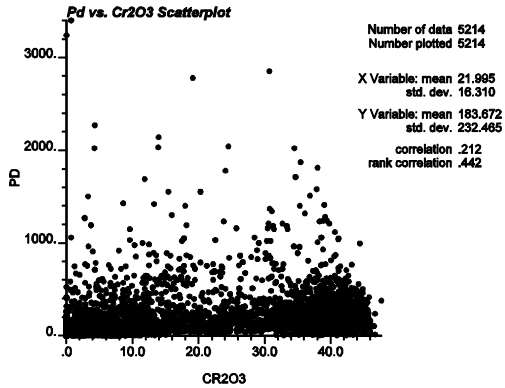


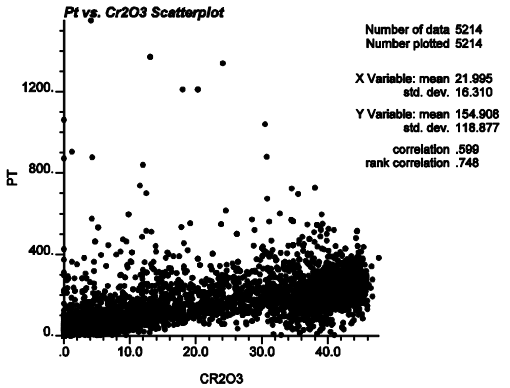
Scatter Plots

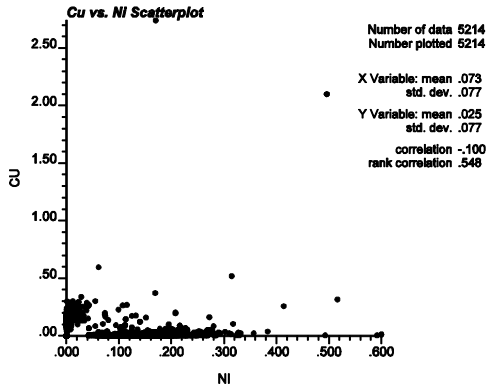


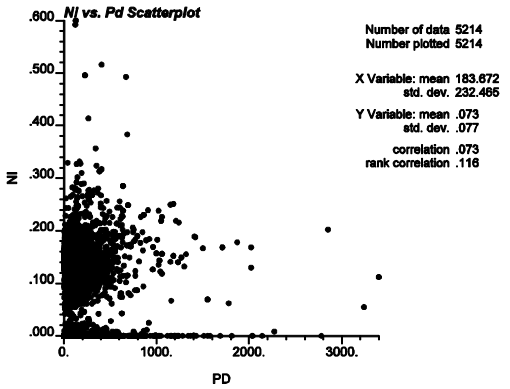


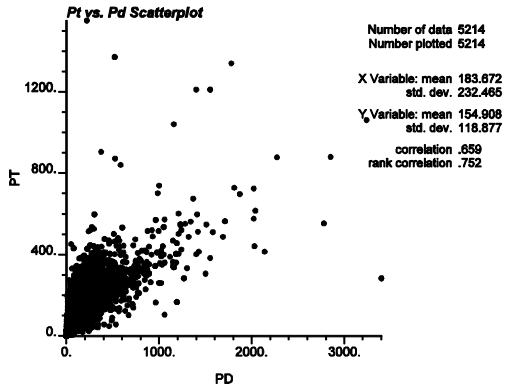










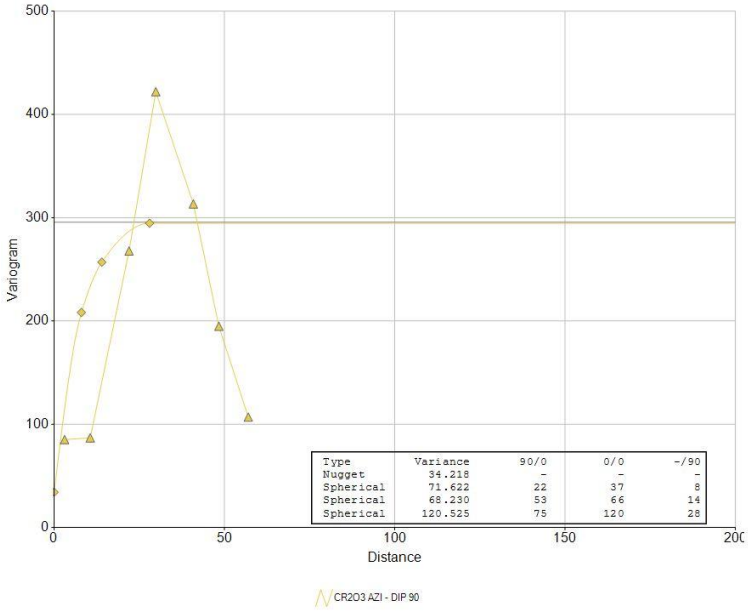


Appendix 3 – Experimental Variograms and Models

