OreWin
Independent Mining Consultants

ENTRÉE GOLD INC.

Lookout Hill
Feasibility Study Update
Ömnogövi, Mongolia

March 2016

Job No. 14006

IMPORTANT NOTICE

This notice is an integral component of the Lookout Hill Feasibility Study Update (LHTR16) attached and should be read in its entirety and must accompany every copy made of the LHTR16. The LHTR16 has been prepared using the Canadian National Instrument (NI) 43-101 Standards of Disclosure for Mineral Projects.

The LHTR16 has been prepared for Entrée Gold Inc (Entrée) by OreWin Pty Ltd (OreWin). The LHTR16 is based on information and data supplied to OreWin by Entrée and other parties and where necessary OreWin has assumed that the supplied data and information are accurate and complete.

The conclusions and estimates stated in the LHTR16 are to the accuracy stated in the LHTR16 only and rely on assumptions stated in the LHTR16. The results of further work may indicate that the conclusions, estimates and assumptions in the LHTR16 need to be revised or reviewed.

OreWin has used its experience and industry expertise to produce the estimates and approximations in the LHTR16. Where OreWin has made those estimates and approximations, it does not warrant the accuracy of those amounts and it should also be noted that all estimates and approximations contained in the LHTR16 will be prone to fluctuations with time and changing industry circumstances.

The LHTR16 should be construed in light of the methodology, procedures and techniques used to prepare the LHTR16. Sections or parts of the LHTR16 should not be read or removed from their original context.

The LHTR16 is intended to be used by Entrée, subject to the terms and conditions of its contract with OreWin. Recognising that Entrée has legal and regulatory obligations, OreWin has consented to the filing of the LHTR16 with Canadian Securities Administrators and its System for Electronic Document Analysis and Retrieval (SEDAR). Except for the purposes legislated under provincial securities laws, any other use of this report by any third party is at that party's sole risk.

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Title Page

Project Name:	Lookout Hill
Title:	Lookout Hill Feasibility Study Update
Location:	Ömnögovi Aimag, Mongolia
Effective Dates:	
Effective Date of Technical Report:	29 March 2016
Effective Date of Mineral Resources:	
Hugo North Extension	28 March 2014
Heruga	30 March 2010
Effective Date of Mineral Reserve:	
Hugo North Extension	20 September 2014

Qualified Persons:

- Bernard Peters, BEng (Mining), FAusIMM (201743), employed by OreWin Pty Ltd as Technical Director – Mining, was responsible for the overall preparation of the Lookout Hill Feasibility Study Update and the Mineral Reserves.
- Sharron Sylvester, BSc (Geol), RPGeo AIG (10125), employed by OreWin Pty Ltd as Technical Director – Geology, was responsible for the preparation of the Mineral Resources.
- Robert M. Cann, MSc (Geol), P.Geo., consultant to and former Vice President, Exploration of Entrée Gold Inc., was responsible for preparation of all sections related to Shivee West.

Signature Page

Effective Dates:

Effective Dates of the Lookout Hill Feasibility Study Update: 29 March 2016

Effective Dates of Mineral Resource:

Hugo North Extension	28 March 2014
Heruga	30 March 2010

Effective Date of Mineral Reserve:

Hugo North Extension	20 September 2014

Overall Preparation of the Lookout Hill Feasibility Study Update and Mineral Reserves

/s/Bernard Peters

Bernard Peters, BEng (Mining), FAusIMM (201743), OreWin Pty Ltd

Mineral Resources

/s/Sharron Sylvester

Sharron Sylvester, BSc (Geol), RPGeo AIG (10125), OreWin Pty Ltd

Shivee West

/s/ Robert M. Cann

Robert M. Cann, M.Sc., P.Geo., consultant to and former Vice President, Exploration of Entrée Gold Inc.

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1.1 Project Overview

Entrée Gold Inc. (Entrée) retained OreWin Pty Ltd (OreWin) to prepare a Technical Report on the 62,920 ha Lookout Hill property (Lookout Hill), Mongolia, which includes the Hugo North Extension copper-gold and Heruga copper—gold—molybdenum deposits.

Lookout Hill is located in the Gobi region of southern Mongolia, and includes two mining licences (MLs) – Shivee Tolgoi ML and Javhlant ML. Lookout Hill completely surrounds the 8,490 ha Oyu Tolgoi ML, owned 100% by Oyu Tolgoi LLC (OT LLC). The eastern portion of the Shivee Tolgoi ML, which hosts the Hugo North Extension of the Hugo Dummett copper–gold deposit, and the Javhlant ML, which hosts the Heruga copper–gold–molybdenum deposit (together, the EJV Property), are subject to a joint venture between Entrée and OT LLC (the Entrée–OT LLC Joint Venture, or the EJV). The 23,114 ha western portion of the Shivee Tolgoi ML (Shivee West) is 100% owned by Entrée but is subject to a first right of refusal by OT LLC.

The Hugo North Extension and Heruga deposits respectively form the northern-most and southern-most parts of the Oyu Tolgoi project, which is a series of world-class, porphyry-style deposits containing copper, gold, silver and molybdenum. The Mineral Resources stretch over 12 km, from the Hugo North Extension deposit on the EJV Property in the north, through the Hugo North, Hugo South, Southern Oyu Tolgoi (SOT), and northern extension of the Heruga deposit on OT LLC's Oyu Tolgoi ML, to the Heruga deposit on the EJV Property in the south.

Under the terms of the EJV, Entrée has a 20% carried interest in mineralisation extracted from the Hugo North Extension and Heruga deposits. OT LLC has the remaining 80% interest. OT LLC is owned 66% by Turquoise Hill Resources Ltd. (TRQ) and 34% by the Government of Mongolia (GOM). OT LLC is the appointed manager under the terms of the Entrée–OT LLC Joint Venture. However, pursuant to various agreements between the Rio Tinto Group (Rio Tinto), TRQ, and OT LLC, Rio Tinto is responsible for both management and the building and operation of the Oyu Tolgoi project, including the Hugo North Extension and Heruga deposits on the EJV Property, and all exploration operations on behalf of OT LLC, including exploration on the EJV Property.

This report is titled the Lookout Hill Feasibility Study Update (LHTR16). LHTR16 updates the Technical Report 2013 on the Lookout Hill Property (LHTR13) released by Entrée in March 2013. LHTR16 was prepared by OreWin for Entrée and is based on information contained within the Oyu Tolgoi Feasibility Study 2014 (OTFS14) completed in July 2014 by OT LLC and the 2014 Oyu Tolgoi Technical Report (2014 OTTR) released by TRQ in October 2014 and also prepared by OreWin. The OTFS14 has yet to be updated by OT LLC and is the most current completed feasibility study work available.

Unless otherwise indicated, any reference in this report to Hugo North, Hugo Dummett, Lift 1, or Lift 2 is inclusive of Hugo North Extension.

The EJV Property Mineral Reserve is contained within the Hugo North Extension of the Lift 1 Block Cave and will be mined as part of the Oyu Tolgoi project. As such, the EJV Property Mineral Reserve is a subset of the total Oyu Tolgoi project Mineral Reserves reported in the 2014 OTTR, which assumes processing of 1.5 billion tonnes of ore, mined from OT LLC's SOT open pit and from Lift 1 Hugo North block cave, including Hugo North Extension. The mining areas included in the LHTR16 Reserve Case are shown schematically in Figure 1.1. The Mineral Reserves are based on mine planning work prepared by OT LLC. This work was reviewed and has been used as the basis for reporting the current Mineral Reserves.

Entrée also has significant Indicated and Inferred mineral resources in the Hugo North Extension deposit (updated from resources reported in LHTR13) and significant Inferred mineral resources in the Heruga deposit (unchanged from previous studies). Both Hugo North Extension and Heruga are large, bulk mineable underground deposits that would be mined by multiple block caves requiring separate future development decisions based on then prevailing economic conditions and the development experience obtained from developing and operating the initial phases of the Oyu Tolgoi project. The block caves will have a nominal maximum production of 95 ktpd and any production shortfall will be supplemented by feed from the OT LLC SOT open pit. Construction of the SOT open pit mine, supporting infrastructure and a nominal 100 ktpd concentrator is complete and the plant is operating at name-plate capacity or greater.

OT LLC continues engineering studies for the Oyu Tolgoi project, including the EJV Property. These will include examining all production scenarios and associated expansion options. OT LLC plans a focused and structured review of the study work to be used in the capital approvals process as the operation develops. OreWin believes that further design work could identify opportunities to improve project economics via cost reductions and mine plan optimisation. This may result in further positive changes to the EJV development schedule that could bring potential development of EJV mineral resources forward.

Figure 1.1 LHTR16 Reserve Case Mining Areas

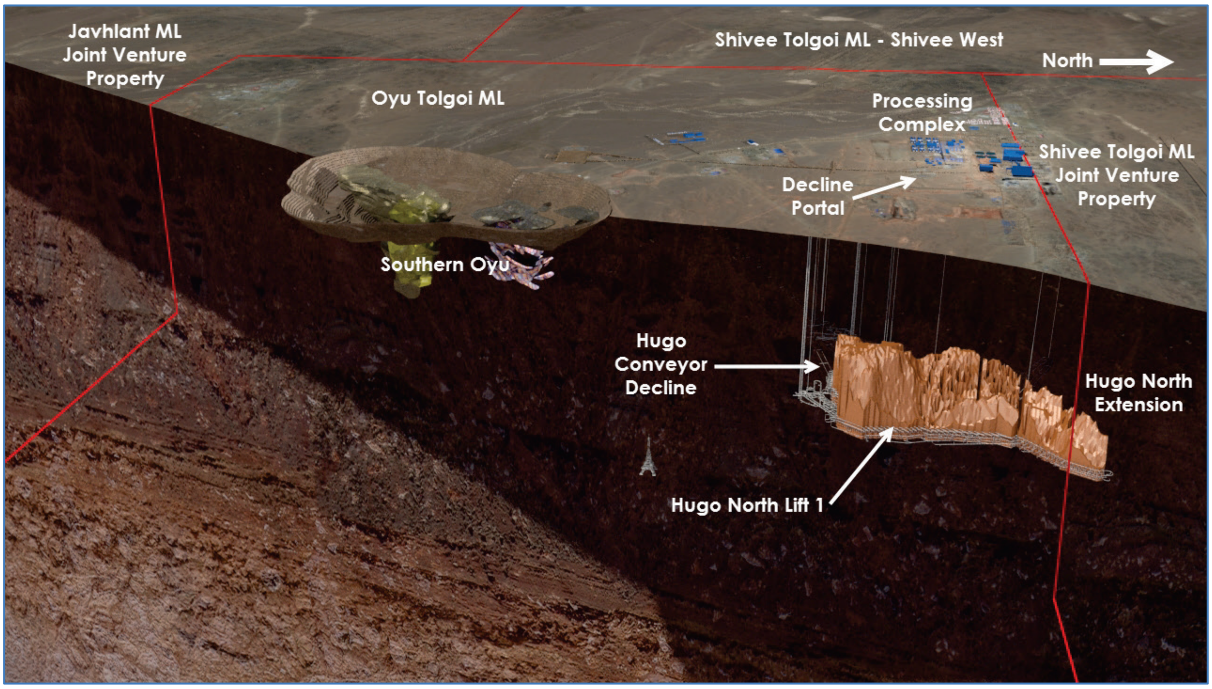


Figure by OreWin 2014

A summary of the financial results for the LHTR16 Reserve Case is shown in Table 1.1. The financial analysis has been prepared using the following long-term metal price estimates: copper at $3.08/lb; gold at $1,304/oz and silver at $21.46/oz (in LHTR16, currency is expressed in US dollars unless otherwise noted). The after-tax NPV at 8% discount rate (NPV8) attributable to Entrée for the LHTR16 Reserve Case is $106 M. OTFS14 assumed that the timing for the restart of the underground mine development would occur at the commencement of 2015, and even though this did not occur, the economic analysis of the Mineral Reserve remains valid and the costs and revenues are delayed by the same timing.

Table 1.1 EJV LHTR16 Reserve Case Financial Results

Description	Units	Total
Total OT Processed	bt	1.5
EJV Property Results		
EJV Processed	Mt	34.8
NSR	$/t	100.57
Cu Grade	%	1.59
Au Grade	g/t	0.55
Ag Grade	g/t	3.72
Copper Recovered	Mlb	1,121
Gold Recovered	koz	519
Silver Recovered	koz	3,591
Total Cash Costs After Credits	$/lb Payable Copper	0.99
NPV (8%) After Tax (Entrée)	$M	106
NPV (8%) Before Tax (Entrée)	$M	142

1. Metal prices used for calculating the Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work. The analysis indicates that the mineral reserve is still valid at these metal prices.
2. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
3. The block cave shell was defined using a NSR cut-off of $15/t NSR.
4. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
5. Only Measured mineral resources were used to report Proven mineral reserves and only Indicated mineral resources were used to report Probable mineral reserves.
6. EJV is the Entrée—OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
7. The base case financial analysis has been prepared using the following current long term metal price estimates: copper at $3.08/lb; gold at $1,304/oz; and silver at $21.46/oz.
8. The mineral reserves reported are not additive to the mineral resources.

1.2 Project Status

The EJV Property is an integral part of the development of the Hugo North underground mine at Oyu Tolgoi, the construction of which is a separate mining project expected to be approved by stakeholders in 2016. During 2015, a number of important milestones were reached towards achieving this approval. Finalised timing for the restart to underground construction and the realisation of value from the EJV Property remains dependent upon the finalisation of an updated feasibility study, receipt of all necessary permits and a definitive Notice to Proceed to be issued by the boards of Rio Tinto, TRQ and OT LLC. Under the terms of the project finance, once a Notice to Proceed is issued, the finance facility could be drawn down in full to support underground development.

In August 2013, development of the underground mine was suspended to allow matters between OT LLC, Rio Tinto, TRQ and the GOM to be resolved. In May 2015, the GOM, OT LLC, TRQ, and Rio Tinto signed the Underground Mine Development and Financing Plan (UDP). The UDP provides a path forward for restarting underground development and resolves key outstanding Oyu Tolgoi shareholder issues, including tax matters, a 2% NSR royalty acquired by TRQ from BHP Billiton in 2003, the Oyu Tolgoi 5% sales royalty calculation, management services payments and the sourcing of power for Oyu Tolgoi from within Mongolia.

In August 2015, TRQ announced that Oyu Tolgoi LLC had filed revised schedules for the Statutory Feasibility Study with the Mongolian Minerals Council. The filing also aligned the Statutory Feasibility Study with the UDP. The Mongolian Minerals Council had already tentatively accepted the Statutory Feasibility Study filed in March 2015, pending a revision of its schedules and alignment with the UDP. TRQ has said that the Statutory Feasibility Study is based on the March 2015 Statutory Feasibility Study and aligns with the 2014 OTTR. TRQ further announced that funding for pre-start activities had been approved, in order to ensure the project is ramped back into production as soon as possible, while not making contract commitments ahead of completing the full project approval. The funding covers work scheduled to take place before the official Notice to Proceed is approved.

In December 2015, TRQ announced that OT LLC had signed a $4.4 billion project finance facility. The Project Finance Facility is being provided by a syndicate of international financial institutions and export credit agencies representing the governments of Canada, the United States and Australia, along with 15 commercial banks. In September 2015, TRQ had noted the signing by the GOM of the request of the Multilateral Investment Guarantee Agency for host country approval with respect to guarantees to be issued by MIGA in connection with the Oyu Tolgoi Project Financing. The financing was disclosed with an all-in finance cost of LIBOR plus 6%.

TRQ further announced that it will continue to work with Rio Tinto and OT LLC towards completing an updated feasibility study, including the updated capital estimates required in connection therewith, and securing all necessary permits for the development of the underground mine, which TRQ announced it expected early in the second quarter of 2016 with an anticipated underground development restart expected mid-2016.

1.3 Qualified Persons

The LHTR16 was managed by OreWin Pty Ltd (OreWin), Adelaide, South Australia. The following Qualified Persons (QPs) were responsible for the preparation of the LHTR16:

- Bernard Peters, BEng (Mining), FAusIMM (201743), employed by OreWin Pty Ltd as Technical Director – Mining, was responsible for the overall preparation of the report and Mineral Reserves.

- Sharron Sylvester, BSc (Geol), RPGeo AIG (10125), employed by OreWin Pty Ltd as Technical Director – Geology, was responsible for the preparation of the Mineral Resources.

- Robert M. Cann., MSc (Geol), P.Geo, consultant to and former Vice President, Exploration of Entrée Gold Inc., was responsible for preparation of all sections related to Shivee West.

1.4 Project Location, Access and Ownership

Lookout Hill is located in the aimag of Ömnögovi in the South Gobi region of Mongolia, about 570 km south of the capital city of Ulaanbaatar and 80 km north of the border with China. It comprises two MLs (Shivee Tolgoi and Javhlant), which cover a total of approximately 62,920 ha and completely surrounds OT LLC's Oyu Tolgoi ML. The Shivee Tolgoi and Javhlant MLs are held by Entrée's wholly owned Mongolian subsidiary, Entrée LLC. Lookout Hill is divided into two contiguous areas: (1) the area governed under a joint venture between Entrée and OT LLC (EJV Property), and (2) Shivee West.

The ownership of the Shivee Tolgoi and Javhlant MLs is divided between Entrée and the EJV as described below and in Figure 1.2 and Figure 1.3.

- The EJV Property comprises 39,807 ha consisting of the eastern portion of the Shivee Tolgoi ML and all of the Javhlant ML, (together the EJV Property) and is governed by a joint venture between Entrée and OT LLC. The EJV Property is contiguous with, and on three sides (to the north, east, and south) surrounds the OT LLC Oyu Tolgoi ML. The EJV Property hosts the Hugo North Extension deposit and the Heruga deposit. Rio Tinto is acting as manager of the Entrée–OT LLC Joint Venture on behalf of OT LLC.

- The portion of Lookout Hill outside of the EJV Property (Shivee West) covers an area of 23,114 ha and consists of the western portion of the Shivee Tolgoi ML. Shivee West is 100% owned by Entrée but is subject to a first right of refusal by OT LLC.

Road access to Lookout Hill follows well-defined roads directly south from Ulaanbaatar requiring approximately 8–12 hours travel time in a four wheel drive vehicle. Mongolian rail service and a large electric power line lie 350 km east of the project at the main rail line between Ulaanbaatar and China. The China–Mongolia border is located approximately 80 km south of Lookout Hill. OT LLC has constructed a 105 km road from the site to the border. OT LLC has constructed a 3.25 km concrete airstrip and the site is serviced by charter and scheduled flights to and from Ulaanbaatar. Ulaanbaatar has an international airport, and Tsogttsetsii and the aimag capital of Dalanzadgad have regional airports.

In October 2004, Entrée entered into an arm's-length Equity Participation and Earn-In

Agreement as amended on November 9, 2004 (the Earn-In Agreement) with TRQ. Under the Earn-In Agreement, TRQ agreed to purchase equity securities of Entrée, and was granted the right to earn an interest in the EJV Property. Most of TRQ's rights and obligations under the Earn-In Agreement were subsequently assigned by TRQ to what was then its wholly-owned subsidiary, OT LLC which is also the title holder of the Oyu Tolgoi ML. On 30 June 2008, OT LLC gave notice that it had completed its earn-in obligations by expending a total of $35 M on exploration on the EJV Property. As a consequence, OT LLC earned an 80% interest in all minerals extracted below a sub-surface depth of 560 metres from the EJV Property and a 70% interest in all minerals extracted from surface to a depth of 560 metres from the EJV Property. The Earn-In Agreement provides that at such time as OT LLC completes its earn-in obligations, the parties will enter into a joint venture agreement in the form attached to the Earn-In Agreement. While the parties have not formally executed the joint venture agreement, the EJV is operating under those terms.

Under the terms of the Entrée–OT LLC Joint Venture, Entrée elected to have OT LLC debt finance Entrée's share of exploration and development costs with interest accruing at OT LLC's actual cost of capital or prime plus 2%, whichever is less, at the date of the advance. Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from the sale of Entrée's share of products. Such amounts will be applied first to payment of accrued interest and then to repayment of principal. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of operations for the month. The debt financing and repayment provisions limit dilution of Entrée's interest as the project progresses. Since formation, and as of 31 December 2015, the EJV has expended $27.8 M to advance the EJV Property. As of 31 December 2015, OT LLC has contributed on Entrée's behalf the required cash participation amount, including interest at prime plus 2%, of $6.8 M, equal to 20% of the $27.8 M incurred to date.

On 6 October 2009, TRQ, its wholly-owned subsidiary OT LLC, and Rio Tinto signed an Investment Agreement (IA) with the GOM, which regulates the relationship among the parties and stabilises the long term tax, legal, fiscal, regulatory and operating environment to support the development of the Oyu Tolgoi project. The IA specifies that the GOM will own 34% of the shares of OT LLC (and by extension, 34% of OT LLC's interest in the EJV) through its subsidiary Erdenes Oyu Tolgoi LLC. A shareholders' agreement was concurrently executed to establish the GOM's 34% ownership interest in OT LLC and to govern the relationship among the parties.

The contract area defined in the IA includes the Javhlant and Shivee Tolgoi MLs, including Shivee West which is not subject to the EJV. However, at the time of negotiation of the IA, Entrée was not made a party to the IA, and as such does not have any direct rights or benefits under the IA. OT LLC agreed, under the terms of the Earn-In Agreement, to use its best efforts to cause Entrée to be brought within the ambit of, made subject to and to be entitled to the benefits of the IA or a separate stability agreement on substantially similar terms to the IA.

Entrée is engaged in ongoing constructive discussions with stakeholders of the Oyu Tolgoi project, including the GOM, OT LLC, Erdenes Oyu Tolgoi LLC, TRQ, and Rio Tinto. The discussions to date have focussed on issues arising from Entrée's exclusion from the IA, including the fact that the GOM does not have a full 34% interest in the EJV Property; the fact that the mining licences integral to future underground operations are held by more than one corporate entity; and the fact that Entrée does not benefit from the stability that it would otherwise have if it were a party to the IA. In order to receive the benefits of the IA, the GOM may require Entrée to agree to certain concessions, including with respect to the ownership of the EJV, Entrée LLC or the economic benefit of Entrée's interest in the EJV Property, or the royalty rates applicable to Entrée's share of the EJV Property mineralisation. No agreements have been finalised.

Figure 1.2 Lookout Hill – Land Tenure

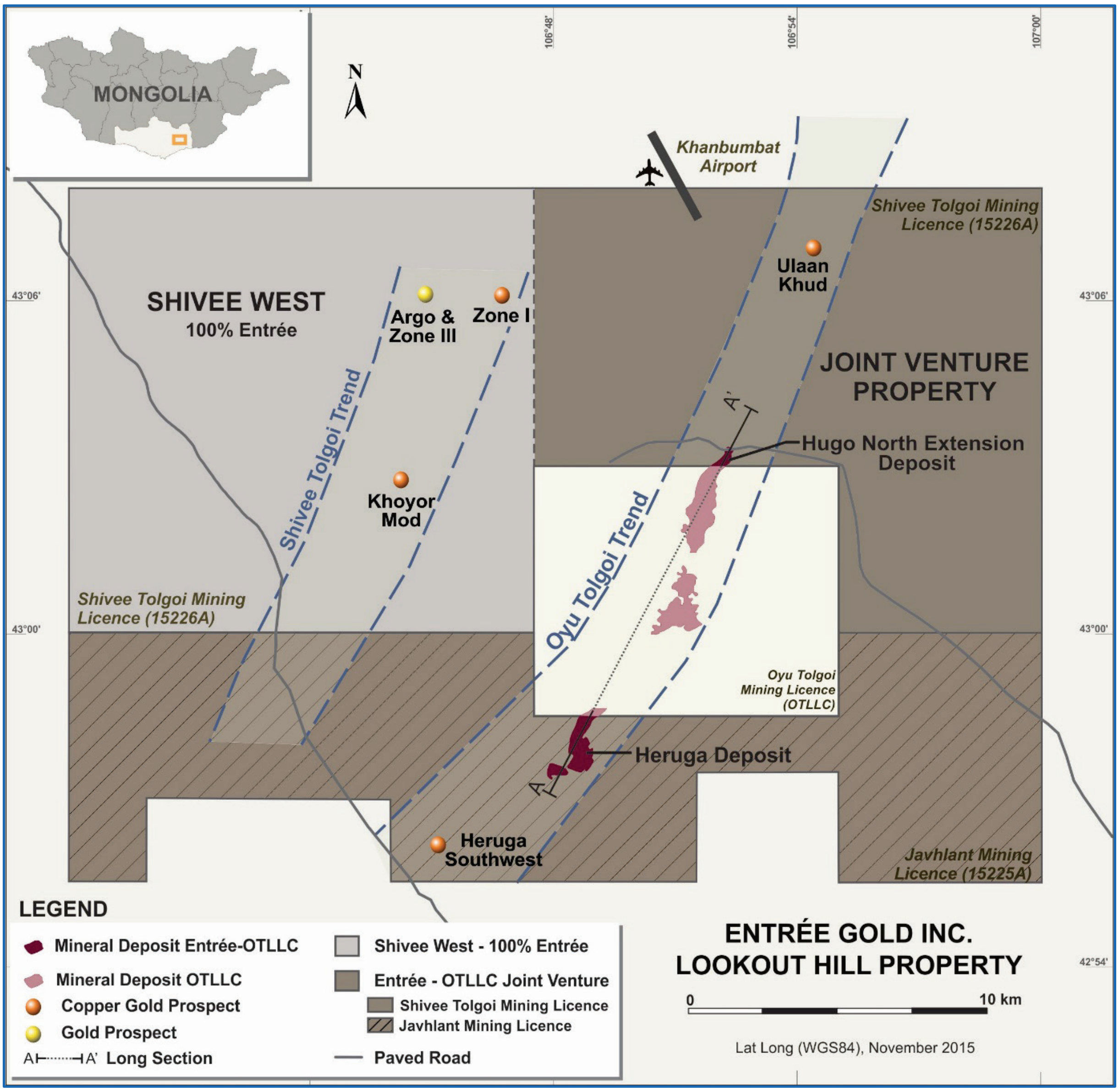
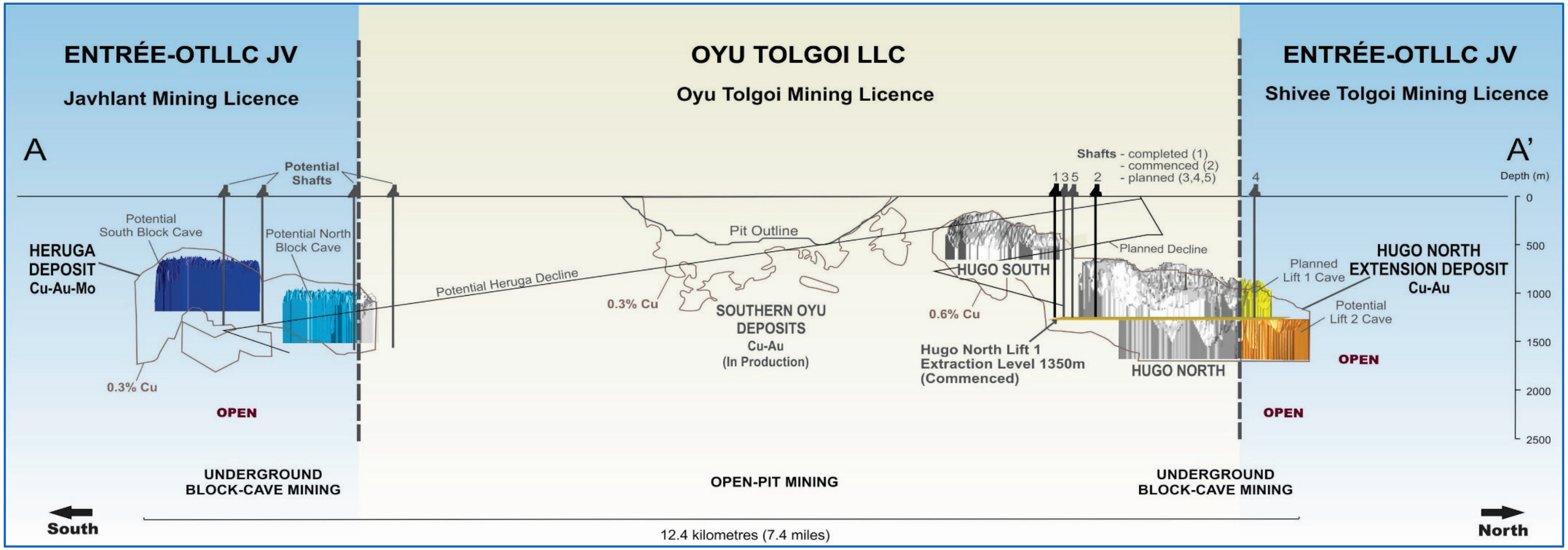


Figure by Entrée 2016

Figure 1.3 Idealised Long-Section of Oyu Tolgoi including Hugo North Extension and Heruga Deposits (looking west)



Modified from OT LLC, Entrée 2016.

1.5 Geology

1.5.1 Regional Geology

Lookout Hill lies within the Palaeozoic Gurvansayhan Terrane in southern Mongolia, a component of the Altaid orogenic collage, which is a continental-scale belt dominated by compressional tectonic forces. The Gurvansayhan Terrane consists of highly deformed accretionary complexes and oceanic island arc assemblages. The island arc terrane is dominated by basaltic volcanics and intercalated volcanogenic sedimentary rocks (Upper Devonian Alagbayan Group), intruded by pluton-sized, hornblende-bearing granitoids of mainly quartz monzodiorite (Qmd) to possibly granitic composition. Carboniferous age sedimentary rocks (Sainshandhudag Formation) overlie this assemblage.

Major structures in this area include the Gobi–Tien Shan sinistral strike-slip fault system, which splits eastward into a number of splays, and the Gobi–Altai Fault system, which forms a complex zone of sedimentary basins overthrust by basement blocks to the north and north-west.

1.5.2 Local Geology

The Oyu Tolgoi series of porphyry copper–gold deposits, which includes the EJV deposits, occur along a north—north-east corridor with Hugo North Extension at the north end and the Heruga deposit at the south end. Mineralisation is related to Devonian quartz monzodiorite intrusions and associated quartz stockwork. The deposits have varied characteristics in regard to host rock, intrusive bodies, sulphide mineralogy, grade, and alteration.

The pre-Carboniferous (probably Devonian) stratigraphy of Oyu Tolgoi series of deposits consists of massive augite basalt, conglomerate, dacitic tuffs, and siltstones, which are overthrust by the 'Heruga sequence', comprising basaltic flows, volcaniclastic rocks, and siltstones. Only the lower parts of the Devonian sequence host porphyry mineralisation and associated alteration. The Carboniferous Sainshandhudag Formation unconformably overlies the older rocks. Major Carboniferous or younger faults disrupt the mineralised corridor and bound the western side of most deposits.

The Hugo North Extension deposit within the EJV Property contains copper–gold porphyry-style mineralisation associated with Qmd intrusions, concealed beneath a deformed sequence of Upper Devonian and Lower Carboniferous sedimentary and volcanic rocks.

The high-grade zone at Hugo North Extension comprises relatively coarse bornite impregnating quartz and disseminated in wall rocks of varying composition, usually intergrown with subordinate chalcopyrite. Bornite is dominant in the highest grade parts of the deposit (with these zones averaging around 3.0% to 5.0% Cu) and is zoned outward to chalcopyrite (to zones averaging around 2.0% Cu for the high-grade chalcopyrite dominant mineralisation).

The Heruga deposit contains copper–gold–molybdenum porphyry-style mineralisation hosted in Devonian basalts and Qmd intrusions, concealed beneath a deformed sequence of Upper Devonian and Lower Carboniferous sedimentary and volcanic rocks. The deposit is cut by several major brittle fault systems, partitioning the deposit into discrete structural blocks. Internally, these blocks appear relatively undeformed, and consist of south–east dipping volcanic and volcaniclastic sequences. The stratiform rocks are intruded by Qmd stocks and dykes that are probably broadly contemporaneous with mineralisation. The deposit is shallowest at the southern end (approximately 500 m below surface) and plunges gently to the north.

The alteration at Heruga is typical of porphyry-style deposits, with notably stronger potassic alteration at deeper levels. Locally intense quartz–sericite alteration with disseminated and vein pyrite is characteristic of mineralised Qmd. Molybdenite mineralisation seems to spatially correlate with stronger quartz–sericite alteration.

Copper sulphides occur at Heruga in both disseminations and veins/fractures. Mineralised veins have a much lower density at Heruga than in the more northerly deposits.

1.6 Mineral Resources

The Hugo North Extension Mineral Resource inventory, cut at the adjacent Oyu Tolgoi licence boundary, is based on drilling as of 14 February 2014 and reported as of the Resource Effective Date of 28 March 2014. The Effective Date for the Heruga Mineral Resource is 30 March 2010 and is based on drilling to 21 June 2009.

OT LLC produced 3D geological models of the major structures and lithological units based on the structural and geological information outlined in the geological discussion in this report. For each deposit, appropriate copper and gold shells at various cut-off grades were also defined. These shapes were then edited on plan and section views to be consistent with the structural and lithological models and the drill assay data. Checks on the structural, lithological, and grade shell models indicated that the shapes honoured the drillhole data and interpreted geology.

The Hugo North Extension and Heruga Mineral Resources are shown in Table 1.2, reported at copper equivalent cut-off grades above 0.37%. The Mineral Resource estimate for the Hugo North Extension deposit is classified as Measured, Indicated, and Inferred, while the Mineral Resource estimate for the Heruga deposit is classified as Inferred. The Mineral Resources were classified in a manner consistent with the 2014 Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards on Mineral Resources and Mineral Reserves (CIM Definition Standards) required by NI 43-101. Mineral Resources are not Mineral Reserves until they have demonstrated economic viability based on a feasibility study or prefeasibility study.

The formulae used to calculate copper equivalency have been updated in 2014 for each deposit and are discussed in more detail below. The various recovery relationships at Oyu Tolgoi are complex and relate both to grade and Cu : S ratios.

Table 1.2 Entrée–OT LLC Joint Venture Mineral Resource Summary

Classification	Ownership	Tonnage (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Contained Metal				
								Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)	CuEq (Mlb)
Hugo North Extension (0.37% CuEq Cut-Off)												
Measured	EJV	1.2	1.38	0.12	2.77	38.4	1.47	36	4.4	105	0.1	38
Indicated	EJV	128	1.65	0.55	4.12	33.6	1.99	4,663	2,271	16,988	9.5	5,633
Inferred	EJV	179	0.99	0.34	2.68	25.4	1.20	3,887	1,963	15,418	10.0	4,730
Heruga (0.37% CuEq Cut-Off)												
Inferred	EJV	1,700	0.39	0.37	1.39	113.2	0.64	14,610	20,428	75,955	424	24,061

1. CuEq is copper-equivalent grade, expressed in percent.
2. Effective date for the Mineral Resources for Hugo North Extension is 28 March 2014.
3. Effective date for the Mineral Resources for Heruga is 30 March 2010.
4. The 0.37% CuEq cut-off is equivalent to the underground Mineral Reserve cut-off as determined by OT LLC.
5. CuEq has been calculated using assumed metal prices ($3.01/lb for copper, $1,250/oz for gold, $20.37/oz for silver, and $11.90/lb for molybdenum).
   a) Hugo North Extension CuEq% = Cu% + ((Au (g/t) x 1,250 x 0.0321507 x 0.913) + (Ag (g/t) x 20.37 x 0.0321507 x 0. 942)) / (3.01 x 22.0462)
   b) Heruga CuEq% = Cu% + ((Au (g/t) x 1,250 x 0.0321507 x 0.911) + (Ag (g/t) x 20.37 x 0.0321507 x 0. 949) + (Mo (ppm) x 11.9 x 0.0022046 x 0.736)) / (3.01 x 22.0462)
6. The contained copper, gold, silver, and molybdenum in the tables have not been adjusted for metallurgical recovery.
7. Totals may not match due to rounding.
8. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
9. The EJV includes a portion of the Shivee Tolgoi licence and the all of Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi licence are held for the EJV by Entrée. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in mineralisation extracted from the EJV Property and OT LLC has an 80% interest.

1.6.1 Hugo North Extension

The Hugo North Extension resource model is based on a new geological interpretation and refined structural model for the Hugo North deposit. Updated Hugo North interpretations were developed as three dimensional wireframes based on all of the available drillhole data as at the close-off date of 14 February 2014.

A sub-celled volume model was developed from these updated interpretations using parent cell dimensions equal to 15 m x 15 m x 15 m and minimum sub-cell dimensions down to 5.0 m x 5.0 m x 5.0 m to allow good resolution at interpreted boundaries. Interpolation was undertaken into the mineralised domains (Va, Qmd, Ign, and xBigD) using ordinary kriging methods, except for bulk density, which was interpolated using a combination of simple kriging and inverse distance weighting to the third power (ID3). Grades were estimated into parent cells and assigned to sub-cells of like-domain using 5.0 m drillhole composites. A nearest neighbour estimation run was also undertaken for validation purposes. Search parameters were derived from variographic analysis. Concentric expanding search ellipsoids were used in a three-pass estimation process, whereby model cells that did not receive an estimate in a previous search ellipse moved to the next larger pass for a repeated attempt at estimation. At least three drillholes were used to estimate blocks in the first search pass, and the number of composites from a single drillhole that could be used was restricted to three. Similarly, search pass two required a minimum of two drillholes to generate an estimate. The number of composites allowed from a single hole was restricted to three. For both copper and gold, a combination of outlier restriction and grade capping was used to control the effects of high-grade samples within the domains.

At Hugo North Extension, block confidence classification is based on three processes: preliminary block classification using a script based on distance to a drillhole and number of drillholes used to estimate a block, generation of probability model for the three confidence categories, and manual 'cleaning' using polygons generated in sectional view.

1.6.2 Heruga

The Heruga resource model has not been updated; however, grades and tonnages have been revised slightly because of changes to the CuEq calculation (see discussion below) and resultant changes to blocks contained within the CuEq cut-off grade. The 2014 revised CuEq formula has affected the Heruga mineral resource estimate, with a 7% drop in tonnage, a 4% drop in copper, gold, silver, and molybdenum contained metals, and a 10% drop in copper equivalent metal relative to the Mineral Resource reported in LHTR13.

Mineral Resources are not Mineral Reserves until they have demonstrated economic viability based on a feasibility study or prefeasibility study.

The Mineral Resource estimate was originally prepared by OT LLC. A close-off date of 31 May 2009 for survey (collar and downhole) data was utilised for constructing the geological domains. The Effective Date for the Heruga Mineral Resource is 30 March 2010. OreWin has reviewed the Heruga resource estimate and is of the opinion that the original data is still reliable and current and there have been no material changes resulting from drilling completed after May 2009.

Modelling of mineralisation zones for resource estimation purposes revealed that there is an upper copper-dominant zone and a deeper gold-dominant zone within the overall copper–gold porphyry at Heruga. In addition, there is significant (100–1,000 ppm) molybdenum mineralisation in the form of molybdenite, which is more-closely associated with the copper mineralisation.

The database used to estimate the Mineral Resources for the Heruga deposit consists of samples and geological information from 43 drillholes, including daughter holes, totalling 58,276 m.

OT LLC created 3D shapes (wireframes) of the major geological features of the Heruga deposit. To assist in the estimation of grades in the model, OT LLC also manually created 3D grade shells (wireframes) for each of the metals to be estimated. Construction of the grade shells took into account prominent lithological and structural features, in particular the four major sub-vertical post-mineralisation faults. For copper, a single grade shell at a threshold of 0.3% Cu was used. For gold, wireframes were constructed at thresholds of 0.3 g/t Au and 0.7 g/t Au. For molybdenum, a single grade shell at a threshold of 100 ppm Mo was constructed. Silver was estimated using the copper domains. These grade shells took into account known gross geological controls in addition to broadly adhering to the above mentioned thresholds.

Resource estimates were undertaken by OT LLC and the methods used were very similar to those used to estimate the Hugo North Extension. Interpolation domains were based on mineralised geology, and grade estimation based on ordinary kriging. Bulk density was interpolated using an inverse distance to the third power methodology. The assays were composited into 5.0 m downhole composites; block sizes were 20 m x 20 m x 15 m.

The Mineral Resources for Heruga (Table 1.2) were classified using logic consistent with the 2014 CIM Definition Standards required by NI 43-101. Blocks within 150 m of a drillhole were initially considered to be Inferred. A 3D wireframe was constructed, inside of which the nominal drill spacing was less than 150 m.

1.6.3 2014 CuEq Formula Derivation

The 2014 copper-equivalence formulae incorporate copper, gold, and silver, and also molybdenum for Heruga. The assumed metal prices are $3.01/lb for copper, $1,250/oz for gold, $20.37/oz for silver, and $11.90/lb for molybdenum.

Copper estimates are expressed in the form of percentages (%), gold and silver are expressed in grams per tonne (g/t), and molybdenum is expressed in parts per million (ppm).

Metallurgical recovery for gold, silver, and molybdenum are expressed as a percentage relative to copper recovery.

All elements included in the copper equivalent calculation have a reasonable potential to be recovered and sold, except for molybdenum. Molybdenum grades are only considered high enough to support construction of a molybdenum recovery circuit for Heruga mineralisation; hence the recoveries of molybdenum are assumed to be zero for Hugo North Extension.

CuEq14(Hugo North Extension) =

Cu + ((Au x 1,250 x 0.0321507 x 0.913) + (Ag x 20.37 x 0.0321507 x 0.942)) / (3.01 x 22.0462)

The base formula for Heruga is as follows:

CuEq14(HERUGA) =

Cu + ((Au x 1,250 x 0.0321507 x 0.911) + (Ag x 20.37 x 0.0321507 x 0.949) + (Mo x 11.9 x 0.0022046 x 0.736)) / (3.01 x 22.0462)

1.7 Mineral Reserve

The EJV Property Mineral Reserve is contained within the Hugo North Extension Lift 1 Block Cave. The mine design work on Hugo North Lift 1 was prepared by OT LLC and accepted as the basis for the underground mine planning in the 2014 OTTR. OreWin agrees with this conclusion and has reported the results for the 20 September 2014 Hugo North Extension Mineral Reserve estimate in LHTR16. The EJV Property Mineral Reserve will be mined as part of the Oyu Tolgoi project and as such is a subset of the total Oyu Tolgoi Mineral Reserves reported in the 2014 OTTR. The Mineral Reserves are based on mine planning work prepared by OT LLC. This work was reviewed and has been used as the basis for reporting the current Mineral Reserves.

Mineral Reserves were last publically reported in the LHTR13 (March 2013). LHTR16 Mineral Reserves for the EJV Property are shown in Table 1.3. A reconciliation of the LHTR13 and LHTR16 Mineral Reserves is shown in Table 1.4.

Table 1.3 EJV Mineral Reserve, 20 September 2014

Classification	Ore (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Copper (Mlb)	Gold (koz)	Silver (koz)
Proven	–	–	–	–	–	–	–
Probable	35	1.59	0.55	3.72	1,121	519	3,591
Total EJV	**35**	**1.59**	**0.55**	**3.72**	**1,121**	**519**	**3,591**

1. Metal prices used for calculating the Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work. The analysis indicates that the mineral reserve is still valid at these metal prices.
2. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
3. The block cave shell was defined using a NSR cut-off of $15/t NSR.
4. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low-grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
5. Only Indicated mineral resources were used to report Probable mineral reserves.
6. EJV is the Entrée–OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
7. The base case financial analysis has been prepared using the following current long-term metal price estimates: copper at $3.08/lb; gold at $1,304/oz; and silver at $21.46/oz.
8. The mineral reserves reported above are not additive to the mineral resources.

The underground Mineral Reserve statement in LHTR16 only considers Mineral Resources in the Indicated category, and engineering that has been carried out to a feasibility level or better. Copper and gold grades of Inferred Resources within the block cave shell were set to zero and such material was assumed to be dilution. The block cave shell was defined using a net smelter return (NSR) cut-off of $15/t NSR, and further mine planning will examine lower cut-offs.

Table 1.4 LHTR16 and LHTR13 Probable Mineral Reserve Comparison

Classification	Ore (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Copper (Mlb)	Gold (koz)	Silver (koz)
LHTR16	35	1.59	0.55	3.72	1,121	519	3,591
LHTR13	31	1.73	0.62	3.74	1,090	521	3,229
Difference	4	–0.14	–0.07	–0.02	31	–2	361
Difference (%)	11.7%	–8.1%	–11.3%	–0.6%	2.8%	–0.4%	11.2%

1. LHTR13 Mineral Reserves have the effective date 25 March 2013.
2. LHTR16 Mineral Reserves have the effective date 20 September 2014.
3. Metal prices used for calculating the LHTR16 Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work.
4. Metal prices used for calculating the LHTR13 Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $2.81/lb; gold at $970/oz; and silver at $15.50/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work.
5. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
6. For both the LHTR13 and LHTR16 the block cave shell was defined using a NSR cut-off of $15/t NSR.
7. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
8. Only Indicated mineral resources were used to report Probable mineral reserves.
9. EJV is the Entrée–OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
10. The mineral reserves reported above are not additive to the mineral resources.

1.8 Mining Methods

Oyu Tolgoi, including the EJV Property, hosts four main semi-contiguous, surface and underground porphyry copper–gold deposits (Hugo North, Hugo South, SOT, and Heruga – from north to south) along a 12 km north–north-east trending belt. Mineral reserves and resources estimated on these deposits form the basis of future project development. The deposits are located both on the Oyu Tolgoi ML and on the adjacent EJV Property, but the EJV deposits will be developed, operated and processed by OT LLC under the terms of the Entrée–OT LLC Joint Venture. This provides the operator with flexibility in studying alternative paths for mine development to match future economic conditions and actual mine performance.

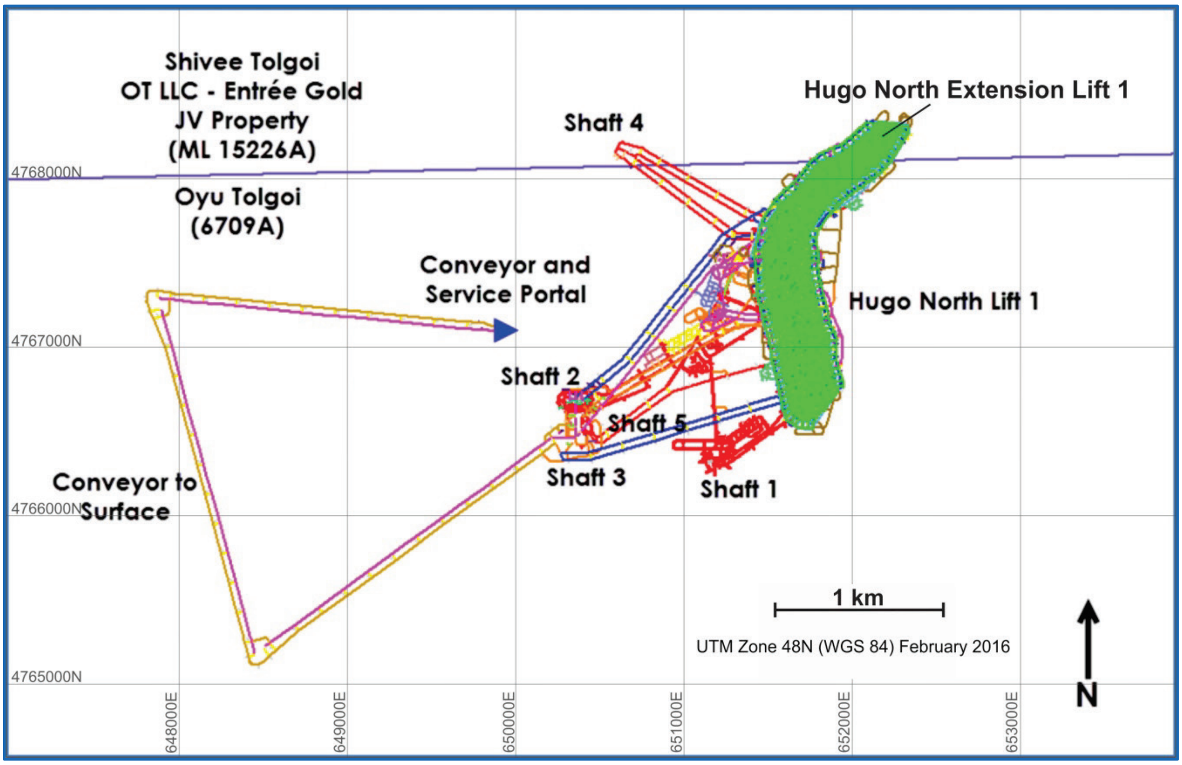
Underground mining at Oyu Tolgoi, including the EJV Property, is planned to be by panel caving which is a variation of block caving. The weak, massive nature of the Hugo North and Hugo North Extension deposits and their location between 700 m and 1,400 m below surface make them well suited both geotechnically and economically to the large-scale caving method of underground mining. Caving requires a large early capital investment but is highly productive and has low operating costs.

The mine design consists of 203 km of lateral development, five shafts, and two decline tunnels from surface. Five shafts are required to provide access for mining personnel and equipment, for production, and for intake and exhaust ventilation-ways. The primary life-of-mine material handling system will transport material to surface by a series of conveyors to surface. An overview of Lift 1 development is shown in Figure 1.4. The underground mine will operate at a nominal 95 ktpd. The long operating life of the mine supports this initial capital investment. Lift 1 cave dimensions are summarised in Table 1.5.

Table 1.5 Hugo North (including Hugo North Extension) Cave Dimensions

Cave	Extraction Level		Length (m)	Width (m)	Height (m)
	Above Sea Level (m)	Below Surface (m)			
Lift 1	-100	1,270	2,000	280	600

Figure 1.4 Hugo North Lift 1 Mine Design



Modified from OT LLC figure by Entrée 2014.

1.9 Metallurgy and Process

Oyu Tolgoi employs a conventional SAG mill / ball mill / grinding circuit (SABC) followed by flotation, as shown in the basic flowsheet (Figure 1.5). Phase 1 (OT LLC's open pit and concentrator), which commenced production in 2013, uses two grinding lines, each consisting of a SAG mill, two parallel ball mills, and associated downstream equipment to treat up to 100 ktpd of plant feed from the Southwest Zone pit.

Combined with Hugo North underground production, concentrator feed rates will be as high as 121 ktpd, which represents the tailings handling capacity of the plant. The Phase 2 (Lift 1) concentrator development programme optimises the concentrator circuit to enable it to maximise recovery from the higher grade Lift 1 plant feed. The Phase 2 concentrator expansion will include:

- The addition of a fifth ball mill to achieve a finer primary grind P_{80} of 150–160 µm for a blend of Hugo North and open pit feeds, compared to 180 µm for Southwest Zone.
- Additional roughing and cleaner column flotation capacity to process the higher level of concentrate production when processing the higher grade Hugo North plant feed.
- Additional concentrate dewatering and bagging capacity.

Figure 1.5 Basic Oyu Tolgoi Flowsheet – Phase 1

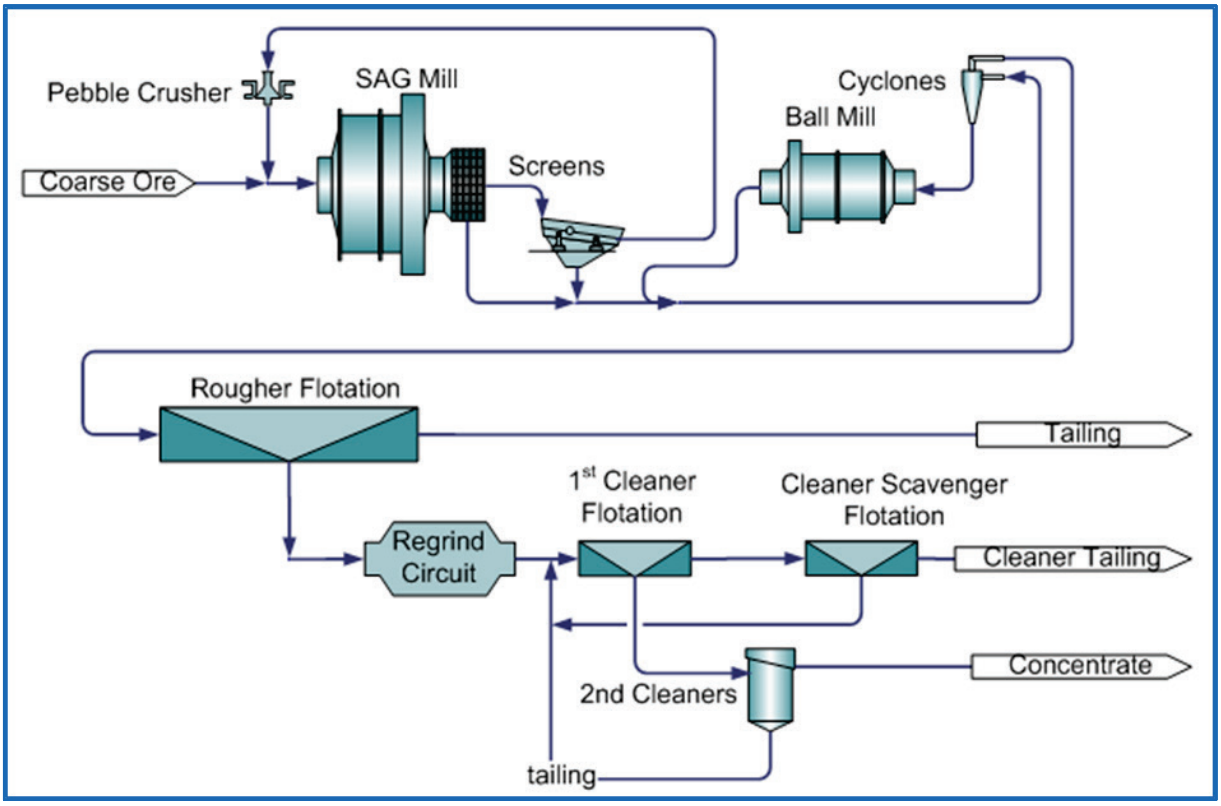


Figure by OT LLC 2014.