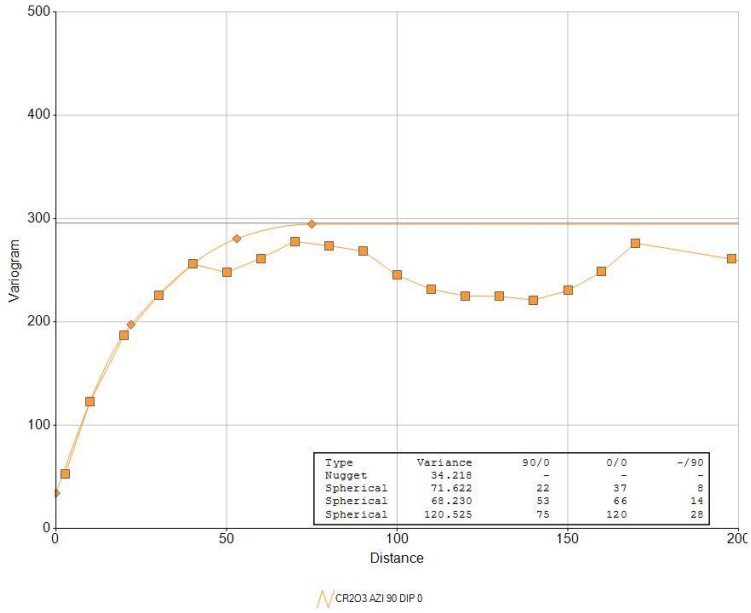
Big Daddy chromite deposit

Cr_2O_3

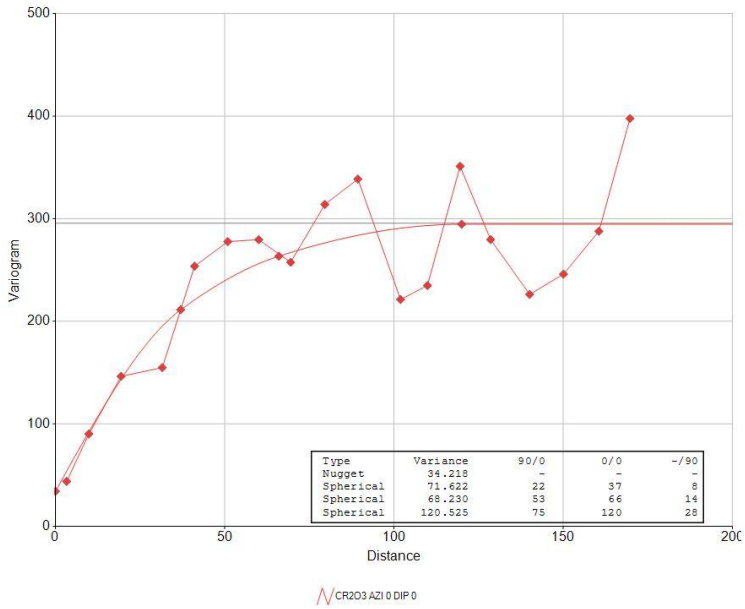
UCSA



UCSB



UCSC


Variogram
Distance
0
100
200
300
400
500
0
50
100
150
200
Type Variance 90/0 0/0 -/90
Nugget 34.218 - - -
Spherical 71.622 22 37 8
Spherical 68.230 53 66 14
Spherical 120.525 75 120 28
CR2O3 AZI 0 DIP 0

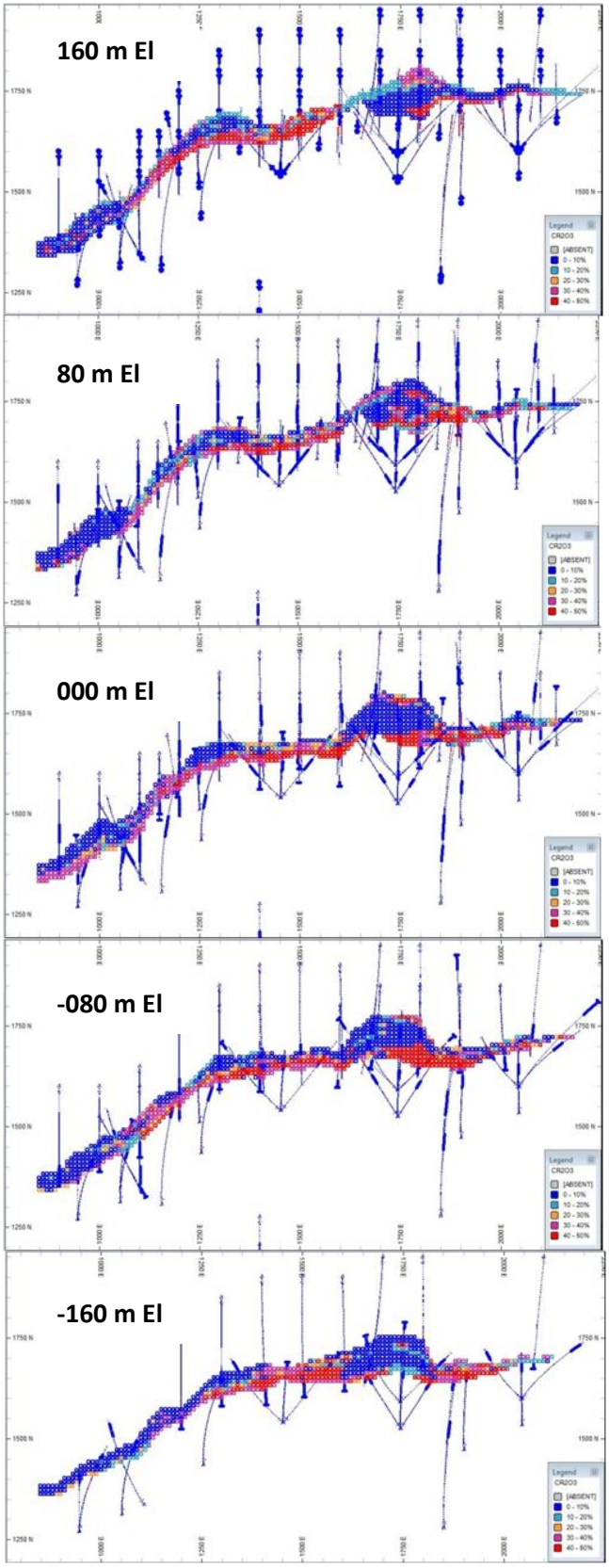
Appendix 4 – OK Search Parameters Used

SEARCH	UCSA	UCSB	UCSC	OCTANT METHOD USED?	MINIMUM NUMBER OF OCTANTS	MINIMUM SAMPLES PER OCTANT	MAXIMUM SAMPLES PER OCTANT	MINIMUM NUMBER OF SAMPLES	MAXIMUM NUMBER OF SAMPLES	MAX. NUMBER OF SAMPLES PER HOLE
1	20	75	120	YES	5	1	4	20	32	6
2	25	115	160	YES	5	1	4	10	32	6
3	30	155	200	NO	n/a	n/a	n/a	10	32	0

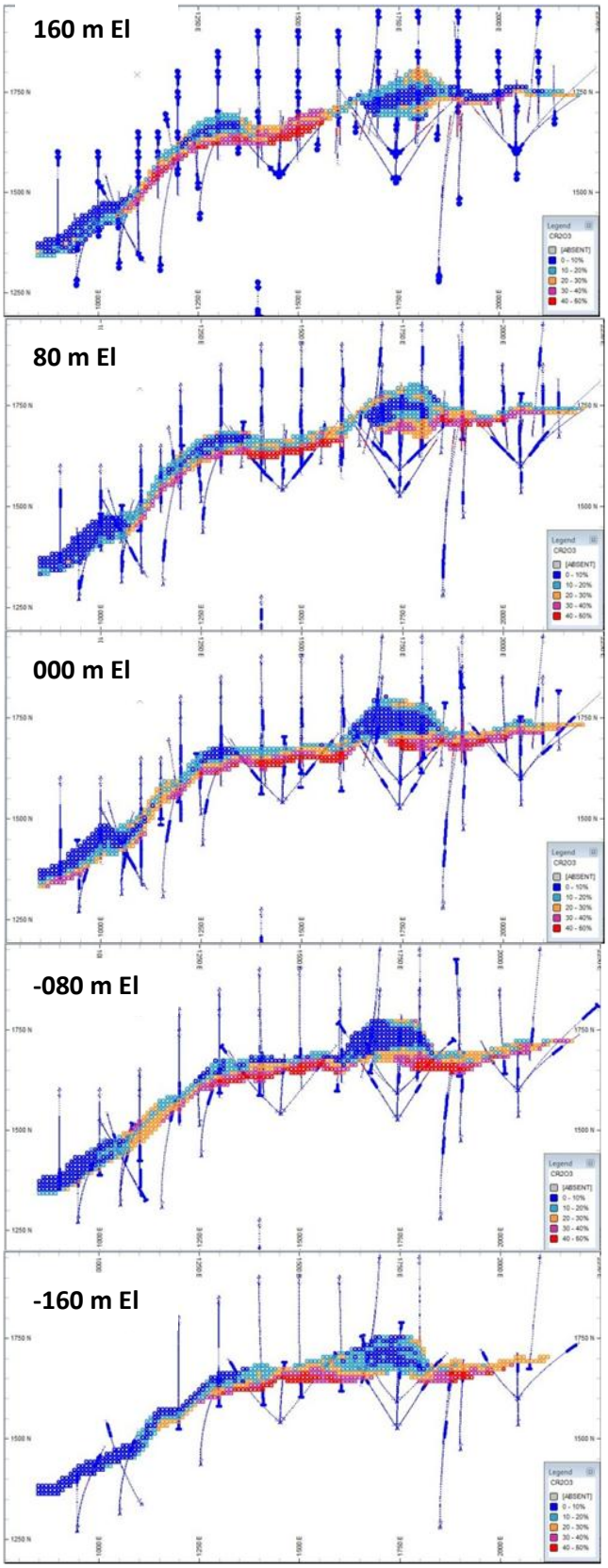
UCSA - across the dip
UCSB - down the dip
UCSC - along the strike