1.10 Project Infrastructure and Power

The Oyu Tolgoi project now has an established base set of infrastructure. A site plan showing the key infrastructure and locations of the plant and mines is shown in Figure 1.6. The EJV LHTR16 Hugo North Extension mining area is immediately north of the Oyu Tolgoi ML.

In the current study, power has been assumed to be purchased from a Mongolian supplier. On 14 August 2014, TRQ announced that OT LLC had signed a Power Sector Cooperation Agreement with the GOM, which provides for an open, international tender process to identify and select an independent power provider to privately fund, construct, own and operate a power plant to supply electricity, with the Oyu Tolgoi project (including the EJV Property) as the primary customer.

In May 2015, as part of the agreement between stakeholders for the UDP, OT LLC committed to providing working assumptions for a financing plan towards supporting a long-term power agreement with a Tavan Tolgoi power station.

Figure 1.6 Site Plan

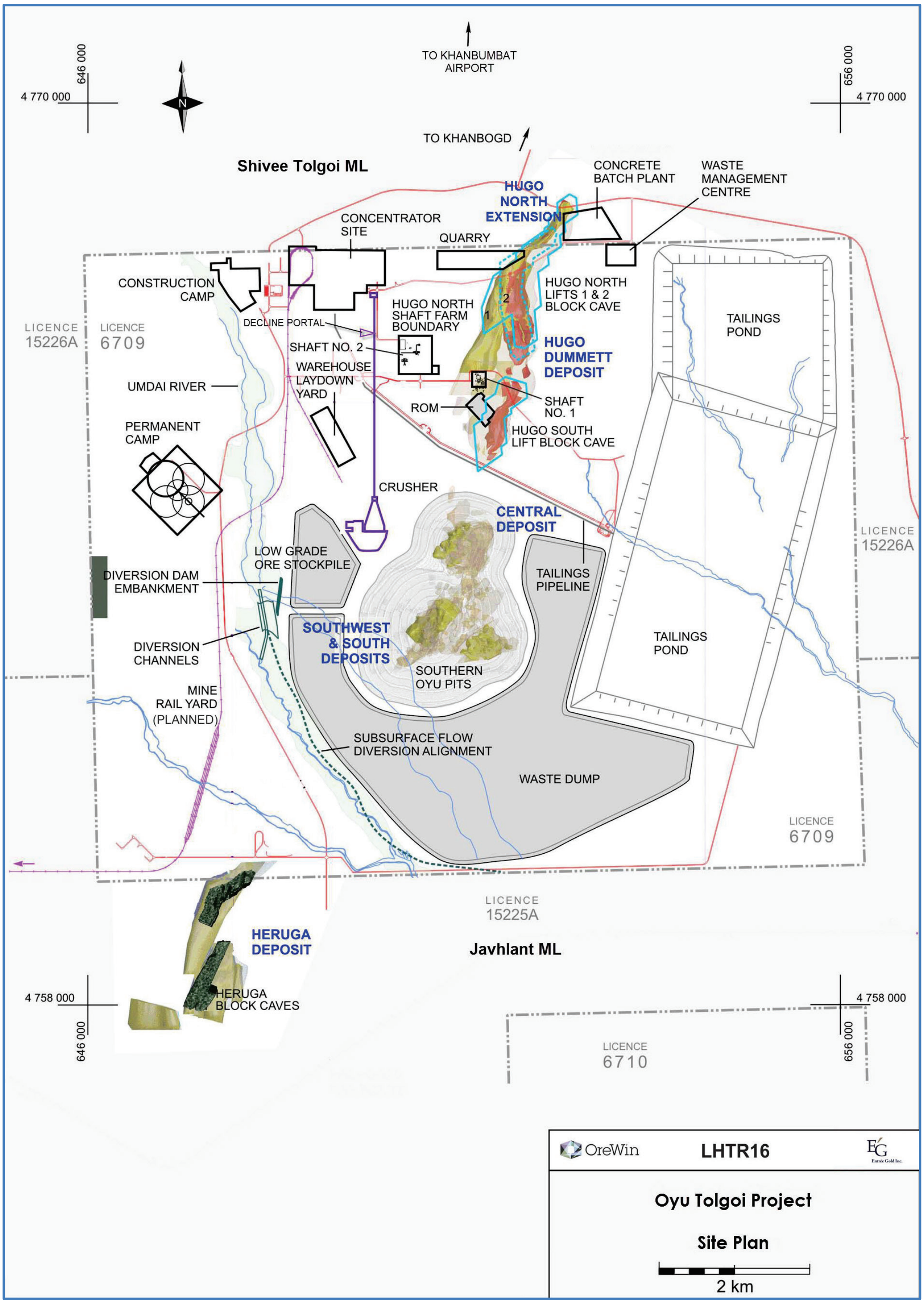


Figure by OreWin, 2016

1.11 Transport and Logistics

Concentrate and supplies are currently transported along a 105 km sealed road that has been constructed to the Mongolian–Chinese border crossing at Gashuun Sukhait. The GOM has committed to providing OT LLC with non-discriminatory access to any railway constructed between Mongolia and China. The GOM is currently supporting construction of a standard gauge single-track heavy-haul rail from the Tavan Tolgoi coal mine (approximately 120 km to the north-west of Lookout Hill) to Gashuun Sukhait (Figure 1.7), ultimately to be interconnected with the Chinese rail network at Ganqimaodao on the Chinese side of the border. Once constructed, the South Gobi Rail alignment would pass across the Javhlant ML and therefore represents an opportunity for eventual connection of the Oyu Tolgoi project to the rail network. Rail line construction is currently suspended but could be completed by 2018 if financing is secured.

Figure 1.7 Oyu Tolgoi Regional Road and Rail

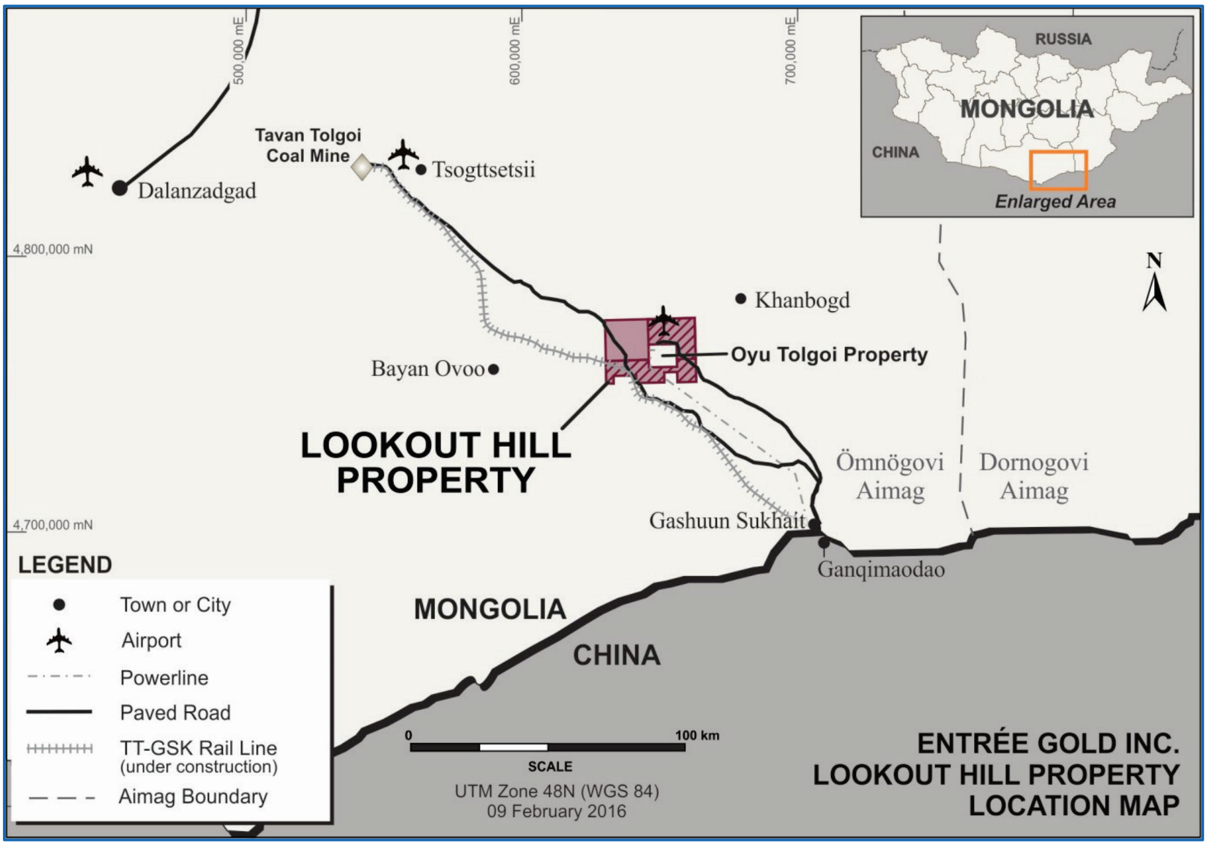


Figure by Entrée 2014.

1.12 Concentrate Sales and Marketing

Concentrate is sold in-bond free-on-board at a bonded yard on the Chinese side of the border in Ganqimaodao (Figure 1.7). Sales contracts were signed for 100% of Oyu Tolgoi's 2015 concentrate production and 90% of 2016 planned production; over 80% of concentrate production has been contracted for up to eight years.

OT LLC's analysis of the copper market indicates long-term dynamics for copper will be driven by a combination of factors. Significant increases are forecast in copper consumption per capita, owing particularly to the industrialisation and urbanisation of China and other emerging markets. A back-drop of strong long-term copper demand and constrained supply is expected to offer fundamental support to copper prices. In recent years, supply has failed to respond quickly enough to increased demand from emerging regions. Global electrification and the growth of China and India will drive the increasing intensity of use per capita gross domestic product (GDP).

Copper demand will also benefit from a greater long-term focus on renewable sources of energy and energy-efficient technologies such as wind turbines and electric / hybrid vehicles, which are of copper-intensive fabrication.

1.13 Environmental Studies and Social Impact Assessment

OT LLC has completed a comprehensive Environmental and Social Impact Assessment (ESIA) for Oyu Tolgoi, including the EJV Property. The ESIA undertaken as part of the project finance process was publically disclosed in August 2012 and identifies and assesses the potential environmental and social impacts of the project, including cumulative impacts, focusing on key areas such as biodiversity, water resources, cultural heritage, and resettlement.

The ESIA also sets out measures through all project phases to avoid, minimise, mitigate, and manage potential adverse impacts to acceptable levels established by Mongolian regulatory requirements and good international industry practice, as defined by the requirements of the Equator Principles, and the standards and policies of the International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), and other financing institutions.

OT LLC has implemented and audited an environmental management system (EMS) that conforms to the requirements of ISO 14001 : 2004.

The EMS for operations consists of detailed plans to control the environmental and social management aspects of all project activities following the commencement of commercial production from the OT LLC open pit in 2013. The Oyu Tolgoi ESIA builds upon an extensive body of studies and reports, and Detailed Environmental Impact Assessments (DEIAs) that have been prepared for project design and development purposes, and for Mongolian approvals under the following laws:

- The Environmental Protection Law (1995);
- The Law on Environmental Impact Assessment (1998, amended in 2001); and
- The Minerals Law (2006).

Initial studies, reports, and DEIAs were prepared over a six-year period between 2002 and 2008, primarily by the Mongolian company Eco-Trade LLC, with input from Aquaterra Consulting Pty Ltd., now RPS Group Plc (RPS Aquaterra) on water issues.

The original DEIAs were in accordance with Mongolian standards and while they incorporated World Bank and IFC guidelines, they were not intended to comprehensively address overarching IFC policies such as the IFC Policy on Social and Environmental Sustainability, or the EBRD Environmental and Social Policy.

Following submission and approval of the initial DEIAs, the GOM requested that OT LLC prepare an updated, comprehensive ESIA whereby the discussion of impacts and mitigation measures was project-wide and based on the latest project design. The ESIA was also to address social issues, meet GOM (legal) requirements, and comply with current IFC good practice.

For the ESIA, the baseline information from the original DEIAs was updated with recent monitoring and survey data. In addition, a social analysis was completed through the commissioning of a Socio-Economic Baseline Study and the preparation of a Social Impact Assessment (SIA) for the project.

The requested ESIA, completed in 2012, combines the DEIAs, the project SIA, and other studies and activities that have been prepared and undertaken by and for OT LLC.

1.14 Capital and Operating Costs

Under the terms of the EJV, OT LLC is responsible for 80% of all costs incurred on the EJV Property for the benefit of the EJV, including capital expenditures, and Entrée is responsible for the remaining 20%. Under the terms of the EJV, Entrée has elected to have OT LLC debt finance Entrée's share of costs for approved programs and budgets, with interest accruing at OT LLC's actual cost of capital or prime +2%, whichever is less, at the date of the advance. Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from the sale of Entrée's share of products. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of EJV activities for the month that are operating costs under Canadian generally accepted accounting principles.

Under the terms of the EJV, any mill, smelter and other processing facilities and related infrastructure will be owned exclusively by OT LLC and not by Entrée. Minerals from the EJV Property will be processed at cost (using industry standards for calculation of cost including an amortization of capital costs). The amortization allowance for capital costs will be calculated in accordance with generally accepted accounting principles determined yearly based on the estimated quantity of minerals to be processed for Entrée's account during that year relative to the total design capacity of the processing facilities over their useful life.

The capital and operating costs in LHTR16 for the Reserve Case are those that were prepared for OTFS14. The average operating costs for the EJV is shown in Table 1.6.

Table 1.6 EJV Average Operating Cost Summary

Description	Unit	Total
Average Operating Cost	$/t Processed	34.56

Includes mining and process assets depreciation and administration charge.

The EJV capital expenditure including expansion and sustaining capital is shown in Table 1.7. The concentrator capital cost is applied proportionally by the total tonnes processed as a depreciation charge to the EJV.

Table 1.7 EJV Capital Expenditure

Description	Unit	Total
EJV Shaft 4	$M	18
Hugo North Extension Lift 1	$M	417
Total	**$M**	**435**

Capital includes only direct project costs and does not include non-cash shareholder interest, management payments, foreign exchange gains or losses, foreign exchange movements, tax pre-payments, or exploration phase expenditure. Entrée is responsible for 20% of EJV capital expenditures, or approximately $87M.

Power has been treated as a purchased utility from a third-party provider. Mine site cash costs are shown in Table 1.8. Cash costs are those costs relating to the direct operating costs of the mine site, namely:

- Mining
- Concentration
- Tailings
- Operational Support Costs
- Infrastructure
- Depreciation Charge
- Administration Fees

Table 1.8 EJV Unit Operating Costs by Copper Production

Description	Unit	LOM Average
Mine Site Cash Cost	$/lb Payable Copper	1.11
TC/RC, Royalties & Transport	$/lb Payable Copper	0.54
Total Cash Costs Before Credits	**$/lb Payable Copper**	**1.66**
Gold Credits	$/lb Payable Copper	0.60
Silver Credits	$/lb Payable Copper	0.06
Total Cash Costs After Credits	**$/lb Payable Copper**	**0.99**

Includes mining and process assets depreciation and administration charge.

1.15 Economic Analysis

The financial analysis has been prepared using the following long-term metal price estimates: copper at $3.08/lb; gold at $1,304/oz and silver at $21.46/oz (in LHTR16, currency is expressed in US dollars unless otherwise noted). A summary of the EJV Property production and financial results for the LHTR16 Reserve Case is shown in Table 1.9. The after-tax NPV8 attributable to Entrée for the LHTR16 Reserve Case is $106 M.

OTFS14 assumed that the timing for the restart of the underground mine would occur at the commencement of 2015. Despite the fact that this did not occur, the economic analysis of the Mineral Reserve remains valid and the costs and revenues are delayed by the same timing. Based on the TRQ expectation that underground development will restart in mid-2016 the discounted cash flow has been calculated assuming Year 1 is 2016. A summary of the LHTR16 Reserve Case discount rate sensitivity is shown in Table 1.10.

Table 1.9 Summary Production and Financial Results

Description	Units	Total
Total OT Processed	bt	1.5
EJV Property Results		
EJV Processed	Mt	34.8
NSR	$/t	100.57
Cu Grade	%	1.59
Au Grade	g/t	0.55
Ag Grade	g/t	3.72
Copper Recovered	Mlb	1,121
Gold Recovered	koz	519
Silver Recovered	koz	3,591
Total Cash Costs After Credits	$/lb Payable Copper	0.99
NPV (8%) After Tax (Entrée)	$M	106
NPV (8%) Before Tax (Entrée)	$M	142

1. Metal prices used for calculating the Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work. The analysis indicates that the mineral reserve is still valid at these metal prices.
2. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
3. The block cave shell was defined using a NSR cut-off of $15/t NSR.
4. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
5. Only Measured mineral resources were used to report Proven mineral reserves and only Indicated mineral resources were used to report Probable mineral reserves.
6. EJV is the Entrée—OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
7. The base case financial analysis has been prepared using the following current long term metal price estimates: copper at $3.08/lb; gold at $1,304/oz; and silver at $21.46/oz.
8. The mineral reserves reported are not additive to the mineral resources.

Table 1.10 Entrée Financial Results — Discount Rate Sensitivity — LHTR16 Reserve Case

Discount Rate	Net Present Value ($M) Entrée	
	Before-Tax	After-Tax
Undiscounted	440	328
5.0%	215	160
6.0%	187	139
7.0%	163	121
8.0%	**142**	**106**
9.0%	124	93
10.0%	109	81

The EJV and OT LLC processing tonnages and copper, gold, and silver metal production in the LHTR16 Reserve Case is shown in Figure 1.8 to Figure 1.11. The production shown is the total production from the EJV of which 20% is attributable to Entrée. Total EJV Lift 1 production is forecast to total 34.8 Mt. Underground development on Hugo North Extension is expected to start in 2021 and deposit production is expected to commence in 2027 and continue to 2034. EJV Lift 1 production will reach a peak of 8.3 Mt in 2031.

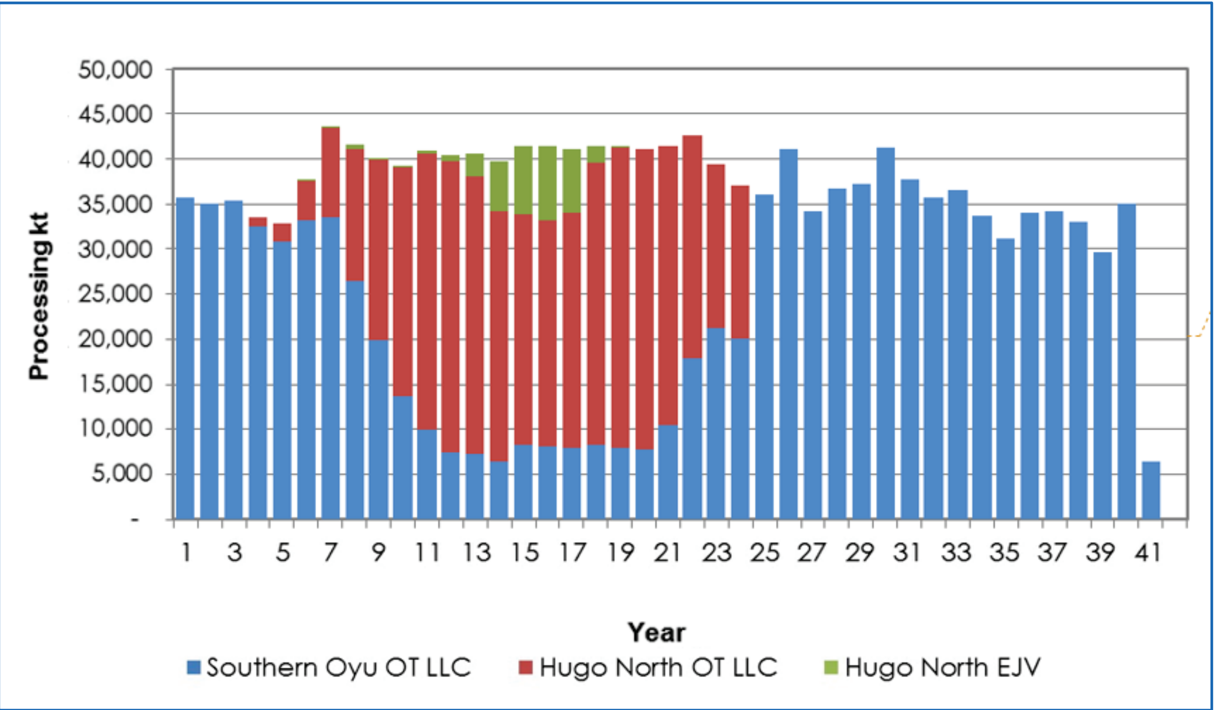
The following is a summary of the terms of the EJV relating to cost allocation and revenues to Entrée. Under the terms of the EJV, Entrée elected to have OT LLC debt finance Entrée's share of costs with interest accruing at OT LLC's actual cost of capital or prime plus 2%, whichever is less, at the date of the advance.Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from sale of Entrée's share of products. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of operations for the month.

For the analysis in LHTR16 Entrée have advised that under the terms of the EJV, OT LLC is responsible for 80% of all costs incurred on the EJV Property, including capital expenditures, and Entrée for the remaining 20%, subject to the following exceptions:

- OT LLC is responsible for 100% of costs incurred on the EJV Property to the extent the costs benefit the Oyu Tolgoi ML; and
- Costs relating to construction or operation of mill, smelter and other processing facilities are solely for the account of OT LLC, with Entrée paying milling and smelting charges at cost (using industry standards for calculation of cost including an amortization of capital costs).

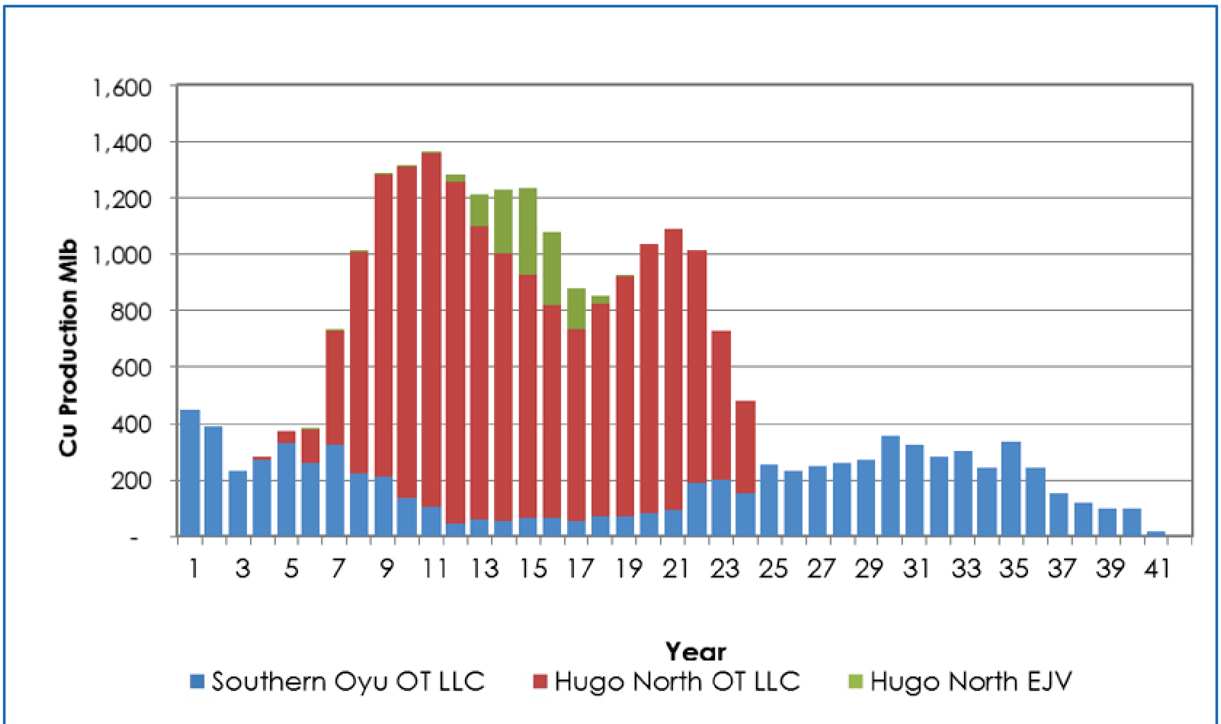
LHTR16 Reserve Case concentrate and metal production are summarised in Figure 1.12. Entrée's cash flows from the Reserve Case are shown in Figure 1.13.

Figure 1.8 Processing by Source — LHTR16 Reserve Case



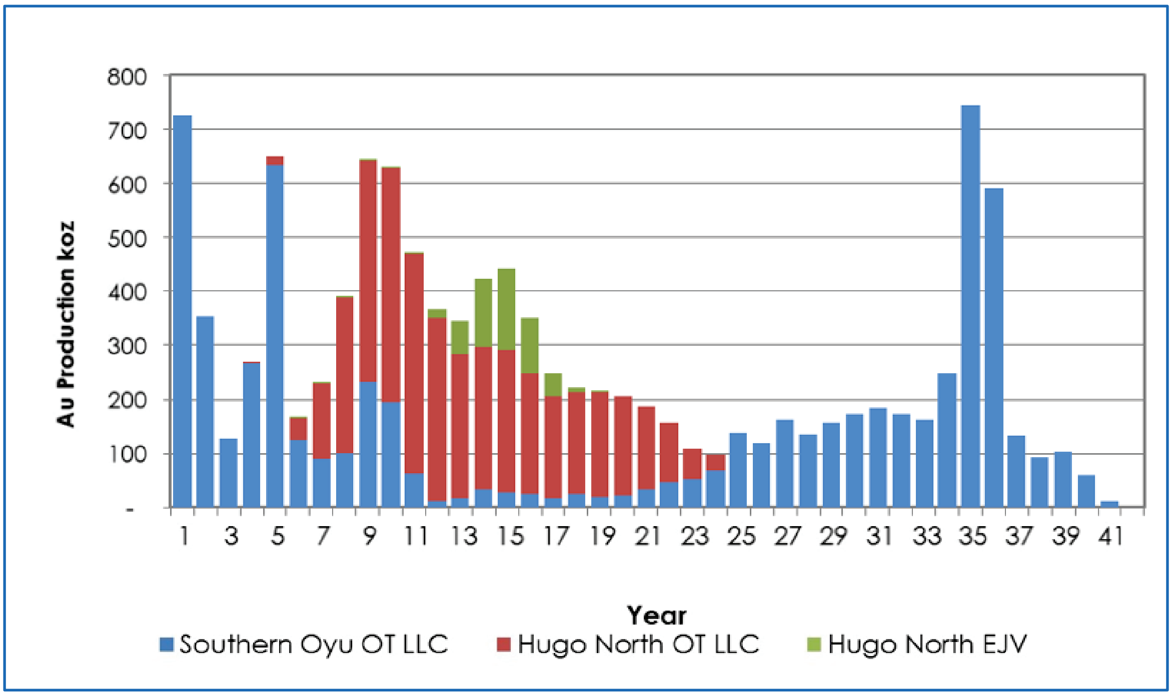
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

Figure 1.9 Copper Production — LHTR16 Reserve Case



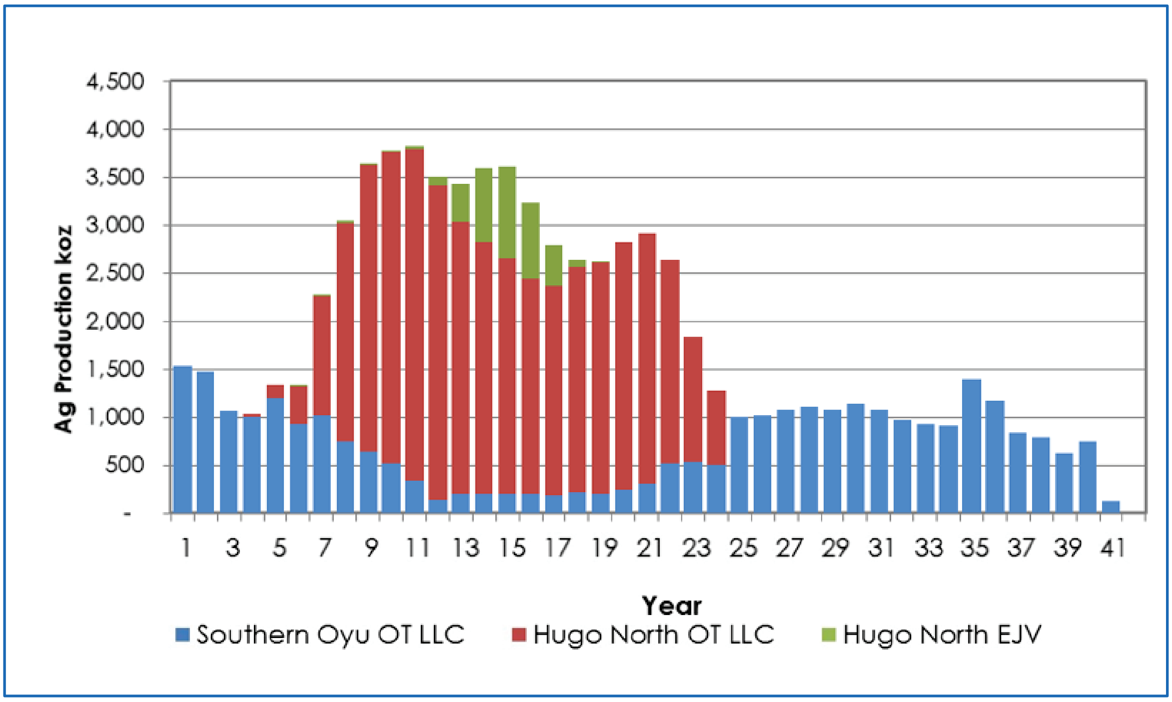
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

Figure 1.10 Gold Production — LHTR16 Reserve Case



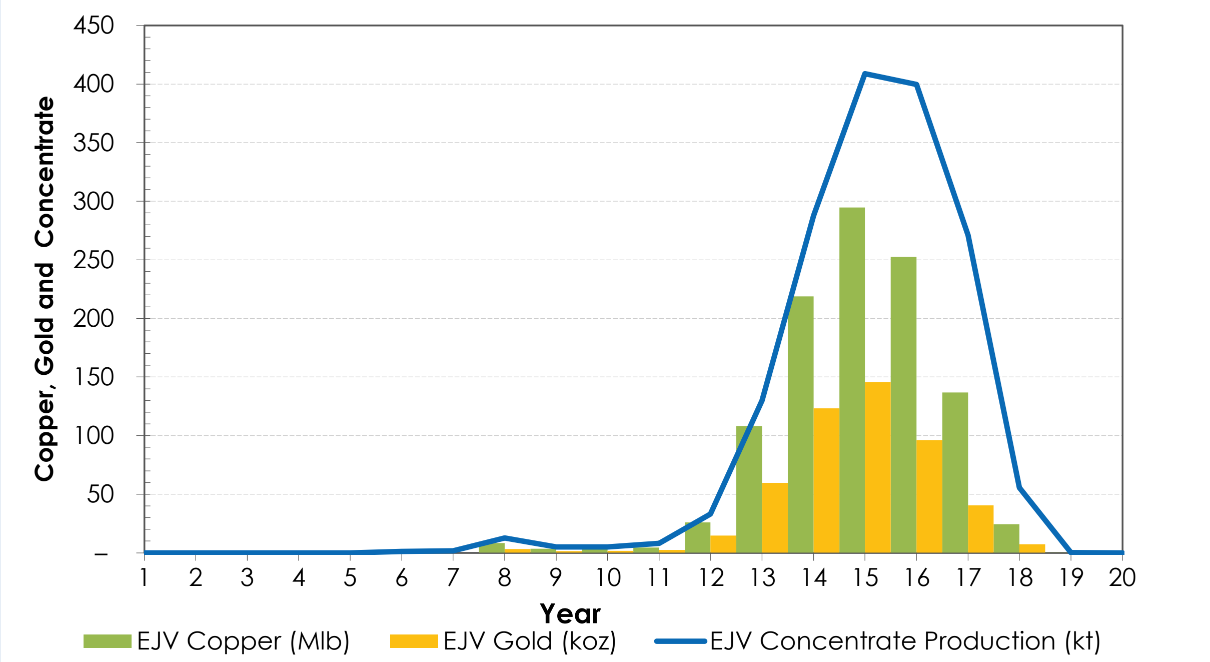
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

Figure 1.11 Silver Production — LHTR16 Reserve Case



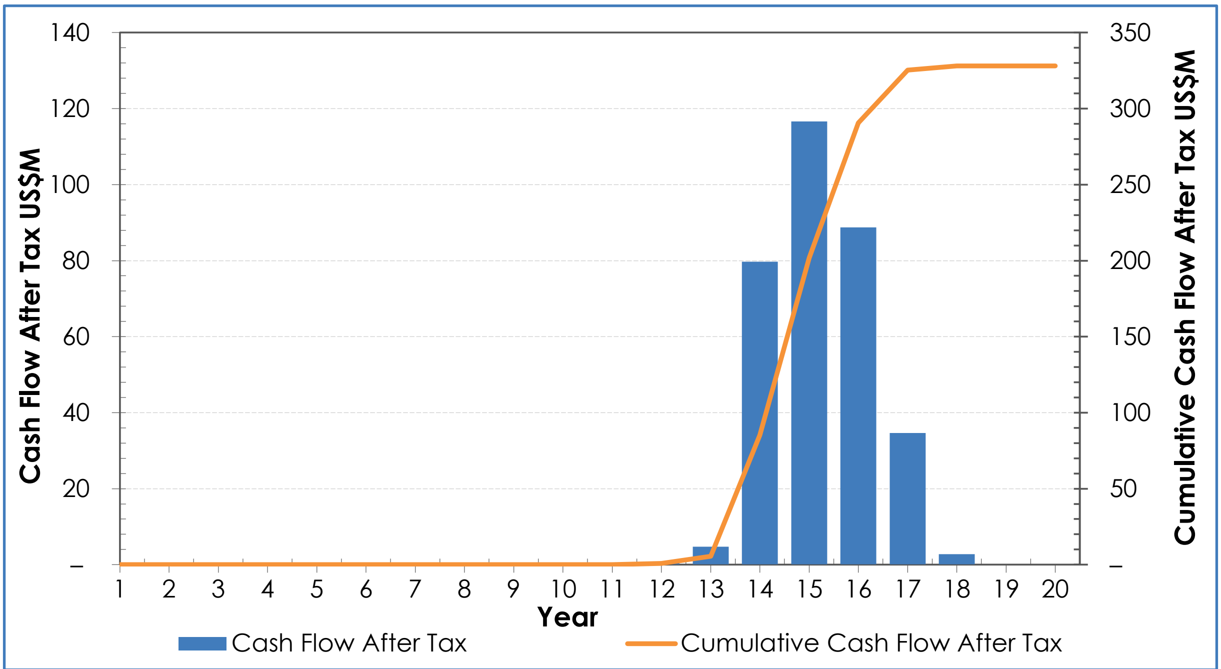
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

Figure 1.12 EJV Concentrate and Metal Production — LHTR16 Reserve Case



Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

Figure 1.13 Entrée Cumulative Undiscounted Cash Flow — LHTR16 Reserve Case



Note: Entrée has a 20% interest in ore extracted from Hugo North EJV.

1.16 Alternative Production Cases

Oyu Tolgoi is a very large project that includes four separate deposits. The long-term development of Oyu Tolgoi would involve the development of the resources on all deposits. Alternative Production Cases have been developed to provide early-stage analysis of the development flexibility that exists with respect to later phases of the Oyu Tolgoi deposits (Heruga, Hugo South, and Lift 2 of Hugo North).

While it is outside of the scope of reserve reporting, as part of the long-term development strategy OT LLC continues to examine the Alternative Production Cases to better define future work plans and prepare for investment decision points. The mine designs developed by OT LLC and considered in the Alternative Production Cases are shown schematically in Figure 1.14 and listed below:

- SOT Open Pits (Reserves)
- Hugo North Lift 1 Block Cave (Reserves)
- Hugo North Lift 1 Block Cave (Resources Indicated and Inferred)
- Hugo North Lift 2 Block Cave (Resources Indicated and Inferred)
- Hugo South Block Cave (Resources Inferred)
- Heruga Block Cave (Resources Inferred)

The mine designs above that are in the Alternative Production Cases and on the EJV Property are:

- Hugo North Extension Lift 1 Block Cave (Reserves)
- Hugo North Extension Lift 2 Block Cave (Resources Indicated and Inferred)
- Heruga Block Cave (Resources Inferred)

Under NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised.

Development of these deposits will require separate development decisions in the future based on the prevailing conditions and the development experience obtained from developing and operating the initial phases of Oyu Tolgoi.

Figure 1.14 Alternative Production Cases Mining Areas

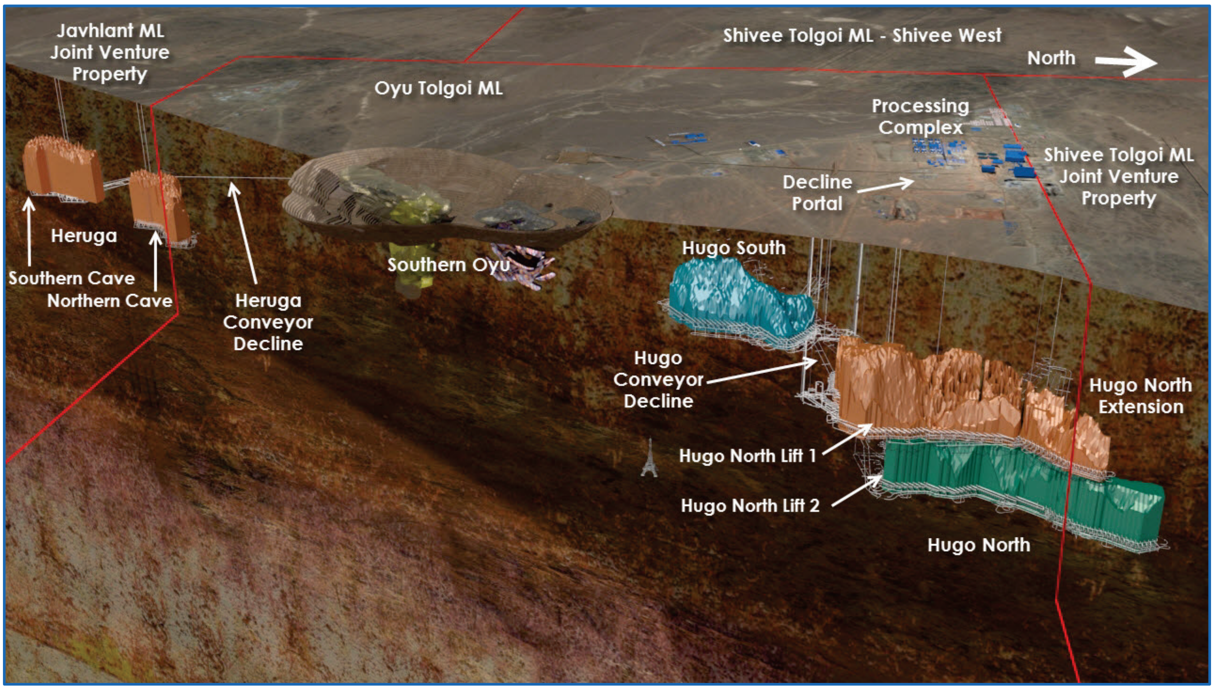
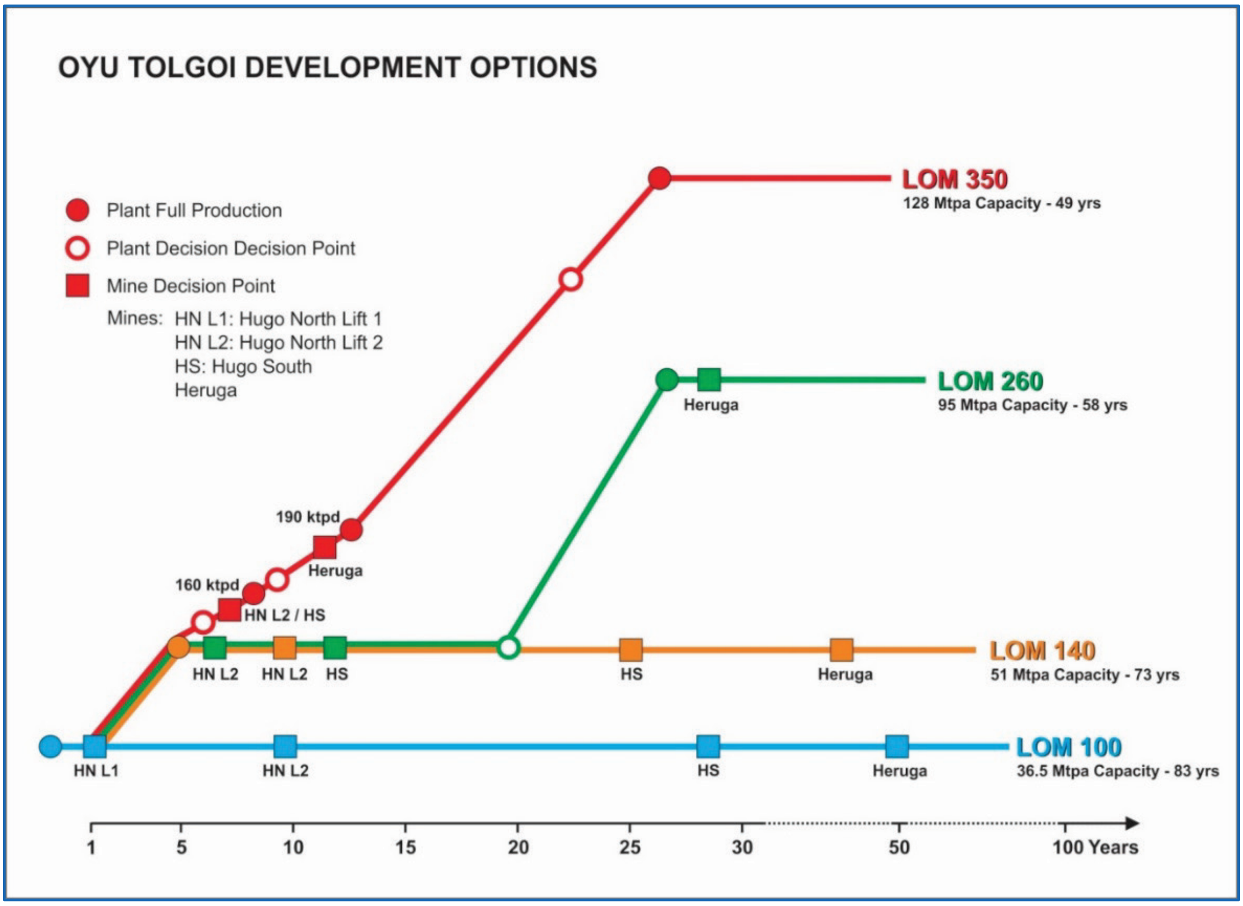


Figure by OreWin, 2014

Figure 1.15 shows an example of the decision tree for the possible development options at Oyu Tolgoi including the EJV Property. This has been updated to include options that take advantage of productivity improvements in plant throughput that have begun to be recognised in the process plant. The decision tree shows options assuming that continuous improvements in plant productivity are achieved over the next five years. Then there would be key decision points for plant expansion and the development of new mines at Hugo North Lift 2, Hugo South, and eventually Heruga. This provides an opportunity as OT LLC will have the benefit of incorporating actual performance of the operating mine into the study before the next investment decisions are required. OT LLC plans to continue to evaluate Alternative Production Cases in order to define the relative ranking and timing requirements for overall development options.

Figure 1.15 Oyu Tolgoi Development Options



These Alternative Production Cases will be part of the strategic planning that is being undertaken by OT LLC. There are four production cases, the initial case assumes no expansion of the plant and three Alternative Production Cases that assume expansions to the plant capacity described by the decision tree shown in Figure 1.15. The Alternative Production Cases are:

- LOM 140 - Continuous improvement of plant throughput of 5.0% per year for five years.
- LOM 260 - LOM 140 plus a 100% plant expansion after approximately 20 years.
- LOM 350 - Progressive expansion of the plant to 350 ktpd.

LOM 140 assumes that there is an increased in plant throughput productivity of 5.0% per year for five years and that the Hugo North Lift 1 development is followed by production from Hugo North Lift 2, Hugo South and Heruga. The average throughput rate is approximately 140 ktpd or 51 Mtpa and potential processing schedule for LOM 140 is shown in Figure 1.16.

LOM 260 (see Figure 1.17) is an extension of LOM 140 and assumes that the plant capacity is doubled after approximately 20 years to an average throughput rate of 260 ktpd or 95 Mtpa.

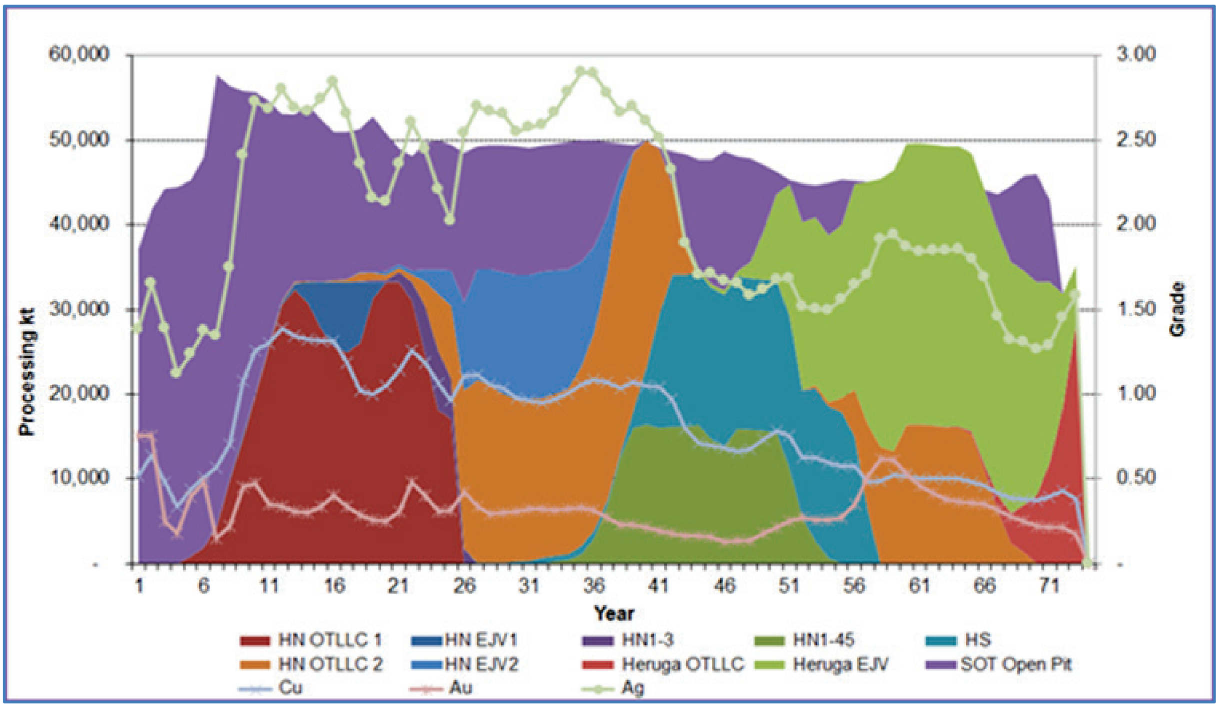
LOM 350 assumes that there are progressive plant expansion to a rate of 350 ktpd or

128 Mtpa. With each successive expansion case there is a reduction of the mine life that would necessitate the success of further exploration to continue production. In LOM 350 (Figure 1.18) this would be required to bring the exploration potential to production in approximately 30 years.

The work on the Alternative Production Cases is not yet at feasibility study stage, in particular the definition of the expansion sizes and costing of the cases. It is recommended that the options be studied further and that the timing of the new mines be defined in more detail.

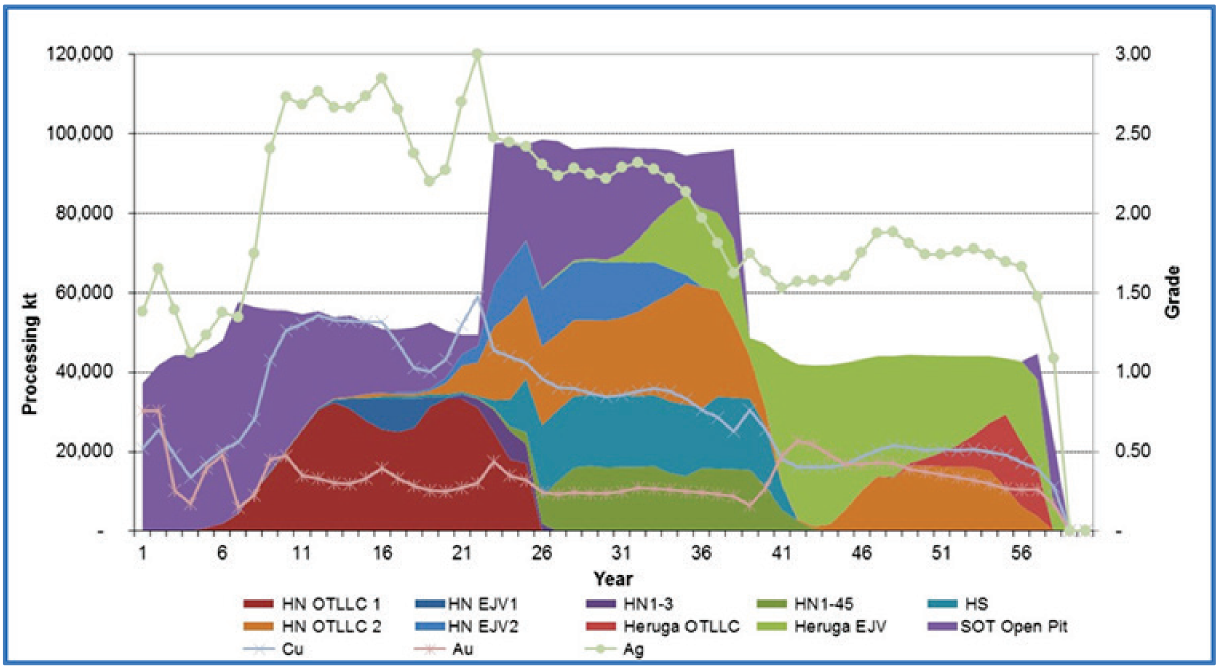
Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised.

Figure 1.16 Alternative Production LOM 140



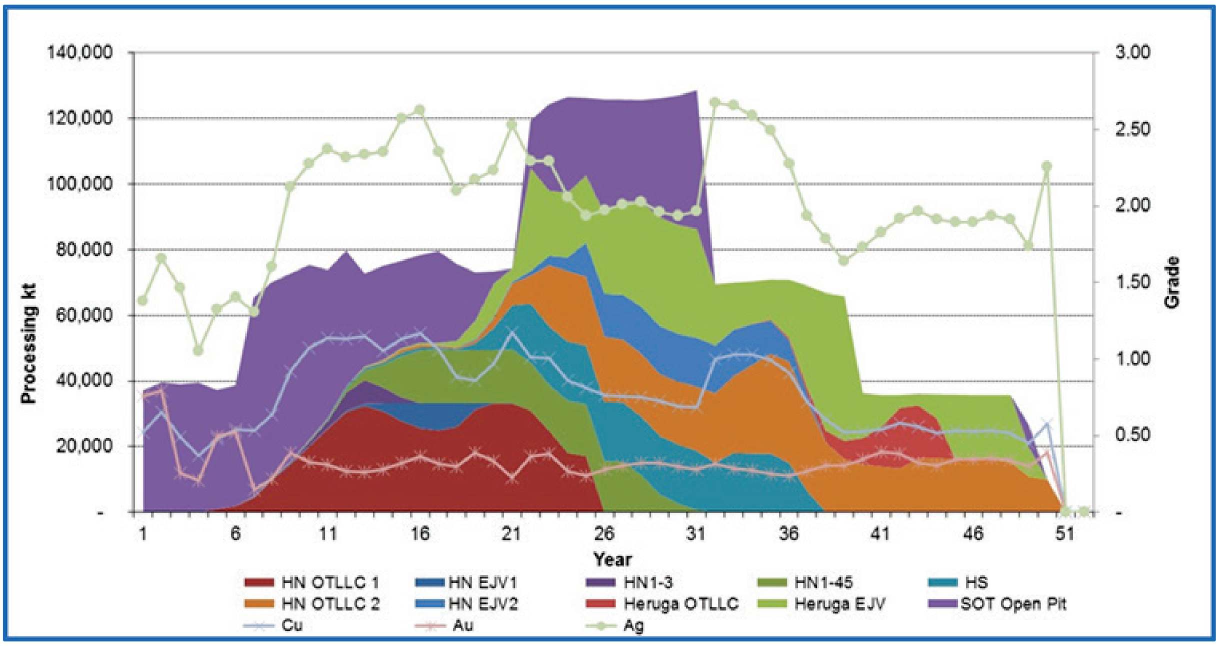
Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

Figure 1.17 Alternative Production LOM 260



Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

Figure 1.18 Alternative Production LOM 350



Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

1.17 Shivee West

Entrée has a 100% interest in the 23,114 ha western portion of the Shivee Tolgoi ML. To date, no economic zones of precious or base metals mineralisation have been outlined on Shivee West, however, zones of gold and copper mineralisation have been identified at Zone III / Argo Zone, Khoyor Mod and at Zone I, respectively. In 2011, reverse circulation (RC) drilling was conducted over the Zone III near-surface epithermal gold target and expanded north, where a new gold zone (Argo Zone) was discovered 250 m beyond the previously known area of gold mineralisation. The Argo Zone was partly defined by six RC holes, two trenches, and surface chip sampling. Hole EGRC-11-112 returned 14 m of 1.82 g/t Au and hole EGRC-11-111 returned 3.0 m of 2.21 g/t Au. Two separate high-grade surface chip samples averaged 42.4 g/t Au over 4.0 m and 19.3 g/t Au over 3.0 m. Shallow gold mineralisation in both zones is hosted by quartz veined felsic volcanic rocks.