Appendix 5 – Block Model Plans and Sections

NN Models Sample Plan views - Big Daddy chromite deposit

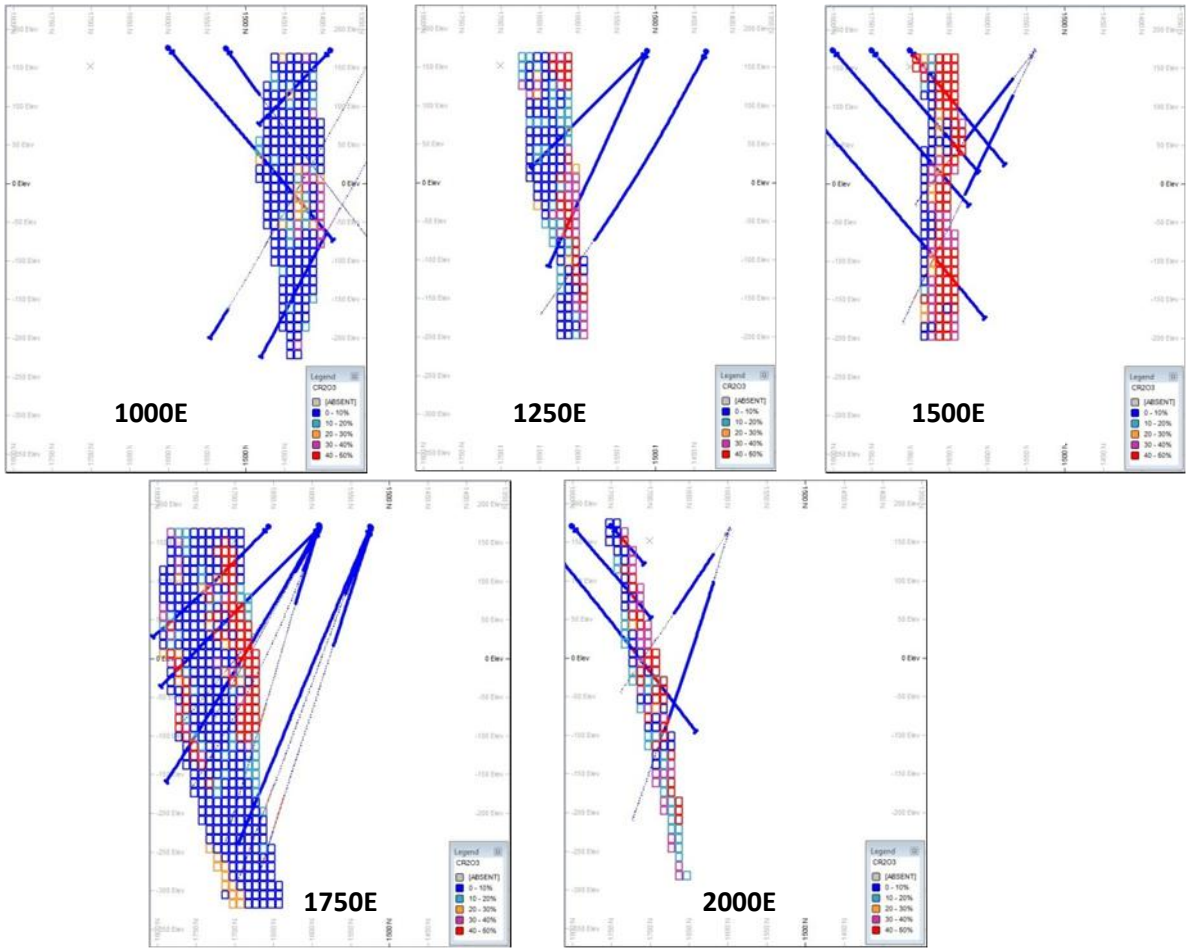


OK Models: Sample Plan views - Big Daddy chromite deposit



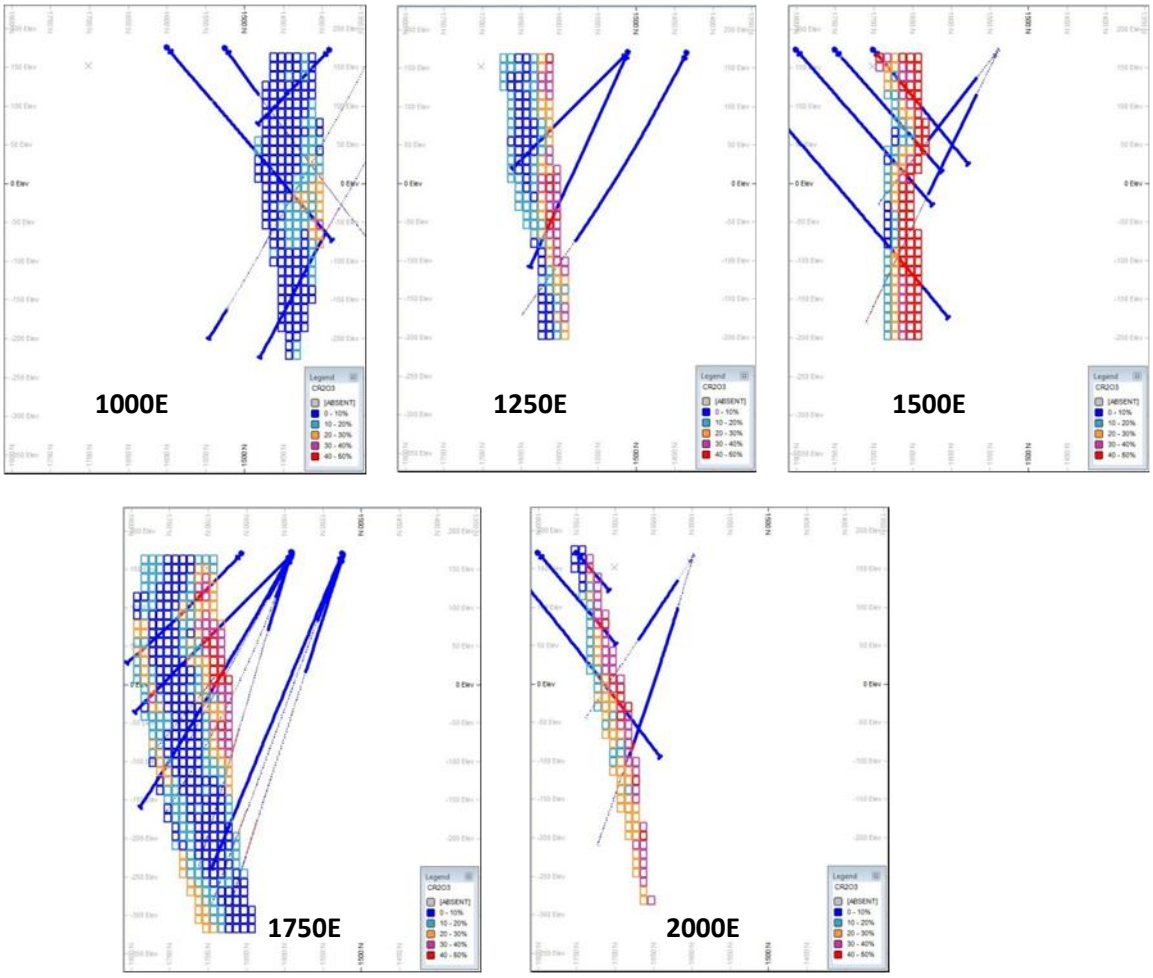
NN Model – N-S Sample Sections

Big Daddy chromite deposit



OK Models - N-S Sample Sections

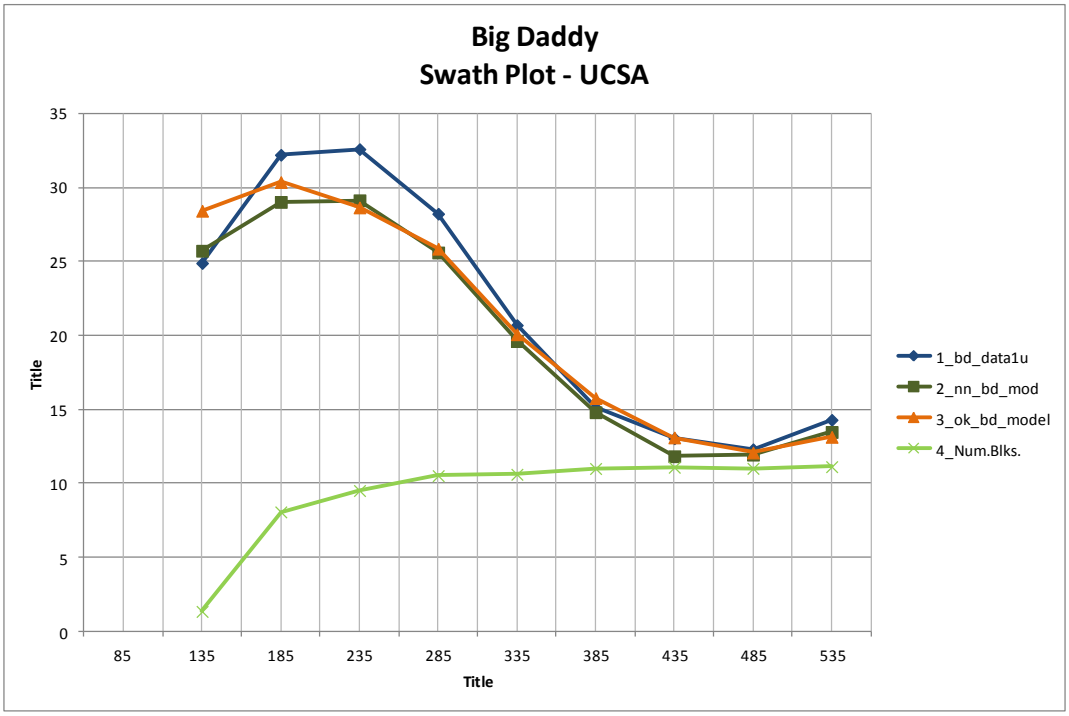
Big Daddy chromite deposit



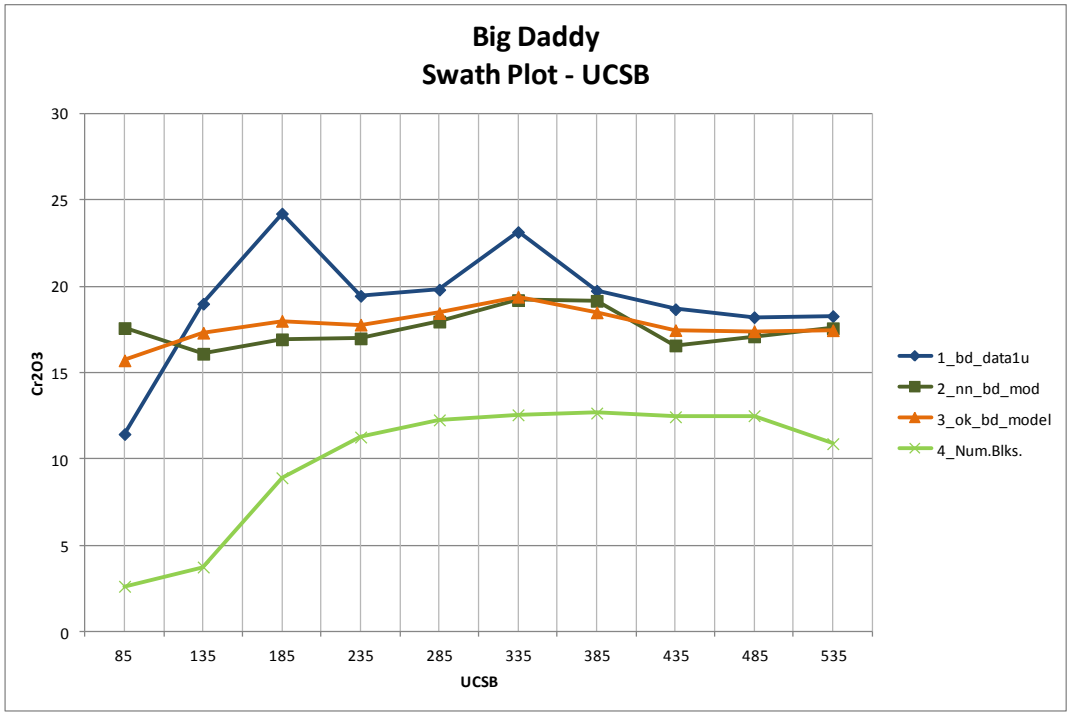
Appendix 6 - Model Validation

Swath Plots - Cr_2O_3

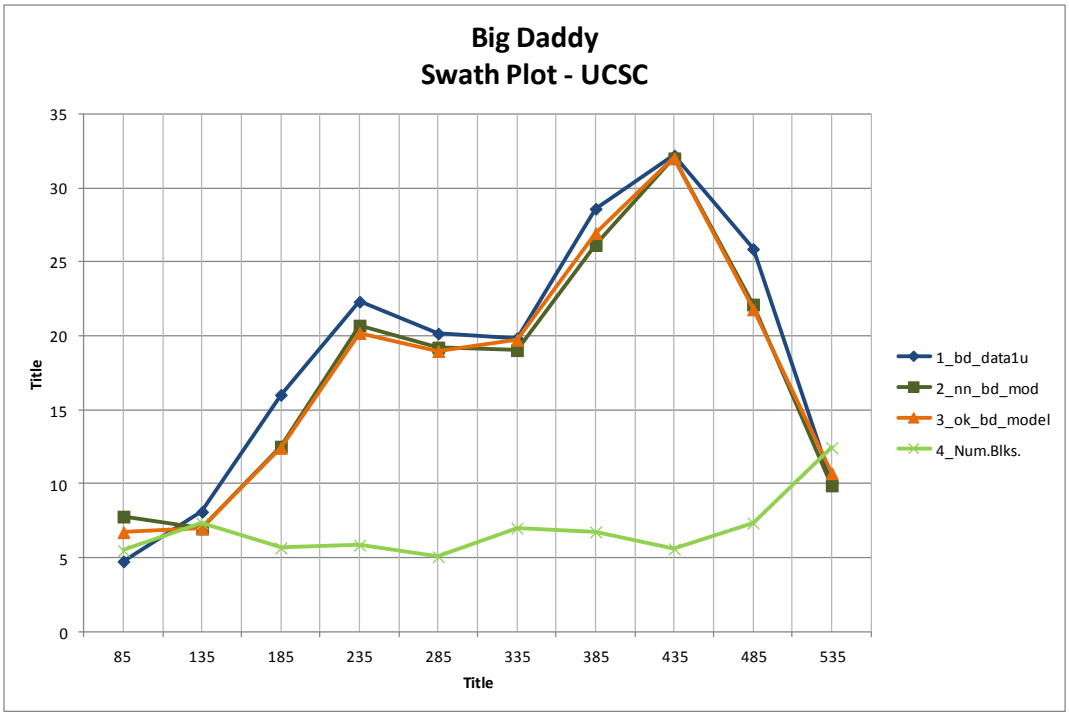
UCSA



UCSB



UCSC


Big Daddy
Swath Plot - UCSC
35
30
25
20
15
10
5
0
Title
85
135
185
235
285
335
385
435
485
535
Title
1_bd_data1u
2_nn_bd_mod
3_ok_bd_model
4_Num.Blks.

Appendix 7 – Variance Correction

Theory Used