In 2012, work focused on geological mapping, excavator trenching and sampling in the Argo Zone / Zone III and Khoyor Mod areas. In total, 22 trenches (1,723 m) were excavated. The area of Argo gold mineralisation was extended 140 m further north from mineralisation defined by 2011 RC drilling and the Argo Zone now measures approximately 400 m long by up to 130 m wide. One of the trench samples returned 81.4 g/t Au over 3 m, confirming and expanding 2011 high-grade gold values. The Khoyor Mod target is located approximately 6 km south of Argo and comprises a 250 m x 300 m area of quartz stockwork within Devonian sediments. The stockwork is anomalous in gold (trace to 0.58 g/t) and copper (67–505 ppm) and displays some characteristics of porphyry-style mineralisation.

Zone I is located 2.5 km east of Zone III / Argo Zone and is a prominent 2 km long area of argillic and advanced argillic alteration. This zone has received considerable attention using mapping, RC and core drilling, geophysics (Induced Polarisation - IP), and excavator trenching. The silicified rocks that define Zone I form a discrete region of coalescing northerly trending ridges that outline a topographically prominent highland feature about 1.0 km by 3.8 km in size. The best drill results from Zone 1 were 0.1%–0.2% Cu over widths of 2.0–4.0 m.

No exploration work was completed on Shivee West in 2013, 2014, and 2015.

1.18 Conclusions

Entrée has significant Indicated, and Inferred Mineral Resources in the Hugo North Extension deposit and Inferred Mineral Resources in the Heruga deposit. The long-term development of the Oyu Tolgoi project would involve the development of the resources on all deposits, including Hugo North Extension and Heruga.

The present geological interpretations are acceptable for the geological and resource models at the levels of confidence stated. The geological interpretations and models are likely to change as the project proceeds to detailed mine design and construction.

The Alternative production cases have been developed to provide early-stage analysis of the development flexibility that exists with respect to later phases of the Oyu Tolgoi project (Heruga, Hugo South, and Lift 2 Hugo North, including Hugo North Extension). Development of these deposits will require separate development decisions in the future based on then prevailing conditions and the development experience obtained from developing and operating the initial phases of Oyu Tolgoi.

OT LLC plans to undertake engineering studies of expansion options in the continuing study of the Oyu Tolgoi project, including the EJV Property. This will include examining all production scenarios and associated expansion options. OT LLC plans a focused and structured review of the study work to be used in the capital approvals process as the operation develops. OreWin believes that further design work could identify opportunities to improve project economics via cost reductions and mine plan optimisation. This may result in further positive changes to the EJV development schedule that could bring forward development of EJV mineral deposits relative to the LHTR16 Reserve Case.

The EJV exploration programme relies strongly on geophysical survey data (IP and magnetics), and other valid targets still remain to be tested within the project land holdings.

The Shivee West exploration programme relies strongly on geophysical survey data (IP and magnetics), and valid targets still remain to be tested. Both the Argo and Zone III gold targets lie within a well-defined, northerly-trending magnetic-low, which extends for at least 2.5 km along strike. Mineralisation at Argo and Zone III may have a relationship to the bedrock geology lying east of the gold targets. The highest gold grades in both drilling and surface sampling have come from the north end of Argo, along the western flank of a significant accumulation of flow-laminated dacite. The Khoyor Mod target comprises a 250 m x 300 m area of quartz stockwork, which is anomalous in gold (trace to 0.58 g/t) and copper (67–505 ppm) and displays some characteristics of porphyry-style mineralisation. This target requires drill testing.

1.19 Recommendations

1.19.1 Development Strategies Oyu Tolgoi Project including the EJV Property,

The large Mineral Resource base at the entire Oyu Tolgoi project, including the EJV Property represents significant opportunities, not only as an exceptionally long-life project but also for production expansion. Ongoing planning work using Inferred resources has identified the potential for further expansions. The LHTR16 demonstrates the potential for expansion and shows that the EJV resources are an integral part of the long-term development plans.

Separate development decisions will need to be made based on future prevailing conditions and the experience obtained from developing and operating the initial phases of the Oyu Tolgoi project.

Exploration and development of the EJV Property is under the control of the OT LLC. The future work recommendations in the 2014 OTTR although primarily focused on the Oyu Tolgoi licence area, will be of benefit to Entrée as they will include examination of the EJV Property.

The EJV will benefit from continuing study of the Hugo North deposit, including Hugo North Extension. In particular, making use of the additional haulage capacity that is planned to be installed underground could allow for improved performance to accelerate Hugo North Lift 1 production and so bring Hugo North Lift 2 development forward.

The Heruga mining study work is preliminary and should be optimised to maximise the metal extraction and project value. This work should involve a review and definition of the Heruga design followed by iteration of the scheduling options. The outcome of this work will assist the analysis of all the Alternative Production Cases.

The commencement of mining on Hugo North Lift 1 will provide valuable 'real life' data for mining, processing and other disciplines for improved modelling of Hugo North Lift 2 development and production.

The work on the Alternative Production Cases is not complete, in particular the definition of the expansion sizes and costing of the cases needs additional work. It is recommended that Entrée work with TRQ and OT LLC to study the options further and that the timing of the new mines is defined in more detail.

1.19.2 Shivee West

Based on exploration to date, additional work, estimated to cost $6.6 M, is recommended for Shivee West. The recommended work includes:

Precious Metal Exploration – Argo Zone / Zone III:

- Additional detailed geological mapping and excavator-assisted chip sampling along strike to the north and south of known mineralisation. Expansion and infill of the existing MMI soil sampling to cover in greater detail the magnetic low that is associated with the gold mineralisation.
- Dipole–dipole IP surveying, to cover the magnetic anomaly.
- 6,000 m of RC and core drilling to infill the core drilling and to follow the Argo mineralisation along strike to the north.

Porphyry Copper Exploration:

- Re-evaluation of previous drilling of the Khoyor Mod area.
- Evaluation of MMI-Au anomalies north of the Khoyor Mod area.
- 6,000 m of core drilling to continue exploration in the Khoyor Mod area and to test strong hydrothermal alteration encountered in EG-10-140.

2 INTRODUCTION

2.1 Issuer for Whom Report Prepared

This report is titled the Lookout Hill Feasibility Study Update (LHTR16) and has been prepared under the management of OreWin Pty Ltd (OreWin) for Entrée Gold Inc (Entrée).

2.2 Terms of Reference and Purpose of Report

This report is titled the Lookout Hill Feasibility Study Update (LHTR16). LHTR16 updates the Technical Report 2013 on the Lookout Hill Property (LHTR13) released by Entrée in March 2013. LHTR16 was prepared by OreWin for Entrée and is based on information contained within the Oyu Tolgoi Feasibility Study 2014 (OTFS14) completed in July 2014 by OT LLC and the 2014 Oyu Tolgoi Technical Report (2014 OTTR) released by TRQ in October 2014 and also prepared by OreWin. The OTFS14 has yet to be updated by OT LLC and is the most current completed feasibility study work available.

Unless otherwise indicated, any reference in this report to Hugo North, Hugo Dummett, Lift 1, or Lift 2 is inclusive of Hugo North Extension.

The LHTR16 analyses a Mineral Reserve case only (LHTR16 Reserve Case) and is based on a feasibility quality level study complying with Canadian National Instrument 43-101 (NI 43-101). The work of the 2014 OTTR meets the standards of US Industry Guide 7 requirements for reporting Reserves.

The underground Mineral Reserves for the Hugo North deposit, including Entrée's Hugo North Extension deposit, were restated by TRQ in the 2014 OTTR.

2.3 Units of Measure and Currency

Throughout this report, measurements are in metric units and currency in United States dollars unless otherwise stated.

2.4 Sources of Information and Study Participants

LHTR16 was prepared by the QPs as noted on the title and signature pages and was managed by OreWin. Original authors and companies are listed throughout the text.

2.5 Site Visits

The following site visits were carried out by the Qualified Persons:

- Bernard Peters visited the property in March 2003, July 2003, April 2006, April 2009, July 2010, October 2011, November 2012, 28–31 January 2013, 2–14 December 2013, 16–22 March 2014, 28 October 2014, 23-27 August 2015, 8-10 December 2015 and most recently 23-25 February 2016. Meetings were also attended in Ulaanbaatar with OT LLC and Mongolian authorities to discuss the Project from 2003–2011. Some of these meetings did not include site visits. Other visits were made to OT LLC offices in Mongolia, Australia, and China as part of work on the project. Bernard Peters was the QP for Mineral Reserves in the 2014 OTTR.

- Sharron Sylvester visited the property between 28–31 January 2013, 2–14 December 2013, 23-27 August 2015, 8-10 December 2015 and most recently 23-25 February 2016. Other visits were made to OT LLC offices in Mongolia and Australia as part of work on the project. Sharron Sylvester was the QP for Mineral Resources in the 2014 OTTR.

- Robert M. Cann has made numerous, regular site visits to the Shivee West and Oyu Tolgoi projects since 2002. Most recently he visited Shivee West in November and December 2014 and Oyu Tolgoi in October 2015..

3 RELIANCE ON OTHER EXPERTS

The authors of this report state that they are Qualified Persons for those areas as identified in the appropriate 'Certificate of Qualified Person' attached to this report. The authors have relied upon, and believe there is a reasonable basis for this reliance upon the following experts and reports regarding legal, land tenure, corporate structure, permitting, environmental and other issues in portions of this feasibility study in the Sections as noted below.

Reports used in Section 4, Property Description and Location (report used to affirm the corporate structure and ownership of the licences related to Lookout Hill and Oyu Tolgoi):

- OT LLC 2014: Oyu Tolgoi Feasibility Study 2014 prepared by OT LLC July 2014. Volumes:
  - 3.0 Ownership and Legal
  - 4.0 Government and Community Relations
- Amendment to Equity Participation And Earn-In Agreement, Entrée Gold Inc, 9 November 2004, Entrée Gold Inc,
- Letter from Implementation Agency Of The GOM Mineral Resources Authority, 19 March 2015, No. 6-1672, verification of minerals mining licences MV-015226 and MV-015225, provided by Entrée Gold Inc 26 March 2015.
- Letter from Entrée Gold Inc. to OreWin Pty Ltd, 22 March 2016, Re: Lookout Hill Property Licences and Agreement

Reports used in Section 5, Accessibility, Climate, Local Resources, Infrastructure, and Physiography:

- OT LLC 2014: Oyu Tolgoi Feasibility Study 2014 prepared by OT LLC July 2014. Volumes:
  - 3.0 Ownership and Legal
  - 5.0 Human Resources and Capability Development
  - 7.0 Environment
  - 8.0 Water Management

Reports used in Section 19, Marketing Studies and Contracts:

- OT LLC 2014: Oyu Tolgoi Feasibility Study 2014 prepared by OT LLC July 2014. Volumes:
  - 17.0 Marketing

Reports used in Section 20, Environmental Studies, Permitting, and Social or Community Impact:

- OT LLC 2014: Oyu Tolgoi Feasibility Study 2014 prepared by OT LLC July 2014. Volumes:
  - 3.0 Ownership and Legal
  - 7.0 Environment
  - 8.0 Water Management

Reports used in Section 22, Economic Analysis:

- OT LLC 2014: Oyu Tolgoi Feasibility Study 2014 prepared by OT LLC July 2014. Volumes:
  - 3.0 Ownership and Legal
  - 4.0 Government and Community Relations
- Letter from Implementation Agency Of The GOM Mineral Resources Authority, 19 March 2015, No. 6-1672, verification of minerals mining licences MV-015226 and MV-015225, provided by Entrée Gold Inc 26 March 2015.
- Letter from Entrée Gold Inc. to OreWin Pty Ltd, 22 March 2016, Re: Lookout Hill Property Licences and Agreement
- Amendment to Equity Participation And Earn-In Agreement, Entrée Gold Inc, 9 November 2004, Entrée Gold Inc,

4 PROPERTY DESCRIPTION AND LOCATION

OreWin and the QPs of this report have relied exclusively on information provided by Entrée concerning the description of mineral tenure, title to and status of the MLs comprising Lookout Hill, legal and political issues surrounding the EJV Property, and permitting.

4.1 Lookout Hill Location

Lookout Hill is located in the aimag (province) of Ömnögovi in the South Gobi region of Mongolia, about 570 km south of the capital city of Ulaanbaatar and 80 km north of the border with China (Figure 4.1). Lookout Hill is centred at approximately latitude 43°02′ N and longitude, 106°45′ E, or UTM coordinates 4,766,000 mN and 644,000 mE, with datum set to WGS-84, Zone 48N. Elevations in the area range between 1,160 m above sea level (masl) and 1,450 masl. Ömnögovi is also spelled Umnugobi or Umnogovi.

The Hugo North Extension is the principal zone of mineralisation defined on Lookout Hill and is where the majority of the exploration drilling has been conducted. This deposit occurs within the Shivee Tolgoi ML of Lookout Hill and is the northernmost defined portion of a north—north-east trending, 12 km long and 1 km wide copper–gold porphyry mineralised corridor that occurs at Lookout Hill and the adjacent Oyu Tolgoi ML. The Hugo North Extension is centred at approximately latitude 43°04′ N and longitude 106°55′ E within the Shivee Tolgoi ML. Surface elevations above the deposit range from approximately 1,160–1,180 masl.

The Heruga deposit is the second significant zone of mineralisation indicated on Lookout Hill and is where the majority of the 2007 and 2008 exploration drilling was conducted. This deposit occurs near the centre of the Javhlant ML (also spelled Javkhlant), south of the Oyu Tolgoi ML, and is at the southern end of the north—north-east trending, copper–gold porphyry mineralised 'corridor'. The Heruga deposit is centred at approximately latitude 42°58′ N and longitude106°48′ E. Surface elevations range from approximately 1,160–1,170 masl.

Figure 4.1 Regional Project Location Map – Lookout Hill

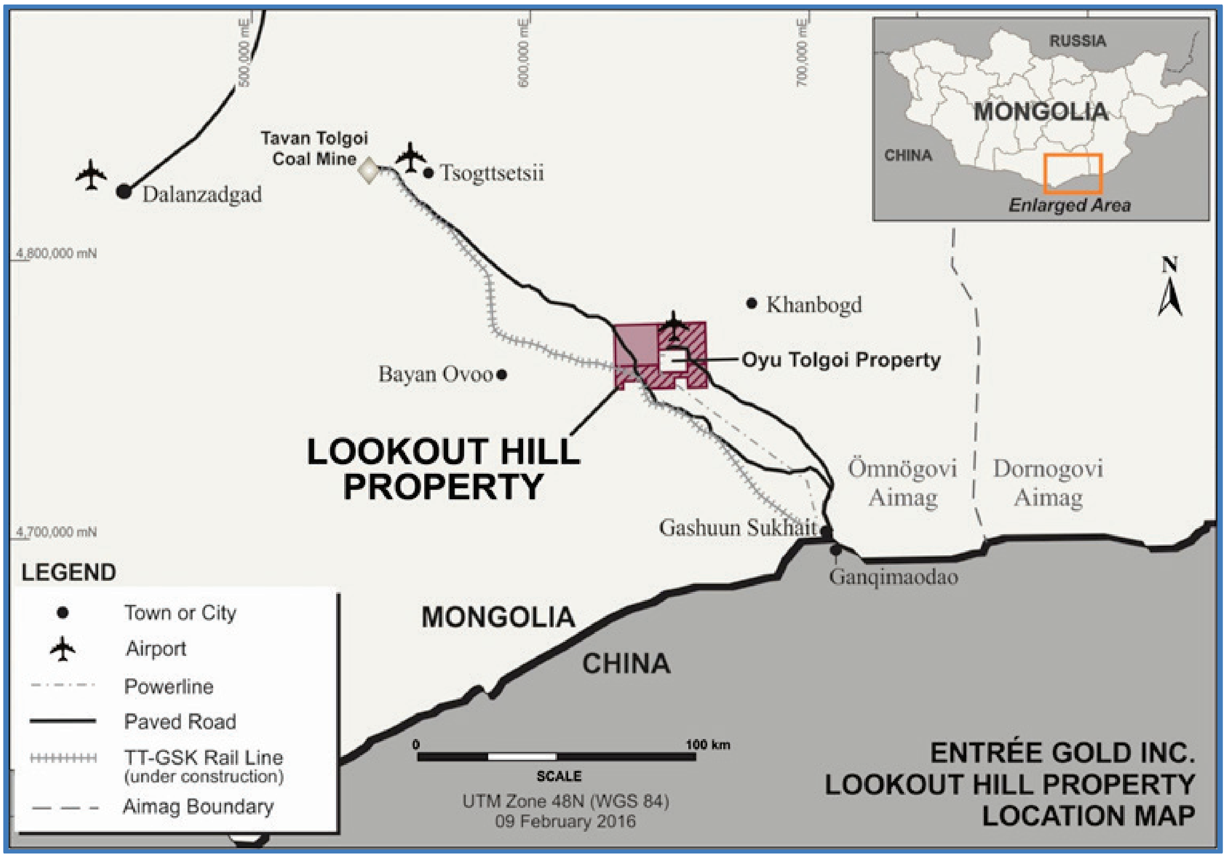


Figure by Entrée 2016

4.2 Lookout Hill Property

Lookout Hill in Mongolia comprises two MLs (Shivee Tolgoi and Javhlant), which cover a total of approximately 62,920 ha and completely surrounds the 8,490 ha Oyu Tolgoi ML, owned 100% by OT LLC. The Shivee Tolgoi and Javhlant MLs are held by Entrée's wholly owned Mongolian subsidiary, Entrée LLC. Lookout Hill is divided into two contiguous areas: (1) the area governed under a joint venture between Entrée and OT LLC (EJV Property), and (2) Shivee West.

The ownership of the Shivee Tolgoi and Javhlant MLs is divided between Entrée and the EJV as described below and in Figure 4.2.

- The EJV Property comprises 39,807 ha consisting of the eastern portion of the Shivee Tolgoi ML and all of the Javhlant ML, (together the EJV Property) and is governed by a joint venture between Entrée and OT LLC. The EJV Property is contiguous with, and on three sides (to the north, east, and south) surrounds the OT LLC Oyu Tolgoi ML. The EJV Property hosts the Hugo North Extension deposit and the Heruga deposit. Rio Tinto is acting as manager of the Entrée–OT LLC Joint Venture on behalf of OT LLC.

- The portion of Lookout Hill outside of the EJV Property (Shivee West) covers an area of 23,114 ha and consists of the western portion of the Shivee Tolgoi ML. Shivee West is 100% owned by Entrée but is subject to a first right of refusal by OT LLC.

Entrée and OT LLC pay the IA stabilized rate of $15/ha for both JV licences. The total estimated annual fee in order to maintain both the Shivee Tolgoi and Javhlant MLs in good standing is approximately $0.94 million, of which Entrée's joint venture partner, OT LLC is responsible for approximately $0.48 million. The annual licence fees were paid in September 2015, and both MLs are currently in good standing. A summary of the Lookout Hill licences and their renewal status is shown in Table 4.1.

Table 4.1 Licence Details – Lookout Hill

Licence Number	Licence Name	Licence Type	Total Area of Licence (ha)	Licence Award Date	Licence Expiry Date	Date of Annual Licence Payment	Annual Licence Payment ($)
15226A	Shivee Tolgoi	Mining	42,592.6	27/10/09	27/10/39	27/10/09	638,889
15225A	Javhlant	Mining	20,327.4	27/10/09	27/10/39	27/10/09	304,911
Total	–	–	**62,920.0**	–	–	–	**943,800**

1. Date that the initial 30-year term will expire.
2. The Company's Javhlant and Shivee Tolgoi exploration licences were converted to mining licences on 27 October 2009. Fees must be paid prior to the anniversary date.
3. The total estimated annual fees to maintain the licences in good standing, which are primarily the responsibility of OT LLC, are approximately $944,000
4. Mining licence fees were revised in February 2015 from $15/ha to MNT21,750/ha. At an exchange rate of approximately MNT1900 per $1.00 this is equivalent to $11.45/ha. Despite the revised licence fees, Entrée and OT LLC continue to pay the IA stabilised rate of $15/ha.
5. Shivee Tolgoi ML was reduced by 12,059.99 ha in October 2015.

Figure 4.2 Local Project Map – Lookout Hill

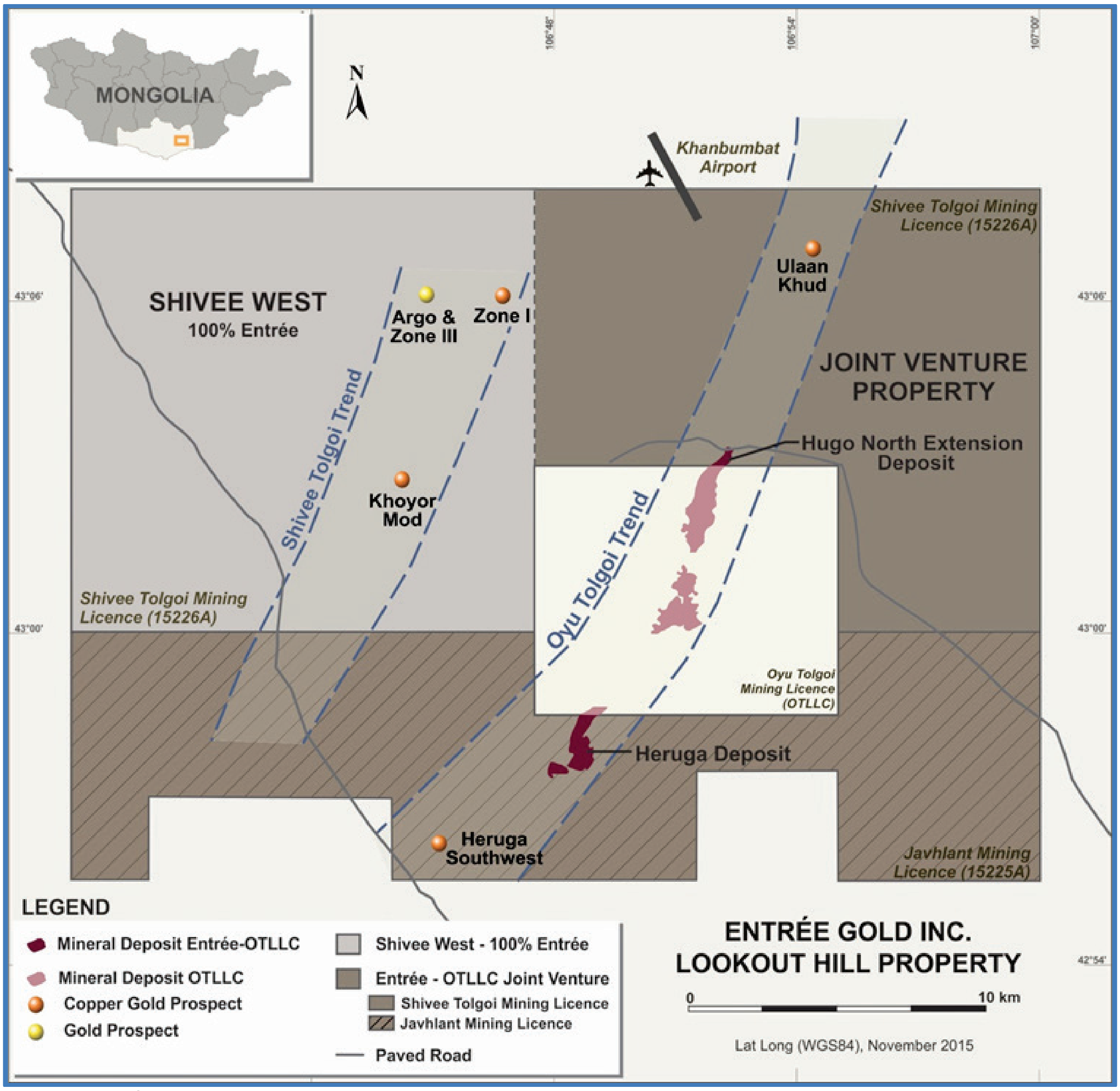


Figure by Entrée 2016

4.2.1 EJV Property

In October 2004, Entrée entered into an arm's-length Equity Participation and Earn-In Agreement (Earn-In Agreement) with Turquoise Hill Resources Ltd. (TRQ). Under the Earn-In Agreement, TRQ agreed to purchase equity securities in Entrée, and was granted the right to earn an interest in mineralisation extracted from the EJV Property. Most of TRQ's rights and obligations under the Earn-In Agreement were subsequently assigned by it to what was then its wholly-owned subsidiary, OT LLC.

On 30 June 2008, OT LLC gave notice to Entrée that it had completed its earn-in obligations by expending a total of $35 million on exploration on the EJV Property. As a consequence, OT LLC earned an 80% interest in all minerals extracted below a sub-surface depth of 560 m from the EJV Property and a 70% interest in all minerals extracted from surface to a depth of 560 m from the EJV Property. The Earn-In Agreement provides that at such time as OT LLC completes its earn-in obligations, the parties will enter into a joint venture agreement in the form attached to the Earn-In Agreement. While the parties have not formally executed the joint venture agreement, the EJV is operating under those terms.

Under the terms of the EJV, Entrée elected to have OT LLC debt finance Entrée's share of exploration and development costs with interest accruing at OT LLC's actual cost of capital or prime (set by the Royal Bank of Canada) plus 2%, whichever is less, at the date of the advance. Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from the sale of Entrée's share of products. Such amounts will be applied first to payment of accrued interest and then to repayment of principal. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of operations for the month. The debt financing and repayment provisions limit dilution of Entrée's interest as the project progresses. Since formation, and as of 31 December 2015, the EJV has expended $27.8 M to advance the EJV Property. As of 31 December 2015, OT LLC has contributed on Entrée's behalf the required cash participation amount, including interest at prime plus 2%, of $6.8 M, equal to 20% of the $27.8 M incurred to date.

Exploration and development of the EJV Property is under the control of Rio Tinto on behalf of manager OT LLC.

The boundaries of the two MLs (or portions thereof) included within the EJV Property are defined by latitude and longitude coordinates (WGS-84 datum) and by UTM coordinates with datum set to WGS-84, Zone 48N. These boundaries are shown in Figure 4.3 and are listed in Table 4.2.

Figure 4.3 Land Tenure Map – Lookout Hill

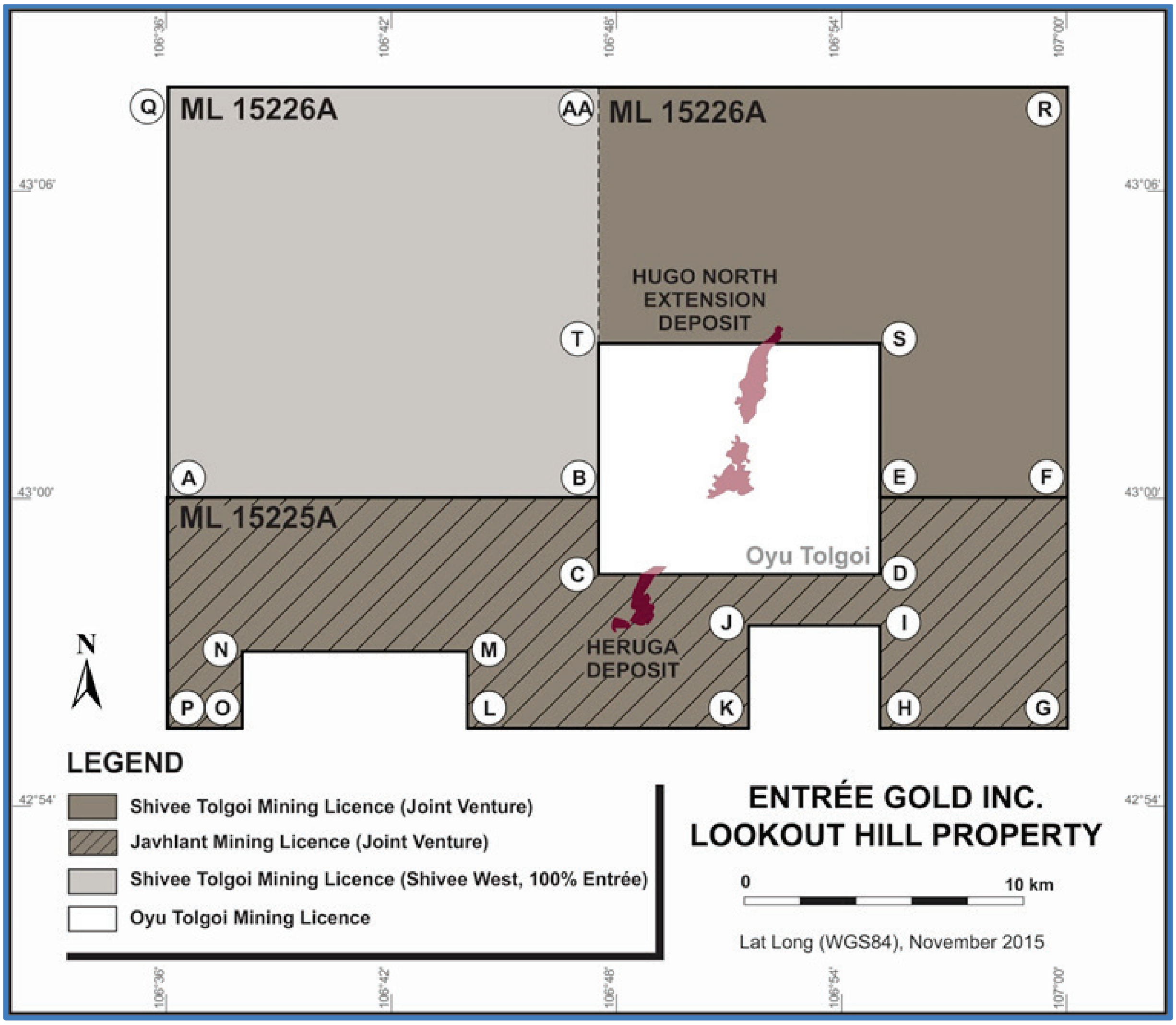


Figure by Entrée 2016

Table 4.2 ML Boundary Coordinates – EJV Property

ML	Point ID	Latitude / Longitude (WGS-84 (MONREF-97))		UTM (WGS-84, Zone 48N)	
		Latitude (N)	Longitude (E)	Easting (m)	Northing (m)
15226A Shivee Tolgoi ML (eastern portion only)	AA	43° 08′ 1.4″	106° 47′ 31.4″	645,752.90	4,777,222.00
	R	43° 08′ 1.4″	107° 00′ 1.5″	662,698.85	4,777,606.89
	F	43° 00′ 1.4″	107° 00′ 1.5″	663,051.79	4,762,799.00
	E	43° 00′ 1.4″	106° 55′ 1.4″	656,257.87	4,762,640.85
	S	43° 03′ 1.4″	106° 55′ 1.4″	656,131.02	4,768,193.51
	T	43° 03′ 1.4″	106° 47′ 31.4″	645,950.61	4,767,968.55
15225A Javhlant ML	A	43° 00′ 1.4″	106° 36′ 1.4″	630,446.14	4,762,099.72
	B	43° 00′ 1.4″	106° 47′ 31.4″	646,068.97	4,762,415.58
	C	42° 58′ 31.3″	106° 47′ 31.5″	646,129.37	4,759,638.32
	D	42° 58′ 31.3″	106° 55′ 1.5″	656,322.33	4,759,863.28
	E	43° 00′ 1.4″	106° 55′ 1.4″	656,257.87	4,762,640.85
	F	43° 00′ 1.4″	107° 00′ 1.4″	663,051.79	4,762,799.00
	G	42° 55′ 31.4″	107° 00′ 1.5″	663,250.93	4,754,470.41
	H	42° 55′ 31.3″	106° 55′ 1.5″	656,449.01	4,754,310.44
	I	42° 57′ 31.3″	106° 55′ 1.5″	656,364.58	4,758,012.45
	J	42° 57′ 31.3″	106° 51′ 31.5″	651,606.78	4,757,905.58
	K	42° 55′ 31.3″	106° 51′ 31.5″	651,688.44	4,754,203.86
	L	42° 55′ 31.4″	106° 44′ 1.5″	641,487.14	4,753,986.00
	M	42° 57′ 1.4″	106° 44′ 1.5″	641,430.13	4,756,762.59
	N	42° 57′ 1.4″	106° 38′ 1.5″	633,272.23	4,756,599.51
	O	42° 55′ 31.4″	106° 38′ 1.5″	633,326.19	4,753,822.92
	P	42° 55′ 31.4″	106° 36′ 1.5″	630,605.88	4,753,770.63

The first point for each ML corresponds with the north–western corner of the ML; remaining points are cited in a clockwise direction. Point ID's are referenced to Figure 4.3.

4.2.2 Shivee West

The boundaries of the portions of the Shivee Tolgoi ML that are 100% held by Entrée are defined by latitude and longitude and UTM coordinates in Table 4.3 and Figure 4.3.

Table 4.3 ML Boundary Coordinates – Shivee West (100% Entrée)

ML	Point ID	Latitude / Longitude (WGS-84 (MONREF-97))		UTM (WGS-84, Zone 48N)	
		Latitude (N)	Longitude (E)	Easting (m)	Northing (m)
15226A Shivee Tolgoi ML (western portion only: Shivee West)	Q	43° 08′ 1.4″	106° 36′ 1.4″	630,163.65	4,776,907.04
	AA	43° 08′ 1.4″	106° 47′ 31.4″	645,752.90	4,777,222.00
	B	43° 00′ 1.4″	106° 47′ 31.4″	646,068.97	4,762,415.58
	A	43° 00′ 1.4″	106° 36′ 1.4″	630,446.14	4,762,099.72

The first point ('Q') corresponds with the north-western corner of the ML; remaining points are cited in a clockwise direction. Point ID's are referenced to Figure 4.3.

4.2.3 Lookout Hill Survey

The original MLs within Lookout Hill were legally surveyed in October 2007 by Aerogeodez from Ulaanbaatar and the corners marked with steel posts. The adjacent Oyu Tolgoi ML was legally surveyed in August 2002 by Surtech International Ltd. using the internationally recognised survey datum WGS-84, Zone 48N. In September 2004, Geomaster Co. Ltd. (Geomaster), a licenced Mongolian land survey company, re-surveyed the Oyu Tolgoi ML corner points based on the official Mongolian survey datum 'MSK42' and marked the corners with concrete and steel pylons. In November 2004, Geomaster also surveyed the northern boundary between the Oyu Tolgoi ML and Entrée's Shivee Tolgoi ML and marked it with wooden posts at 250–500 m intervals.

In September 2011, Geomaster completed another survey of the Shivee Tolgoi and Javhlant MLs (15226A and 15225A, respectively) using the newly instated official Mongolian survey datum MONREF-97. During this survey the corner posts were checked for accuracy as compared to the new MONREF-97 coordinates released by the Cadastre Office earlier in 2010. As of mid-November 2011, all posts were cemented in place for the Shivee Tolgoi and Javhlant MLs.

In November 2015, Geocad LLC officially surveyed and cemented new boundary posts along the new western-most boundary of the Shivee Tolgoi ML after the licence area was voluntarily reduced in October 2015.

4.3 Mining Titles in Mongolia

In Mongolia, Mining Licences (MLs) may be granted for up to 30 years, plus two subsequent 20-year terms (cumulative total of 70 years).

After issuance of a ML, holders are required to pay to the Mongolian Government an annual licence fee. Historically, the annual licence fee was $15.00 per hectare. In February 2015, the Mineral Resources Authority of Mongolia (MRAM) set the per hectare fee at 21,750 MNT, equivalent to approximately $11.45 at the late 2015 exchange rate. Entrée and OT LLC continue to pay the IA stabilized rate of $15/ha for both JV licences.

To maintain the MLs, licence owners must submit, and have accepted, an updated reserve report and feasibility study, prepared by authorised consultants, to the MMC every 5 years. OT LLC last submitted a reserve report to the MMC in July 2014 and an updated feasibility study (OTFS14) in August 2014. Both statutory studies have been approved by the MMC.

All phases of the Company's operations are subject to the Minerals Law of Mongolia, Land Law, and the Law on Environmental Protection as well as the various Taxation Laws. Mongolian Mining Law allows Entrée, through grant of the MLs, the right to access and explore the land covered by the MLs, subject to land use agreements with the local soums (the local Mongolian equivalent of a township or district) or Aimag and the payment of land use fees. Under the requirements of the Minerals Law of Mongolia ML holders need to file a feasibility study that meets the GOM requirements for a feasibility study every five years.

In Mongolia, exploration requires filing an annual exploration work plan at the beginning of the year and provision of a summary report to the local soum. The Lookout Hill property is affiliated with two soums, Khanbogd and Bayan-Ovoo (Figure 4.1). A second report that includes a discussion of environmental impacts must also be filed upon the conclusion of activities. In addition, companies are required to post a bond equal to 50% of the total estimated cost of any anticipated environmental reclamation, which is refunded upon completion of the reclamation work.

A copy of the environmental plan must be delivered to the local soum (but is not approved by the soum) and the environmental bond is placed with a soum government account. MLs require further environmental and social studies in the form of an environmental impact assessment (EIA) and annual environmental protection plan (EPP) when the licence is granted. The soums must also be compensated for water and road usage. Such payments are computed at the end of each calendar year based on the extent of use. Even if the Company relinquishes its licences, it remains responsible for any required reclamation. Entrée states that at the time of this report, it is in compliance with all environmental requirements.

There are few inhabitants living within the boundaries of the Lookout Hill property and no towns or villages. The people who do live there are mostly nomadic herders. Entrée has engaged in small programmes of basic infrastructure improvements to assist the nearby communities in the vicinity of the Lookout Hill property. In addition, Entrée maintains close contact with the soums as part of their community relations efforts. Entrée has reported that it is fully compliant with the relevant Mongolian exploration regulations.

4.4 Strategic Deposits and Investment Agreement

The Minerals Law of Mongolia (2006) defines a mineral deposit of strategic importance (Strategic Deposit) as a mineral resource that may have the potential to impact national security, or the national economic and social development of Mongolia, or that is generating or has the potential to generate more than five percent (5%) of Mongolia's gross domestic product in any given year. Under Resolution No 57 dated 16 July 2009 of the State Great Khural, the Oyu Tolgoi series of deposits were declared to be Strategic Deposits.

The Minerals Law of Mongolia provides that the State may be an equity participant with any private legal entity, up to a 34% equity interest, in the exploitation of any Strategic Deposit where the quantity and grade of the deposit have been defined by exploration that has not been funded from the State budget. On 6 October 2009, TRQ, its wholly-owned subsidiary OT LLC, and Rio Tinto signed an Investment Agreement (IA) with the GOM, which regulates the relationship among the parties and stabilizes the long term tax, legal, fiscal, regulatory and operating environment to support the development of the Oyu Tolgoi project. The IA specifies that the GOM will own 34% of the shares of OT LLC (and by extension, 34% of OT LLC's interest in the EJV Property) through its subsidiary Erdenes Oyu Tolgoi LLC.. A shareholders' agreement was concurrently executed to establish the Government's 34% ownership interest in OT LLC and to govern the relationship among the parties.

The contract area defined in the IA includes the Javhlant and Shivee Tolgoi MLs, including Shivee West. The Ministry of Mining has advised Entrée that it considers the Hugo North Extension and Heruga deposits on the EJV Property to be part of the series of Oyu Tolgoi deposits which were declared to be Strategic Deposits in 2009. However, at the time of negotiation of the IA, Entrée was not made a party to the IA, and as such does not have any direct rights or benefits under the IA.

OT LLC agreed, under the terms of the Earn-In Agreement, to use its best efforts to cause Entrée to be brought within the ambit of, made subject to and to be entitled to the benefits of the IA or a separate stability agreement on substantially similar terms to the IA. Entrée has been in ongoing constructive discussions with stakeholders of the Oyu Tolgoi project, including the GOM, OT LLC, TRQ, and Rio Tinto, since February 2013. The discussions to date have focussed on issues arising from Entrée's exclusion from the IA, including the fact that the GOM does not have a full 34% interest in the EJV Property; the fact that the EJV MLs are held by Entrée LLC rather than OT LLC; and the fact that Entrée does not benefit from the stability that it would otherwise have if it were a party to the IA. In order to receive the benefits of the IA, the GOM may require Entrée to agree to certain concessions, including with respect to the ownership of the EJV, Entrée LLC or the economic benefit of Entrée's interest in the EJV, or the royalty rates applicable to Entrée's share of the EJV mineralisation. No agreements have been finalised.

4.5 Royalties

Royalties potentially payable to the GOM are governed by Article 47 of the Minerals Law of Mongolia. Pursuant to the Minerals Law, the GOM assesses royalties of:

- 5% on the sale value of all metallic minerals (except placer gold) mined in the country.
- 2.5% of the sales value of gold extracted from placer (if sold to authorised banks or the Central Bank).
- 2.5% on coal and common Mineral Resources.

On 1 January 2011, a surtax royalty came into effect in Mongolia. The rates of the surtax royalty vary from 1% to 5% for minerals other than copper. For copper, the surtax royalty rates range between 22% and 30% for ore, between 11% and 15% for concentrates, and between 1% and 5% for final products. No surtax royalty is charged on any minerals below a certain threshold market price, which varies depending on the type of minerals. This is in addition to the standard royalty rates of 2.5% for coal sold in Mongolia and commonly occurring minerals sold in Mongolia, and 5% for all other minerals.

The surtax royalty does not apply to OT LLC as a result of the stability provided under the IA. Entrée is not presently a party to the IA. Unless and until Entrée finalises agreements with the GOM and other Oyu Tolgoi stakeholders, there can be no assurance that Entrée will be entitled to all of the benefits of the IA, including stability with respect to taxes and royalties payable. If Entrée is not entitled to all of the benefits of the IA, it could be subject to the surtax royalty with respect to mineral production from the EJV. The surtax royalty would apply to any mineral production from Shivee West, which is 100% owned by Entrée.

On 18 February 2015, the Mongolian Parliament adopted the Amendment Law to the Minerals Law of 2006 (2015 Amendment), which purports to allow a licence holder to negotiate with the GOM with respect to an exchange of the Government's 34% equity interest in a licence holder with a Strategic Deposit for an additional royalty payable to the GOM. The amount of the royalty payment would vary depending on the Strategic Deposit. The full impact of the 2015 Amendment is not yet known.

4.6 Permits

4.6.1 Overview - EJV Property

The Mongolian Minerals Law (2006) and Mongolian Land Law (2002) govern OT LLC's exploration, mining, and land use rights for the Project. Water rights are governed by the Mongolian Water Law and the Mongolian Minerals Law. These laws allow licence holders to use the land and water in connection with exploration and mining operations, subject to the discretionary authority of Mongolian national, provincial, and regional governmental authorities as granted under Mongolian law.

OT LLC has studied and continues to study the permitting and approval requirements for the development of the Oyu Tolgoi project including the EJV Property and maintains a permit and licencing register.

OT LLC personnel, working with the Mongolian authorities, have developed descriptions of the permitting processes and procedures for the Oyu Tolgoi project, including the underground development of the EJV Property. Key permits have already been obtained and with a small number of permits still in process. OT LLC has advised that it expects that all permits will be obtained in a suitable time frame for the underground project development. Under the terms of the IA, a working group consisting of OT LLC and government representatives has been formed to assist in the permitting process.

Further requirements for environmental impact assessment are discussed below.

4.6.2 Environment Permits – EJV Property

Holders of a ML in Mongolia must comply with environmental protection obligations established in the Environmental Protection Law of Mongolia, Law of Environmental Impact Assessment and the Minerals Law. These obligations include preparation of an environmental impact assessment (EIA) for mining proposals, submitting an annual environmental protection plan (EPP), posting an annual bond against completion of the protection plan and submitting an annual environmental report.

OT LLC has posted environmental bonds to the Mongolian Ministry of Environment, Green Development and Tourism (MEGDT) in accordance with the Minerals Law of Mongolia for restoration and environmental management work required for exploration and the limited development work undertaken at the site. OT LLC pays to the Khanbogd Soum annual fees for water and road usage, while sand and gravel use fees are paid to the Aimag government in Dalanzadgad.

OT LLC has completed a comprehensive Environmental and Social Impact Assessment (ESIA) for the Oyu Tolgoi project, including the EJV Property. The culmination of nearly 10 years of independent work and research carried out by both international and Mongolian experts, the ESIA identifies and assesses the potential environmental and social impacts of the project, including cumulative impacts, focusing on key areas such as biodiversity, water resources, cultural heritage, and resettlement.

The ESIA also sets out measures through all project phases to avoid, minimise, mitigate, and manage potential adverse impacts to acceptable levels established by Mongolian regulatory requirements and good international industry practice, as defined by the requirements of the Equator Principles, and the standards and policies of the International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), and other financing institutions. The IFC and the EBRD have similar, but not identical, definitions for the scope of an impact assessment. Both institutions frame assessments in terms of a project's 'area of influence'. The guidance provided by both IFC and the EBRD was utilised in defining the scope of the ESIA. The Oyu Tolgoi ESIA builds upon an extensive body of studies and reports, and Detailed Environmental Impact Assessments (DEIAs) that have been prepared for project design and development purposes, and for Mongolian approvals under the following laws:

- The Environmental Protection Law (1995)
- The Law on Environmental Impact Assessment (1998, amended in 2001)
- The Minerals Law (2006)

These initial studies, reports and DEIAs were prepared over a six-year period between 2002 and 2008.

The original DEIAs provided baseline information for both social and environmental issues. These DEIAs covered impact assessments for different project areas, and were prepared as separate components to facilitate technical review as requested by the GOM.

The original DEIAs were in accordance with Mongolian standards and while they incorporated World Bank and IFC guidelines, they were not intended to comprehensively address overarching IFC policies such as the IFC Policy on Social and Environmental Sustainability, or the EBRD Environmental and Social Policy.

OT LLC has commenced the development and implementation of an environmental management system (EMS) that conforms to the requirements of ISO 14001:2004. Implementation of the EMS during the construction phases will focus on the environmental policy; significant environmental aspects and impacts and their risk prioritisation; legal and other requirements; environmental performance objectives and targets; environmental management programmes; and environmental incident reporting. The EMS for operations will consist of detailed plans to control the environmental and social management aspects of all project activities following the commencement of commercial production in 2013.

Following submission and approval of the initial DEIAs, the GOM requested that OT LLC prepare an updated, comprehensive ESIA whereby the discussion of impacts and mitigation measures was project-wide and based on the latest project design. The ESIA was also to address social issues, meet GOM (legal) requirements, and comply with current IFC good practice.

For the ESIA the baseline information from the original DEIAs was updated with recent monitoring and survey data. In addition, a social analysis was completed through the commissioning of a Socio-Economic Baseline Study and the preparation of a Social Impact Assessment (SIA) for the project.

The requested ESIA, completed in 2012, combines the DEIAs, the project SIA, and other studies and activities that have been prepared and undertaken by and for OT LLC.

A summary of the previous DEIAs prepared for the Oyu Tolgoi project, including the EJV Property, are shown in Section 20 along with the additional environmental studies that relate to specific components of the project and that have not required a full-scale Detailed Environmental Impact Assessment (DEIA) have been undertaken to achieve regulatory approvals.

For the purposes of the ESIA, the ‘project’ constitutes the direct activities that are to be financed and / or over which the project can exert control and influence through the project design, impact management, and mitigation measures. This includes:

- All Oyu Tolgoi project facilities within the ML area and surrounding 10 km buffer zone, including the following key features:
  - Open pit mining facilities
  - Underground mining facilities
  - Accommodation camps
  - Construction-related activities and facilities, including concrete batch plant, quarry, and laydown areas
  - Power generation facilities
  - Heating plant and boilers
  - Crusher
  - Concentrator
  - Tailings storage facility

  - Water management facilities (including diversion of the Undai River)
  - Waste water management facilities for camps and mining operations
  - Waste management facilities (municipal and industrial)
  - Waste rock storage facilities
  - Access roads within the ML area
  - Vehicle and equipment maintenance and repair facilities
  - Fuel storage facilities
  - Electrical power distribution infrastructure
  - Administration buildings and catering facilities
- Specific infrastructure facilities and disturbances within the EJV licences include:
  - Concrete batch plant and quarry
  - Permanent airport facility and temporary airstrip at Khanbumbat
  - Gunii Hooloi water supply pipeline
  - Drill pads
  - Road to border with China
  - Power lines
- Contractor accommodation camps adjacent to Khanbogd.
- Potential dedicated off-site worker accommodation planned for Khanbogd.
- Gunii Hooloi water abstraction borefield and the water pipeline supplying the mine, as well as maintenance roads, pumping stations, construction camps, storage lagoons, and other support infrastructure.
- Infrastructure improvements (and associated resource use) by Oyu Tolgoi between the mine site and the Chinese border, including the 220 kV power transmission line, the access road that will be used for concentrate export, construction camps, local water boreholes, and borrow pits.
- Dedicated border crossing at Gashuun Sukhait for the exclusive use of the Oyu Tolgoi Project.
  - The concentrate will be sold by Oyu Tolgoi at the Mongolia–China border crossing at Gashuun Sukhait. The point of sale marks a key boundary to the project area.
  - Infrastructure components that may be transferred to third-party ownership in the future.

A number of infrastructure components of the project considered within the ESIA will be constructed by OT LLC but may be transferred at some stage to public or third party operation and / or ownership. Transfer of these infrastructure components to public operation and ownership will limit the degree of control that OT LLC can exert over their management and operation. These infrastructure components, which may be owned and operated by the GOM and will or may be used by members of the public and / or other commercial operations, include:

- The permanent airport, which is planned to be handed over to the GOM after the completion of the project construction phase.
- The road from Oyu Tolgoi to the Chinese border at Gashuun Sukhait, which follows the alignment for the designated national road and is planned to be handed over to the GOM upon completion of the project construction phase.
- The dedicated border crossing facility at Gashuun Sukhait, which will be operated by the Mongolian authorities.
- The 220 kV electricity transmission line from the Chinese border to Oyu Tolgoi, was transferred to the GOM in October 2015.

4.6.2.1 Future Project Elements Not Directly Addressed in the ESIA

In addition to the project elements identified above, certain other activities and facilities are expected to be developed over time, either as part of or in support of the project, that do not constitute part of the project for the purposes of the ESIA. These include:

- Project expansion to support an increase in plant feed throughput from 100,000 tpd to 160,000 tpd.
- Long-term project power supply. Under the terms of the IA, OT LLC will, within four years of the commencement of project operations, source its electricity from within Mongolia. OT LLC may develop a coal-fired power plant within the Oyu Tolgoi ML area to provide the required power from Mongolian sources. This development is considered to be an Associated Facility (as defined in IFC-PS1) of the Oyu Tolgoi project and is the subject of a supplemental ESIA to the existing ESIA for the Oyu Tolgoi project.

While the impacts of these future project elements, and their mitigation and management, are not directly addressed in the ESIA they are considered in the cumulative impact assessment of the ESIA.

4.6.3 Surface Rights and Permits – Shivee West

Mongolian Mining Law allows Entrée, through grant of the MLs, the right to access and explore, subject to land use agreements and fees with the local soums (the local Mongolian equivalent of a township or district) or Aimag.

4.6.4 Environmental and Socio-Economic Issues – Shivee West

Entrée has reported that it is fully compliant with the relevant Mongolian exploration regulations. All phases of the Company's operations are subject to the Minerals Law of Mongolia, Land Law, and the Law on Environmental Protection as well as the various Taxation Laws. Entrée has engaged in small programmes of basic infrastructure improvements to assist the nearby communities in the vicinity of Lookout Hill. In addition, Entrée maintains close contact with the soums as part of their community relations efforts.

4.7 Other Factors and Risks

In June 2010, the GOM passed Resolution 140, the purpose of which is to authorize the designation of certain land areas for "state special needs" within certain defined areas, some of which include or are in proximity to the Oyu Tolgoi project. These state special needs areas are to be used for Khanbogd village development and for infrastructure and plant facilities necessary in order to implement the development and operation of the Oyu Tolgoi project. A portion of the Shivee Tolgoi licence is included in the land area that is subject to Resolution 140.

In June 2011, the GOM passed Resolution 175, the purpose of which is to authorize the designation of certain land areas for "state special needs" within certain defined areas in proximity to the Oyu Tolgoi project. These state special needs areas are to be used for infrastructure facilities necessary in order to implement the development and construction of the Oyu Tolgoi project. Portions of the Shivee Tolgoi and Javhlant MLs are included in the land area that is subject to Resolution 175.

It is expected, but not yet formally confirmed by the Government, that to the extent that a consensual access agreement exists or is entered into between OT LLC and an affected licence holder, the application of Resolution 175 to the land area covered by the access agreement will be unnecessary. OT LLC has existing access and surface rights to the EJV Property pursuant to the Earn-In Agreement. If Entrée is unable to reach a consensual arrangement with OT LLC with respect to Shivee West, Entrée's right to use and access a corridor of land included in the state special needs areas for a proposed power line may be adversely affected by the application of Resolution 175. While the Mongolian Government would be responsible for compensating Entrée in accordance with the mandate of Resolution 175, the amount of such compensation is not presently quantifiable.