The "averaging" process that goes on during interpolation within the block model tends to reduce the variance from its original level. Overall the mean for the entire population remains unaffected. However, since a cut-off grade is used to separate the above- and below-cut-off populations, their specific means are now affected due to this homogenization, or smoothing, of individual estimates. The interpolated mean can be lower or higher than the original mean depending upon whether the cut-off grade is above or below the original mean.

Regression methods such as Kriging may result in an over-smoothing or under-smoothing of the grade variability producing a block grade distribution with a variance that is lower or higher than expected. This expected variance can be calculated using Krige's relationship which states that the dispersion variance for the samples within the deposit is the sum of the dispersion variance of samples within the blocks and the dispersion variance of the blocks within the deposit. This relationship can be written as:

$$D^2(\bullet,A) = D^2(\bullet,\nu) + D^2(\nu,A) \qquad \text{Eq. 5.1}$$

Where ● are the samples, v are the blocks and A is the deposit.

In terms of average variance (known as gamma bar and calculated using the Datamine® FFUNC) the dispersion variance for samples within blocks can be written as:

$$D^2(\bullet,\nu) = \bar{\gamma}(\nu,\nu) - \bar{\gamma}(\bullet,\bullet) \qquad \text{Eq. 5.2}$$

As $\bar{\gamma}(\bullet,\bullet) = 0$ (the variance of a sample with itself equals 0) we can rewrite the above as:

$$D^2(\bullet,\nu) = \bar{\gamma}(\nu,\nu) \qquad \text{Eq. 5.3}$$

And by substituting into the first equation we get:

$$D^2(\bullet,A) = \bar{\gamma}(\nu,\nu) + D^2(\nu,A) \qquad \text{Eq. 5.4}$$

As the left side is equivalent to the sample variance (σ^2) we can reorder so that we can determine the block variance in terms of the average variogram of blocks to blocks (gamma bar) and the sample variance:

$$D^2(\nu,A) = \sigma^2 - \bar{\gamma}(\nu,\nu) \qquad \text{Eq. 5.5}$$

Of these 3 terms we can get the sample variance (σ^2) from our variogram and we can calculate the gamma bar value, using as input our variogram model and our block size. Using this information, and a change of support model we can correct for any differences due to over or under smoothing.