The IA contains provisions restricting the circumstances under which the Shivee Tolgoi and Javhlant MLs may be expropriated. As a result, Entrée considers that the application of Resolution 140 and Resolution 175 to the EJV Property will likely be considered unnecessary.

In March 2014, the GOM passed Resolution 81, the purpose of which is to approve the direction of the railway line heading from Ukhaa Khudag coal deposit located in the territory of Tsogttsetsii soum, Ömnögovi Aimag, to the border port of Gashuun Shukhait and to appoint the Minister of Roads and Transportation to develop a detailed engineering layout of the base structure of the railway. On June 18, 2014, Entrée was advised by MRAM that the base structure overlaps with a portion of the Javhlant ML. By Order No. 123 dated June 18, 2014, the Minister of Mining approved the composition of a working group to resolve matters related to the holders of licences through which the railway passes. The Minister of Mining has not yet responded to a request from Entrée to meet to discuss the proposed railway, and no further correspondence from MRAM or the Minister of Mining has been received. It is not yet clear whether the State has the legal right to take a portion of the Javhlant ML, with or without compensation, in order to implement a national railway project, and if it does, whether it will attempt to exercise that right. While the Oyu Tolgoi IA contains provisions restricting the circumstances under which the Javhlant ML may be expropriated, there can be no assurances that Resolution 81 will not be applied in a manner that has an adverse impact on Entrée.

On February 27, 2013, notice was delivered to Entrée by MRAM advising that any transfer, sale or lease of the Shivee Tolgoi and Javhlant mining licences is temporarily restricted. While Entrée was subsequently advised that the temporary transfer restriction on the mining licences will be lifted, it has not received official notification of the lifting of the restriction.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Access and Infrastructure

Lookout Hill is located in the Aimag Province of Ömnögovi in the South Gobi region of Mongolia, about 570 km south of the capital city of Ulaanbaatar and 80 km north of the border with China (Figure 4.1).

Lookout Hill is centred at approximately latitude 43°02' N and longitude 106°45' E, or UTM coordinates 4,766,000 mN and 644,000 mE, with datum set to WGS-84, Zone 48N. Elevations within the project area range between 1,160 m above sea level (masl) and 1,450 masl.

The topography largely consists of gravel covered plains, with low hills along the northern and western lease borders. Small, scattered rock outcrops and colluvial talus are widespread within the northern, western, and southern parts of the Lookout Hill property.

The EJV property hosts the northernmost and southernmost deposits in a series of copper–gold mineralised deposits in a Palaeozoic porphyry system.

The Hugo North Extension deposit is the principal zone of mineralisation defined on the EJV Property and is where the majority of the exploration drilling has been conducted. The Hugo North Extension is centred at approximately latitude 43°04' N and longitude 106°55' E within the Shivee Tolgoi ML. Surface elevations above the deposit range from approximately 1,160–1,180 masl.

The Heruga deposit is the second significant zone of mineralisation indicated at Lookout Hill and is where the majority of the 2007 and 2008 exploration drilling was conducted. The Heruga deposit is centred at approximately latitude 42°58' N and longitude 106°48' E. Surface elevations range from approximately 1,160–1,170 masl.

5.1.1 Regional Centres and Infrastructure

There are a number of communities in the South Gobi region. The most prominent is Dalanzadgad, population 15,000, which is the administrative centre of the Ömnögovi Aimag and is 200 km north–west of Lookout Hill. Facilities at Dalanzadgad include a regional hospital, tertiary technical colleges, a domestic airport, and a 6 MW capacity coal-fired power station. A paved road connects Dalanzadgad to Ulaanbaatar. OT LLC envisions that Dalanzadgad may be suitable as a regional centre for recruiting and training. The closest community to Lookout Hill is Khanbogd, the centre of the Khanbogd soum. Khanbogd has a population of approximately 7,000 and is 35 km to the east. Other communities relatively near to Lookout Hill include Mandalgovi (population 13,500), the capital of the Dundgovi aimag, 310 km north of the project on the road to Ulaanbaatar, Bayan-Ovoo (population 1,700), 55 km to the west, Tsogttsetsii (population approximately 6,000), 130 km north–west, and Manlai (population 2,400), 150 km to the north.

5.1.2 Transportation Infrastructure

Road access to Lookout Hill follows well-defined paved and dirt tracks directly south from Ulaanbaatar requiring approximately 8 to 12 hours travel time in a four wheel drive vehicle. The Mongolian rail service and a large electricity power line lie 350 km east of the property at the main rail line between Ulaanbaatar and China. The China–Mongolia border is located approximately 80 km south of Lookout Hill. OT LLC has constructed a 105 km road from the site to the border. OT LLC constructed a 220 kV transmission line connecting to the Chinese (Inner Mongolian) grid. This line has the capacity to supply all of Oyu Tolgoi project's power needs. The Government of China has a highway to the Mongolian border, which provides a direct link between the border south of the Oyu Tolgoi project and the trans-China railway system.

OT LLC has constructed a 3.25 km concrete airstrip and the site is serviced by charter and scheduled flights to and from Ulaanbaatar. Ulaanbaatar has an international airport, and Tsogttsetsii, and Dalanzadgad each have regional airports. The closest regional airport in China is at Hohhot. There are no airport facilities at Wuyuan or Bayan Obo.

A standard gauge, 220 km long railway is under construction by the GOM from the Tavan Tolgoi coal project to the Chinese border at Gashuun Sukhait and will pass across the southwest corner of Lookout Hill. Railway construction is currently halted but could be completed by 2018 if funding is finalised.

5.1.3 Power Supply

OT LLC has a Power Purchase Agreement with the Inner Mongolia Power Corporation to supply power to Oyu Tolgoi, including the EJV Property. The term of this agreement covers the commissioning of the business plus the initial four years of commercial operations.

In August 2014, TRQ announced that OT LLC had signed a Power Sector Cooperation Agreement (PSCA) with the GOM for the exploration of a Tavan Tolgoi based independent power producer (IPP). The aim of the PSCA is to lay out a framework for long-term strategic cooperation between the GOM and OT LLC for a comprehensive energy plan for the South Gobi region. Participation in the PSCA meets OT LLC's obligation in the IA to establish a long-term power supply within Mongolia within four years from the commencement of commercial production from the open pit mine. Signing of a PSCA has reset the four years obligation while the opportunity for the establishment of an IPP at Tavan Tolgoi is studied.

The PSCA provides a framework for a broad range of power-related issues, including the establishment of a power generation source, transmission lines, and power imports. The centrepiece of the PSCA is an open, international tender process to identify and select an IPP to privately fund, construct, own, and operate a power plant to supply electricity, with Oyu Tolgoi (including the EJV Property) as the primary consumer.

OT LLC have stated it plans to actively participate in the processes of the PSCA to ensure that there is a timely and reliable power supply solution for Oyu Tolgoi (including the EJV Property) and this approach is endorsed. In May 2015, as part of the agreement between stakeholders for the UDP, OT LLC committed to providing working assumptions for a financing plan towards supporting a long term power agreement with a Tavan Tolgoi power station.

5.2 Climate, Hydrology, and Physiography

The South Gobi region has a continental, semi-desert climate. The spring and autumn seasons are cool, summers are hot, and winters are cold. Typical of desert climates, the site has low average humidity and significant variations in daily temperatures.

The climatic conditions are such that the operating season for the Project will cover the entire year on a continuous shift basis. Minor disruptions are expected and have been allowed for in the estimates of the project operating hours.

5.2.1 Climate

Temperatures range from an extreme maximum of about 50°C to an extreme minimum of about –34°C. The typical air temperature in winter fluctuates between 6°C and –21°C. In the coldest month, January, the average temperature is –12°C.

The average relative humidity ranges from 18.7% in May to 53.3% in January. Daily relative humidity is dependent on current temperature and varies considerably.

From the data available to date, the minimum recorded ground temperature is –39°C and the maximum is 70°C.

Solar radiation data have been collected at the Oyu Tolgoi site station since 2002. Solar radiation is measured in watts per square metre (W/m^2).

The solar radiation fluctuates during the day, ranging from zero W/m^2 at night and peaking soon after midday. The average daily maximum for over the two years of available data is 655 W/m^2, with the highest daily maximum at 1,030 W/m^2, and the lowest daily maximum at 76 W/m^2.

Maximum levels of solar radiation are lower during the winter. The average daily winter maximum is 429 W/m^2 for January and 859 W/m^2 for July.

Average annual precipitation is 57 mmpa, 90% of which falls as rain and the rest as snow. Snowfall accumulations rarely exceed 50 mm in depth. The ground snow load is 0.1 kPa.

Maximum rainfall events of up to 43 mmph for a 1-in-10 year, ten minute storm event have been recorded. In an average year, rainfalls occur on only 19 days, and snow falls on 10–15 days. The ground snow load is 0.1 kPa.

Local records indicate that thunderstorms are likely to occur 2–8 days each year at Lookout Hill. Storm-related electrical activity generally totals about 29 hours each year. An average storm will have up to 83 lightning flashes per minute.

Given the importance of this variable for determining project water requirements, a number of different methods were used to generate and analyse evaporation data to determine design levels.

Wind is usually present at the site, predominantly from the north. Very high winds are accompanied by sandstorms that often severely reduce visibility for several hours at a time. Based on regional information, windstorms can have gusts up to 50 m/s. Snowstorms and blizzards with winds up to 40 m/s occur in the Gobi region for 5–8 days each winter. Spring dust storms are far more frequent and can continue through June and July. The average storm duration is 6–7 hours. An average of 120 hours of dust storm activity and 220 hours of drifting dust are recorded each year. Based on the Mongolian Code, the Basic Wind Speed is 34 m/s.

5.2.2 Hydrology and Surface Water Quality

Lookout Hill is located within the closed Central Asian drainage basin and has no outflow to the ocean. Most riverbeds in this drainage basin are ephemeral creeks that remain dry most times of the year. The Undai River is the most significant hydrological feature of the area. A tributary of the river passes through the site.

Flows after heavy summer rainstorms often result in very turbulent, high-velocity mud flows, locally termed 'Gobian wild floods.' These floods have been known to destroy road crossings and to carry away vehicles caught in the riverbeds. No surface flow data are available for these isolated and episodic flood events. During exploration, only two such events were experienced during the period from 2002 through 2009. Further discussions with locals indicate that these events can occur yearly (excluding current drought conditions).

Shallow springs are used by wildlife and livestock as drinking water sources. Migratory wildlife movements during summer months in the Gobi are likely to be dictated by the presence of surface water in natural springs.

Water quality baseline data for surface waters throughout the project area, access road corridor, and aquifer areas are being collected through current monitoring programmes. This information will be established prior to project development as a basis for assessing potential project-related impacts on surface water quality during routine monitoring.

Potential impacts on surface water systems in the project area will include local changes to natural flow paths and depletion of springs, ephemeral wetlands, and salt marshes from project development and operation activities. The mitigation and design work with regard to surface water focused on the potential impacts to surface water quality include increased sedimentation and risk of pollution of springs, ephemeral wetlands, and salt marshes from increased erosion, contaminated dust fallout, contaminant spills, and accidents associated with project construction and operational activities.

Fugitive dust control management plans and spill management systems are being developed to avoid and mitigate potential impacts to air and surface water quality. These studies will be used to mitigate impacts that may result in loss of wildlife habitat, decrease in wildlife health, and decrease in wildlife population because of higher mortality rates.

On and off-site infrastructure associated with the upgrading of road facilities at the site and along the corridor include the formation of dedicated stream crossings, which may reduce the number of undefined and informal crossings that now exist along tracks within the corridor.

Detailed groundwater investigations to date have been concentrated in the Gunii Hooloi, Galbyn Gobi, and Nariin Zag aquifer areas to assess the potential to meet the project's estimated water demand. Groundwater investigations conducted in the ML area focused on assessment of required dewatering rates for mine works and the potential to meet the project's camp and construction water demands. Process water supply has been registered and will be piped from the Gunii Hooloi basin to the north-east of the project area. Current studies are ongoing at site to confirm groundwater model predictions with respect to dewatering of the pit and underground and groundwater environmental impacts.

5.2.3 Soils

Six soil types were identified in the field surveys, all of low nutrient content and ranging from medium to high alkalinity. Soils in elevated areas contain a high proportion of rock fragments throughout poorly developed horizons. Sandy alluvium over preserved brown loams covers the valleys and steppe areas, providing an indication of the major impact of wind and dusting on soil development. The sandy valley and steppe soils are generally non-saline. Further baseline work within the project area is continuing to further classify soil chemistry so that potential changes resulting from project development can be assessed.

5.2.4 Vegetation

The flora in the Lookout Hill area has been classified as representative of the eastern region of the Gobi Central Zone within the Central Asian Greater Zone. Vegetation tends to be homogenous across the Eastern Gobi Desert Steppe and consists of drought-tolerant shrubs and thinly distributed low grasses. Four rare plant species occur within the ML area. Some shrubs are used for cooking and heating fires in ger dwellings. However, pressure from human use is lower near Oyu Tolgoi due to the low population density. Vegetation in the region serves as wildlife habitat and food source for migrating wildlife and livestock.

Studies will continue in an effort to mitigate potential impacts on vegetation cover and health, and include permanent removal of vegetation cover for the development of project facilities and infrastructure, i.e. open pit, plant site, rock piles, mine roads, tailings storage facility, borrow areas, access road, and power line; and temporary removal and disturbance of vegetation cover for development of underground mines and the water resource pipeline and borefield. Mitigation and monitoring plans will be implemented and updated through operations to continually find ways to reduce these impacts.

5.2.5 Fauna

The fauna of Mongolia is represented in the north by forest steppe species of Eurasia and in the south by desert species of Central Asia. The central belt of Mongolia is a transitional zone that includes both. The desert fauna of the Gobi region is extremely diverse, with many species typical of the Central Asian desert. The low population density and isolation of the southern Gobi region of Mongolia has resulted in the survival of several endangered species that no longer exist in neighbouring countries.

Although the entire project area serves as habitat for reptiles and to migratory mammals and birds, low sandy dunes areas, and shrub lands provide habitat to distinct wildlife communities.

Many of the larger mammals found within the general project area are rare and endangered species. Several species with conservation significance have been recorded along the border corridor access (MEGDT, 1997). Two species (the Asiatic wild ass and black-tailed gazelle), listed as threatened, were sited and recorded in the access road corridor and Galbyn Gobi aquifer area.

Entrée and OT LLC are dedicated to continued mitigation of impacts on fauna associated with the development of the project including changes in abundance, geographic distribution, and productivity at the species and ecosystem level. Wildlife management plans will be developed along with local authorities and government bodies to minimise impacts. These plans will include initiation of wildlife research programmes with Mongolian research facilities to gain a better understanding of wildlife populations, migration, and species diversity.

5.3 Land Use

The land surrounding the ML area is predominantly used for nomadic herding of goats, camels, horses, and sheep by small family units. Use is based on informal traditional Mongolian principles of shared grazing rights with limited land tenure for semi-permanent winter shelters and other improvements. Initiation of the OT LLC Herder Support Programme has reduced the incidence of land use conflict between current mineral exploration and grazing practices. The Oyu Tolgoi project intends to maintain coexistence of traditional grazing practices and mineral development except where there is a risk to public safety or livestock.

5.3.1 Protected Areas

The Small Gobi Strictly Protected Area (SGSPA) is approximately 80 km south of the ML area, on the Mongolia–China border. The access road corridor traverses through 13 km of the protected area. With the acceptance of the EIA for the corridor in June 2004, OT LLC has received approval to cross through this area.

5.4 Closure and Reclamation

As part of overall project planning, OT LLC has prepared a preliminary reclamation and closure plan. Certain features of the mine, such as the open pit, waste dumps, and tailings impoundment, will create permanent changes to the current landscape that cannot be completely remedied through reclamation. The closure plan will, however, ensure that these disturbed areas are seismically and chemically stable so as to limit the ecological impacts to the surrounding water, air, and land.

The closure plan for the project will address the socio-economic impacts of the mine closure considering that the existence and economic survival of some communities may by that time have become dependent on the project. Potential issues include ongoing environmental management during and after reclamation, loss of jobs, and socio-economic impact to the region.

The primary reclamation objective is to develop the mine in a manner that prevents leaving an unsustainable environmental legacy and that considers community input and values. Other key objectives are as follows:

- Protect public health and safety during all stages of project development.

- Prevent or mitigate environmental degradation caused by mining-related activities.
- Return the maximum amount of disturbed land to pre-mining conditions suitable for nomadic herdsmen and their grazing animals.
- Secure the open pit areas, subsidence zones, waste dumps, and tailings storage facilities to ensure public and environmental safety.
- Plan and implement reclamation techniques that eliminate the need for long-term maintenance presence on site and permit OT LLC to 'walk away' from the reclaimed mine with no environmental or social encumbrances.

OT LLC will develop environmental monitoring plans, including proposed activities and schedules, to ensure that environmental parameters meet the criteria, standards, and limits laid out in the EIA and Environmental Protection Plan. In accordance with Mongolian law, OT LLC will undertake monitoring at its own expense using approved methods and accredited facilities. The monitoring will permit procedures and activities to be adjusted and / or modified as necessary to ensure optimal environmental protection.

Parameters to be monitored during the closure and post-closure phases of the mine include the following:

- Surface water and groundwater quality.
- Physical stability of tailings deposits.
- Physical stability of the river water diversion dike, waste rock dumps, drainage ditches, and concrete shaft / raise caps.
- Isolation of open pit voids and unfilled subsidence zones, including status of open water and erosion controls.
- Success of indigenous revegetation, including remediation as required until proven to be self-sustaining.
- Condition of groundwater monitoring wells, piezometers, survey monuments, and other instrumentation.
- Effectiveness of dust-control measures on waste rock, tailings storage facility (TSF), and other waste areas with specific attention to potential wind-blown contaminant sources.

5.5 Seismic Zone and Risk

The seismicity of the Oyu Tolgoi site (including the EJV Property) was determined by OT LLC to be low, and the seismicity of eastern Mongolia is generally low. However, to the west of Lookout Hill lies the Mongolian Altai – a tectonically active mountain range stretching 1,700 km from south–west Siberia to the Gobi Desert. The easternmost extension of the Mongolian Altai is known as the Gobi Altai, which dies out approximately 50–100 km west of Lookout Hill.

The Research Center for Astronomy and Geophysics of Academy of Science

(Seismology Center) is responsible for assessing seismology in Mongolia. OT LLC appointed the Seismology Center to perform a seismic assessment for the Oyu Tolgoi project (including the EJV Property) that was incorporated into the assessment.

6 HISTORY

Mining legislation that was drafted in Mongolia in the early to mid-1990s sparked exploration of the southern Gobi region in what became known as the 'South Mongolian (porphyry) copper–gold belt'.

During the period 1996 through 1999, BHP Exploration Ltd. (BHP) held the area which is currently covered by the Oyu Tolgoi ML and portions of the Shivee Tolgoi and Javhlant MLs. BHP conducted preliminary geological investigations and some geophysical reconnaissance before the areas within the Lookout Hill property were returned to the GOM.

The Shivee Tolgoi, Javhlant and Togoot (no longer part of Lookout Hill) mineral exploration licences (MELs) were awarded by the GOM to a private Mongolian company, Mongol Gazar Co. Ltd. (Mongol Gazar) in March and April 2001. Mongol Gazar subsequently completed grid surveying, soil sampling and shallow gradient IP geophysical surveys. This work was primarily in the area of Zones I and III in the western portion of the Shivee Tolgoi ML (Shivee West).

In 2002, Entrée acquired a 60% interest in the MELs from Mongol Gazar through an arm's length, 5-year option agreement. On 6 November 2003, Entrée, through its wholly-owned Mongolian subsidiary Entrée LLC, entered into a purchase agreement with Mongol Gazar, which replaced the existing option agreement. Details of the agreement can be found in the March 2008 technical report (Vann et al., 2008) filed on SEDAR. Entrée subsequently sold the Togoot licence to an arm's length third party.

Entrée initially focused on Zones I, II, III, and on the copper showings near Bayan-Ovoo (on the formerly held Togoot licence). Other areas such as Ring Dyke (on the formerly held Togoot licence) and West Grid were targeted based on results from ground geophysical surveys (magnetometer and IP surveys), mapping, rock and soil geochemical sampling, and RC and core drilling.

In October 2004, Entrée entered into the Earn-In Agreement with TRQ on the EJV Property. TRQ proceeded to extend its Hugo Dummett deposit onto Entrée's ground through IP surveys and diamond drilling and in late-April 2005, the first mineralised drillhole (EGD006: 258 m averaging 2.56% Cu and 1.17 g/t Au) was reported for Hugo North Extension. This hole was followed in early-June 2005 by EGD006A, which intersected 608 m of 3.24% Cu and 0.82 g/t Au – one of the best mineralised intervals for the Oyu Tolgoi project. The first Hugo North Extension Inferred Mineral Resource was reported in February 2006 and the first Indicated Mineral Resource was reported in March 2007.

7 GEOLOGICAL SETTING AND MINERALISATION

7.1 Regional Geology

Lookout Hill lies within the Palaeozoic Gurvansayhan Terrane in southern Mongolia, a component of the Altaid orogenic collage, which is a continental-scale belt dominated by compressional tectonic forces. (Figure 7.1 and Figure 7.2). The Gurvansayhan Terrane consists of highly deformed accretionary complexes and oceanic island arc assemblages. The island arc terrane is dominated by basaltic volcanics and intercalated volcanogenic sedimentary rocks (Upper Devonian Alagbayan Group), intruded by pluton-sized, hornblende-bearing granitoids of mainly quartz monzodiorite (Qmd) to possibly granitic composition. Carboniferous age sedimentary rocks (Sainshandhudag Formation) overlie this assemblage.

Major structures in this area include the Gobi–Tien Shan sinistral strike-slip fault system, which splits eastward into a number of splays, and the Gobi–Altai Fault system, which forms a complex zone of sedimentary basins overthrust by basement blocks to the north and north-west.

Development of the Central Asian Orogenic Belt consisted of Palaeozoic age accretionary episodes that assembled a number of island and continental margin magmatic arcs, rifted basins, accretionary wedges, and continental margins. Arc development ceased by about the Permian. During the Late Jurassic to Cretaceous, north-south extension occurred, accompanied by the intrusion of granitoid bodies, unroofing of metamorphic core complexes, and formation of extensional and transpressional sedimentary basins. North-east–south-west shortening is superimposed on the earlier units and is associated with major strike-slip faulting and folding within the Mesozoic sedimentary basins.

The Gurvansaikhan Terrane is interpreted to be a juvenile island arc assemblage that consists of highly deformed accretionary complexes and volcanic arc assemblages dominated by imbricate thrust sheets, dismembered blocks, mélanges, and high-strain zones. Lithologies identified to date in the Gurvansaikhan Terrane include Silurian to Carboniferous terrigenous sediments, volcanic-rich sediments, carbonates, and intermediate to felsic volcanic rocks. Sedimentary and volcanic units have been intruded by Devonian granitoids and Permo-Carboniferous diorite, monzodiorite, granite, granodiorite, and syenite bodies, which can range size from dykes to batholiths.

Major structures to the west of the Gurvansaikhan Terrane include the Gobi-Tien Shan sinistral strike-slip fault system that splits eastward into a number of splays in the Lookout Hill area, and the Gobi Altai Fault system, which forms a complex zone of sedimentary basins over-thrust by basement blocks to the north and north-west of Lookout Hill. To the east of the Gurvansaikhan Terrane, regional structures are dominated by the north-east striking East Mongolian Fault Zone, which forms the south-east boundary of the terrane. This regional fault may have formed as a major suture during Late Palaeozoic terrane assembly, with Mesozoic reactivation leading to the formation of north-east elongate sedimentary basins along the fault trace.

Figure 7.1 Regional Setting, Gurvansaikhan Terrane

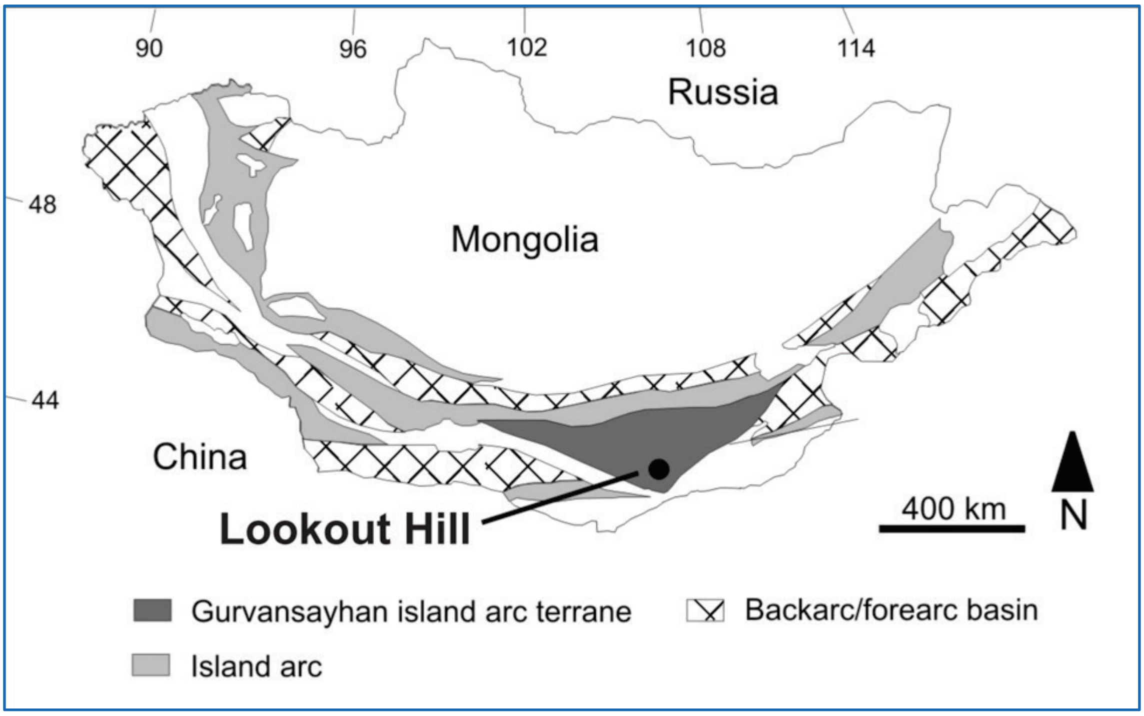


Figure from Wainwright (2008).