Gamma Bar is the calculated value of what *theoretically* should be the "Sample variance in Block" (V_b). As this value is based on the variogram we know that it is directly proportional to the variogram sill, which can be considered equivalent to the "Sample Variance in Deposit" (V_d). Knowing these two values we can then determine what **proportion of the total variance** is represented by the "Sample Variance in deposit" (V_d) using the following relationship:

$$P_{VB} = \frac{(V_d) - (V_b)}{(V_d)} = \frac{[\text{Variogram Sill}] - [\text{Gamma Bar}]}{[\text{Variogram Sill}]} \qquad \text{Eq. 5.6}$$

Using the declusterised variance for our mineral zone (V_d) we can then determine the variance that **should** be attributable to the "Variance between blocks" using the following relationship:

$$V_{B\text{-theoretical}} = P_{VB} * V_d \qquad \text{Eq. 5.7}$$

Now that we have the *theoretical* "Variance between blocks" we can then compare this with the actual "Variance between blocks". The latter is the variance of our Kriged model using our new support. By dividing the theoretical by the actual we get the smoothing ratio:

$$\text{Smoothing ratio} = \frac{V_{B\text{-theoretical}}}{V_{B\text{-actual}}} \qquad \text{Eq. 5.8}$$

A smoothing ratio less than 0.8 or greater than 1.2 require a variance correction. A smoothing ratio between 0 and 0.5 or greater than 4 could reveal errors in the data or in the models and necessitates further investigation.

There are two common methods of correcting for smoothing: the Affine correction (see Equation 5.9 – **Isaaks & Srivastava, 1989**) and the Indirect Lognormal Shortcut method (see Equation 5.10 – **Isaaks & Srivastava, 1989**). The former is best used for normal distributions and expands or contracts the distribution symmetrically about the mean and preserves the general shape of the original distribution. The Indirect Log Normal Shortcut on the other hand is best, as the name implies, for adjusting highly skewed distributions that approach being log normal. Unlike the Affine, which can result in negative values, the Log Normal Shortcut reduces the skewness of the distribution as the variance is reduced yet the minimum will always be 0.

$$q' = \sqrt{f} * (q - m) + m \qquad \text{Eq. 5.9}$$

where $f = \frac{\sigma_{theoretical}}{\sigma_{actual}}$

- For the current project the Indirect Lognormal Shortcut method was used

$$q' = aq^b$$

$$a = \frac{m}{\sqrt{f \times CV^2 + 1}} \left(\frac{CV^2 + 1}{m} \right)^b \qquad \text{Eq. 5.10}$$

$$b = \sqrt{\frac{\ln (f \times CV^2 + 1)}{\ln (CV^2 + 1)}}$$

$$f = \frac{\sigma^2_{theoretical}}{\sigma^2_{actual}} \qquad CV = \frac{\sigma}{m}$$

Appendix 8 – Resource Classification Definitions

The following is an extract from the CIM Definition Standards for Mineral Resources and Mineral Reserves, adopted December 11, 2005.

"A Mineral Resource is a concentration or occurrence of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.

The term Mineral Resource covers mineralization and natural material of intrinsic economic interest which has been identified and estimated through exploration and sampling and within which Mineral Reserves may subsequently be defined by the consideration and application of technical, economic, legal, environmental, socio-economic and governmental factors. The phrase 'reasonable prospects for economic extraction' implies a judgement by the Qualified Person in respect of the technical and economic factors likely to influence the prospect of economic extraction. A Mineral Resource is an inventory of mineralization that under realistically assumed and justifiable technical and economic conditions might become economically extractable. These assumptions must be presented explicitly in both public and technical reports.

Inferred Mineral Resource

An 'Inferred Mineral Resource' is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

Due to the uncertainty that may be attached to Inferred Mineral Resources, it cannot be assumed that all or any part of an Inferred Mineral Resource will be upgraded to an Indicated or Measured Mineral Resource as a result of continued exploration. Confidence in the estimate is insufficient to allow the meaningful application of technical and economic parameters or to enable an evaluation of economic viability worthy of public disclosure. Inferred Mineral Resources must be excluded from estimates forming the basis of feasibility or other economic studies.

Indicated Mineral Resource

An 'Indicated Mineral Resource' is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics, can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered

through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.

Mineralization may be classified as an Indicated Mineral Resource by the Qualified Person when the nature, quality, quantity and distribution of data are such as to allow confident interpretation of the geological framework and to reasonably assume the continuity of mineralization. The Qualified Person must recognize the importance of the Indicated Mineral Resource category to the advancement of the feasibility of the project. An Indicated Mineral Resource estimate is of sufficient quality to support a Preliminary Feasibility Study which can serve as the basis for major development decisions.

Measured Mineral Resource

A 'Measured Mineral Resource' is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.

Mineralization or other natural material of economic interest may be classified as a Measured Mineral Resource by the Qualified Person when the nature, quality, quantity and distribution of data are such that the tonnage and grade of the mineralization can be estimated to within close limits and that variation from the estimate would not significantly affect potential economic viability. This category requires a high level of confidence in, and understanding of, the geology and controls of the mineral deposit."