Figure 7.2 Regional Structural Setting, Gurvansaikhan Terrane

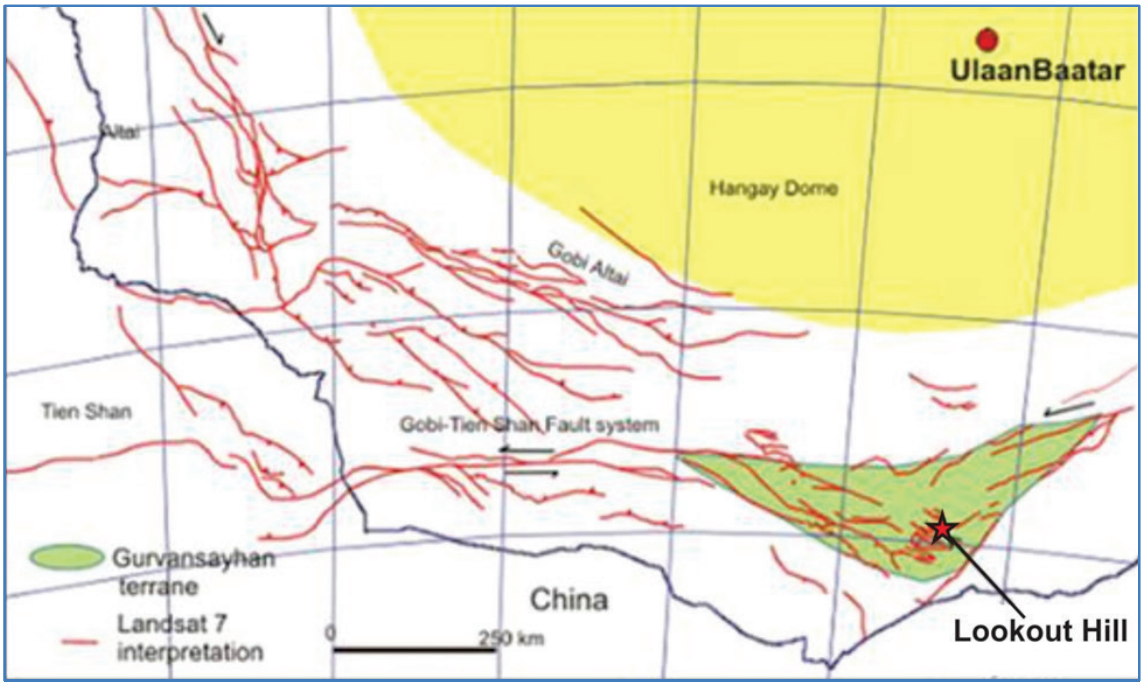


Figure modified by Entrée 2016, North is to top of plan.

7.2 Local Geology

7.2.1 Overview

The Oyu Tolgoi series of porphyry copper–gold deposits, which includes the EJV deposits, occur along a north—north-east corridor with Hugo North Extension at the north end and the Heruga deposit at the south end. Mineralisation is related to Devonian quartz monzodiorite intrusions and associated quartz stockwork. The deposits have varied characteristics in regard to host rock, intrusive bodies, sulphide mineralogy, grade, and alteration.

The pre-Carboniferous (probably Devonian) stratigraphy of Oyu Tolgoi series of deposits consists of massive augite basalt, conglomerate, dacitic tuffs, and siltstones, which are overthrust by the 'Heruga sequence', comprising basaltic flows, volcaniclastic rocks, and siltstones. Only the lower parts of the Devonian sequence host porphyry mineralisation and associated alteration. The Carboniferous Sainshandhudag Formation unconformably overlies the older rocks. Major Carboniferous or younger faults disrupt the mineralised corridor and bound the western side of most deposits.

The Hugo North Extension deposit within the EJV Property contains copper–gold porphyry-style mineralisation associated with Qmd intrusions, concealed beneath a deformed sequence of Upper Devonian and Lower Carboniferous sedimentary and volcanic rocks. The high-grade zone at Hugo North Extension comprises relatively coarse bornite impregnating quartz and disseminated in wall rocks of varying composition, usually intergrown with subordinate chalcopyrite. Bornite is dominant in the highest grade parts of the deposit (with these zones averaging around 3.0% to 5.0% Cu) and is zoned outward to chalcopyrite (to zones averaging around 2.0% Cu for the high-grade chalcopyrite dominant mineralisation).

The Heruga deposit contains copper–gold–molybdenum porphyry-style mineralisation hosted in Devonian basalts and Qmd intrusions, concealed beneath a deformed sequence of Upper Devonian and Lower Carboniferous sedimentary and volcanic rocks. The deposit is cut by several major brittle fault systems, partitioning the deposit into discrete structural blocks. Internally, these blocks appear relatively undeformed, and consist of south–east dipping volcanic and volcaniclastic sequences. The stratiform rocks are intruded by Qmd stocks and dykes that are probably broadly contemporaneous with mineralisation. The deposit is shallowest at the southern end (approximately 500 m below surface) and plunges gently to the north.

The alteration at Heruga is typical of porphyry-style deposits, with notably stronger potassic alteration at deeper levels. Locally intense quartz–sericite alteration with disseminated and vein pyrite is characteristic of mineralised Qmd. Molybdenite mineralisation seems to spatially correlate with stronger quartz–sericite alteration. Copper sulphides occur at Heruga in both disseminations and veins/fractures. Mineralised veins have a much lower density at Heruga than in the more northerly deposits.

The Oyu Tolgoi/EJV area is underlain by complex networks of poorly exposed faults, folds, and shear zones. These structures influence the distribution of mineralisation by both controlling the original position and form of mineralised bodies, and modifying them during post-mineral deformation events. The district geology is shown in Figure 7.4 and the legend for Figure 7.4 is shown in Figure 7.5.

Figure 7.3 Project Stratigraphic Column

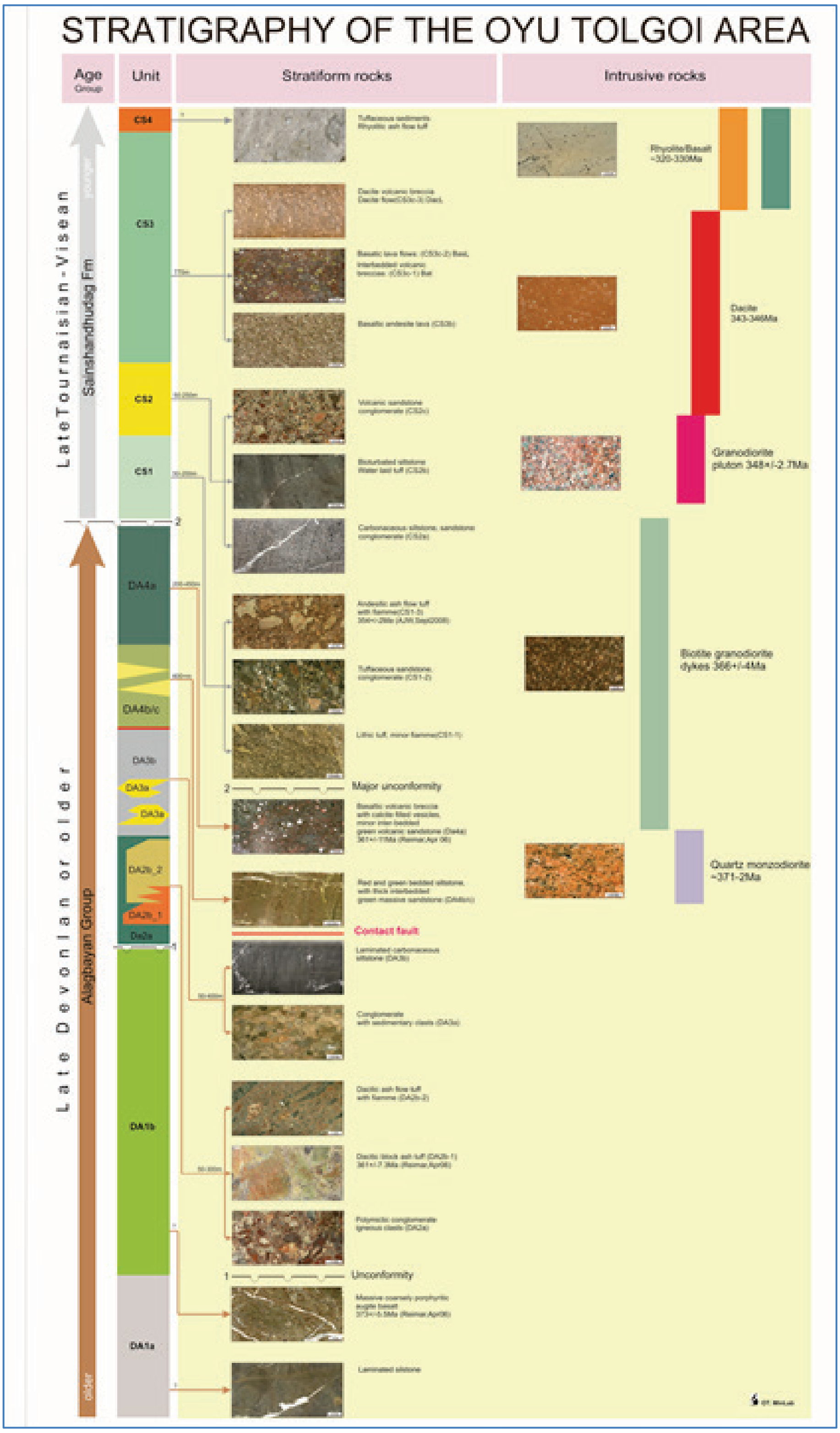


Figure by OT LLC 2014

Figure 7.4 Project Geology Plan

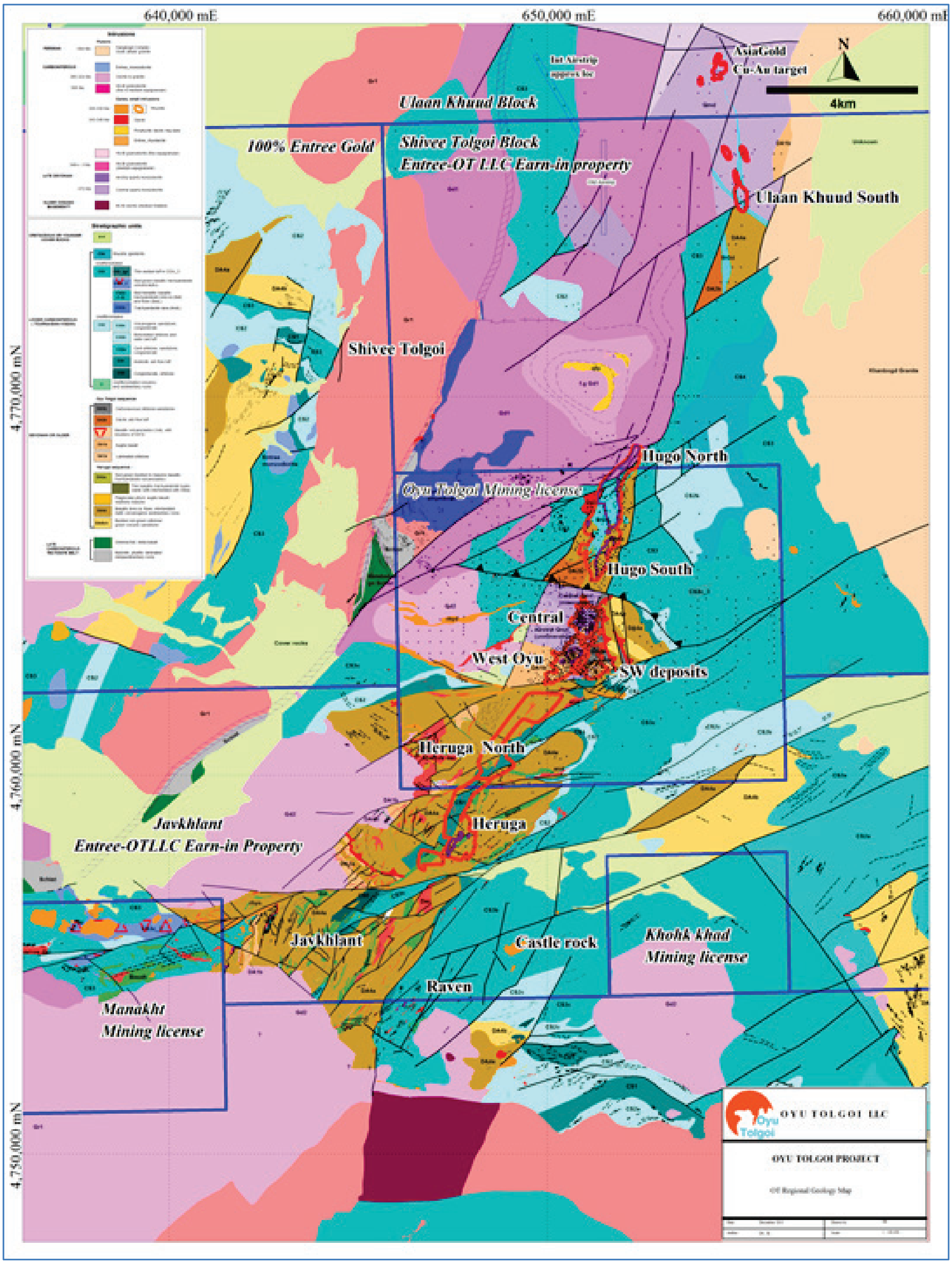


Figure by Entrée 2016

Figure 7.5 Project Geology Plan Legend

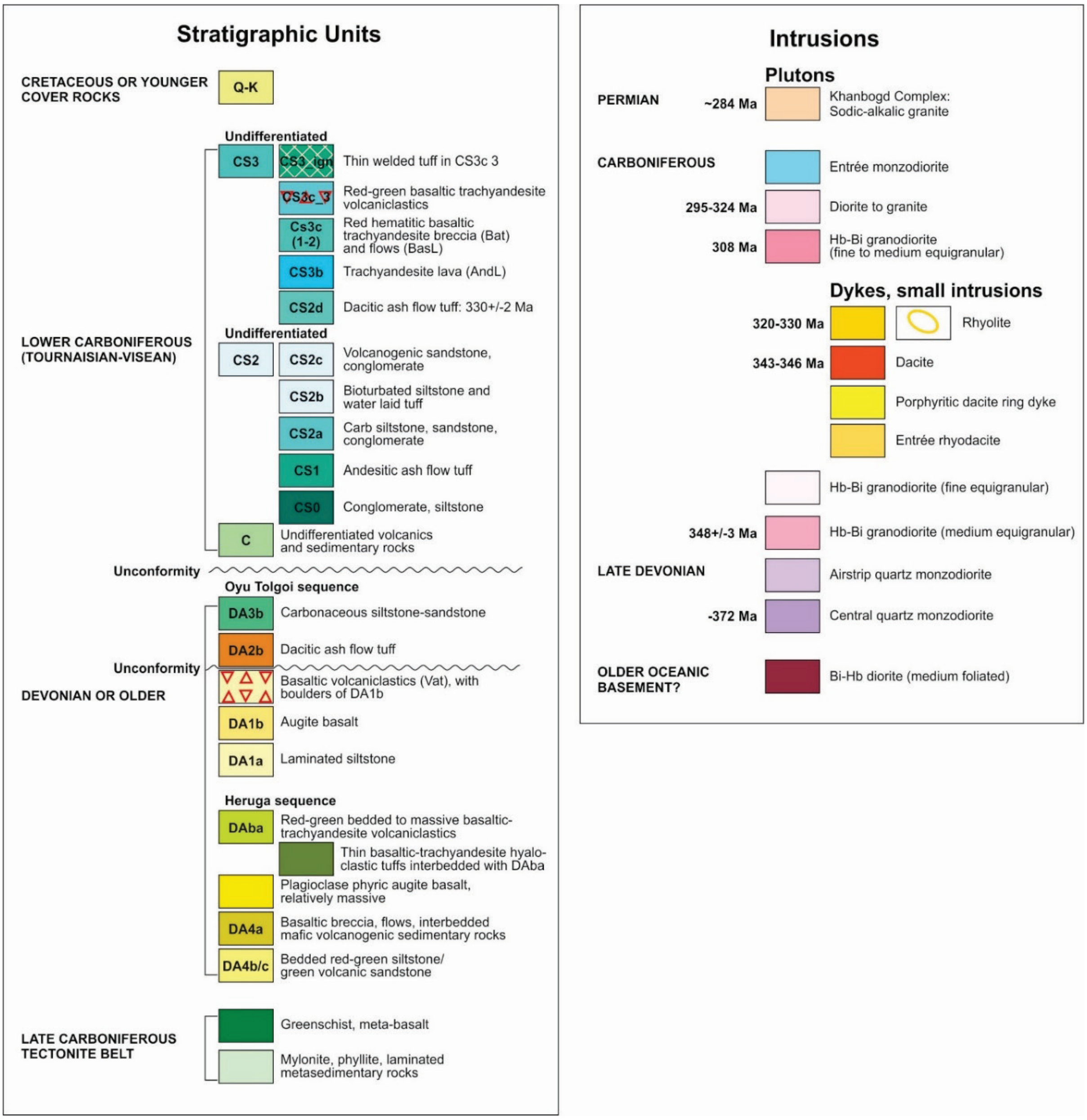


Figure modified from OT LLC.

The Oyu Tolgoi copper–gold deposits currently comprise, from north to south:

- Hugo Dummett (includes the Hugo North Extension zone, which is the extension of the Hugo North deposit onto the joint venture ground).
- Hugo South.
- SOT (includes the Southwest, South, Wedge, Central, Bridge, Western, and Far South zones).
- Heruga.

The surface traces and surface projection of the distinct porphyry centres define a north–north-east trending mineralised corridor underlain by east dipping panels of Upper Devonian or older layered sequences intruded by quartz-monzodiorite and granodiorite stocks and dykes (refer to Figure 7.3).

7.2.1.1 Sedimentary Lithologies

Four major lithological divisions are present within the Alagbayan Group, and each of these divisions consists of two or more mappable subunits (Table 7.1).

The two lower units are commonly strongly altered and form important mineralisation hosts, while the two upper units lack significant alteration and mineralisation. Unit DA4 is separated from the underlying Alagbayan Group units by a contact-parallel fault, known as the Contact Fault.

The Sainshandhudag Formation is divided into three major units at Oyu Tolgoi/EJV: a lowermost tuffaceous sequence, an intermediate clastic package, and an uppermost volcanic/volcaniclastic sequence (Table 7.2). The unit post-dates porphyry mineralisation and is separated from the underlying Devonian rocks by a regional unconformity.

7.2.1.2 Intrusive Rocks

Intrusive rocks are widely distributed through the Oyu Tolgoi/EJV area and range from large batholithic intrusions to narrow discontinuous dykes and sills. At least seven classes of intrusive rocks can be defined on the basis of compositional and textural characteristics (Table 7.3).

Copper–gold porphyry mineralisation is related to the oldest recognised intrusive suite, consisting of large Devonian quartz-monzodiorite intrusions that occur in all of the deposit areas.

Table 7.1 Major Units of the Alagbayan Group

Unit	Lithologies	Description
DA1	Basaltic flows and volcaniclastic rocks; several hundred metres in thickness.	Two subunits: Lower: grey to green, finely-laminated, volcanogenic siltstone and interbedded fine sandstone (DA1a). Upper: dark green, massive porphyritic (augite) basalt. Overlies and partially intercalated with basal unit (DA1b).
DA2	Dacite tuff / volcaniclastic rocks; at least 200 m thick	Three subunits: Lower: monolithic to slightly polylithic basaltic lapilli tuff to volcaniclastic conglomerate/breccia. Underlies and partially intercalated with middle unit (DA2a) Middle: buff to dark green, dacite lapilli tuff. Overprinted by intense sericite and advanced argillic alteration (DA2b_1) Upper: weakly altered to unaltered polymictic block tuff to breccia, with lesser intercalated lapilli tuff (DA2b_2).
DA3	Clastic sedimentary sequence; approximately 100 m thick	Two subunits: Polylithic conglomerate, sandstone, and siltstone. Abundant in the South zone and parts of the Hugo South deposit (DA3a). Rhythmically interbedded carbonaceous siltstone and fine brown sandstone. Ubiquitous in drillholes in Hugo North and is also discontinuously distributed in the more southerly deposits (DA3b).
DA4	Basaltic flows / fragmental rocks, siltstone; approximately 600 m thick	Three subunits: Dark green basaltic volcanic breccia with vesicular, fine-grained to coarsely porphyritic basaltic clasts is the dominant lithotype; interlain with volcanogenic sandstones and conglomerates (DA4a). Thinly interbedded red and green siltstone, which contain subordinate basalt layers in their lower levels (DA4b). Massive green to grey sandstone with rare siltstone interbeds (DA4c).

Table 7.2 Major Units of the Sainshandhudag Formation

Unit	Lithologies	Description
CS1	Andesitic lapilli tuff and volcaniclastic rocks; approximately 200 m thick	Andesitic lapilli tuff with abundant fiamme, and subordinate block tuff to breccia.
CS2	Conglomerate, sandstone, tuff, and coal; approximately 200 m thick	Typically shows a progression from a lower conglomerate-sandstone-siltstone dominant unit (CS2a) to an overlying siltstone-waterlain tuff unit (CS2b). Carbonaceous siltstone and coal beds occur in the lower part of the sequence.
CS3	Basaltic and andesite lava and volcaniclastic rocks; approximately 800 m thick	Four subunits: Basal: thin volcanic sandstone (CS3a). Lower middle: discontinuous porphyritic basaltic andesitic lava sequence (CS3b). Upper middle: thick basaltic breccia-to-block tuff unit (CS3c_1). Upper: intercalated to overlying porphyritic basalt flow sequence (CS3c_2).

Table 7.3 Major Intrusive Rock Units

Unit	Lithologies	Age	Description
Intrusions	Quartz-monzodiorite to monzodiorite	371 ± 2 Ma	Texturally and compositionally varied. Typically phenocryst-crowded, with >40% plagioclase phenocrysts up to 5.0 mm long, and 10–15% biotite and hornblende. Abbreviated to Qmd.
Intrusion, dykes and sills	Biotite-granodiorite	366 ± 4 Ma	Contain large plagioclase phenocrysts with lesser small biotite phenocrysts, within a fine-grained to aphanitic brown groundmass. Intrusions are compositionally and texturally varied and probably include several intrusive phases. Forms a large stock at Hugo North (BiGd).
Intrusions	Syenite, granite, quartz-monzonite, quartz–diorite, and quartz–syenite	348 ± 3 Ma	Large, polyphase granitic complex bounding Oyu Tolgoi to the north-west.
Dykes	Hornblende–biotite andesite and dacite	343 ± 3 Ma	Typically strongly porphyritic with feldspar, hornblende, and biotite. Quartz phenocrysts are common.
Dykes and sills	Rhyolite; range from metres to a few tens of metres wide	320 ± 10 Ma	Aphanitic and aphyric. Intrusive breccias are common along dyke contacts, commonly incorporating both rhyolitic and wall rock fragments within a flow-banded groundmass.
Dykes	Basalt / dolerite; in deposit area range from metres to a few tens of metres wide; in Southwest part of the project can occur as large, sill-like intrusive masses	Carboniferous	Intrude all stratified units. Typically aphanitic to fine-grained, locally vesicular, and contain variable amounts of plagioclase phenocrysts.
Intrusions	Alkaline granite	Permian	Large, circular intrusion exposed just east of Oyu Tolgoi that is defined by abundant pegmatite dykes.

7.2.1.3 Structure

The Oyu Tolgoi/EJV area is underlain by complex networks of faults, folds, and shear zones. Most of these structures are poorly exposed on surface and have been defined through integration of detailed exploration data (primarily drillhole data), property-scale geological mapping, and geophysical data. There is evidence for several phases of deformation and reactivation of the early faults during later deformational events. Major fault structural elements are summarised in Table 7.4.

Table 7.4 Major Structures

Structure	Setting	Description
Central Fault	West–north-west striking, moderately north dipping structure that lies between the Hugo South deposit and the Central zone of the SOT deposit.	Fault consists of several splays and may have experienced multiple periods of displacement. Early fault displacement resulted in north side down apparent offset, followed by a later apparent reverse displacement of lesser magnitude. Visible as linear magnetic feature cutting the overlying Sainshandhudag Formation.
Contact Fault	Low-angle thrust fault generally parallel to bedding; occurs from Heruga deposit in the south to the Hugo Dummett deposits in the north.	Places overturned upper Devonian sedimentary and volcanic rocks belonging to the DA4 unit over upright Devonian sediments of unit DA3b. Does not truncate mineralisation.
7100 Fault	North-west strike, steep dip	Offset of north side down, displacement of all rock units
Bogd Fault	East- West strike, steep dip	Oblique slip fault with dextral lateral displacement
Lower Fault	North–north-west striking, moderate dip	Deposit parallel fault, shear zone
110 Fault	East–west strike, mod. dip to North	Boundary between Hugo North and Hugo South
Axial Fault	Hypothetical, based on alignment of the Southwest and Central zones and the Hugo Dummett deposits, and the elongate form of the Hugo Dummett deposit.	Alignments suggest an underlying north–north-east striking fault or fault zone controlled emplacement of porphyry intrusions and related hydrothermal activity.
West Bat, East Bat Faults	North–north-east trending, bounding Hugo Dummett deposit.	Control the structural high, which hosts Hugo Dummett. Offsets of post-mineral stratigraphic contacts measure at least 1.0 km (east side up) for the West Bat Fault, and 200–300 m (west side up) for the East Bat Fault.
East Bounding and West Bounding Faults	North-east to north–north-east trending; bounding the Southwest zone.	Form a primary control on the distribution of copper and gold mineralisation. Presence of mineralised clasts within the fault zones implies faults were active post-mineralisation. East bounding fault is a gently listric, steeply west dipping fault zone in the order of >50 m wide. The fault has been modelled as a series of segments displaced across newly interpreted north-west–south-east trending faults.

Structure	Setting	Description
Bor Tolgoi and Bor Tolgoi West Faults	North-east to north–north-east trending; bounding the Heruga deposit.	Display 300–500 m of west side down apparent offset of stratigraphic contacts.
Boundary Fault system	East–north-east striking fault zone; juxtaposes the Devonian sequence hosting and overlying the Oyu Tolgoi deposits against the Carboniferous granitic complex to the north.	Faults within this system include the North Boundary Fault, an unnamed splay of the North Boundary Fault, and the Boundary Fault. Faults dip steeply to the north or north-west, and occur as strongly-developed, foliated gouge and breccia zones ranging from tens of centimetres to several tens of metres wide.
North-west Shear Zone	Ductile shear zone that cuts across the far north-west corner of the Oyu Tolgoi area.	Wide shear zone with mylonitic to ultra-mylonitic rocks in the centre, grading outward over about 200 m to rocks lacking visible ductile strain. Marks the break between the Alagbayan Group and Sainshandhudag Formation and the Carboniferous granitic complex.
Solongo Fault	East to east–north-east striking, sub-vertical structure; cuts across Oyu Tolgoi just south of the Southwest and South zones.	Typically occurs as a strongly tectonised, foliated zone up to several tens of metres wide. Forms a major structural break; a minimum of approximately 1,600 m of south side down stratigraphic offset where it juxtaposes mineralised basalt (unit DA1) in the South zone against sediments correlated with the upper Alagbayan Group (unit DA4) to the south.
North-west trending faults	SOT	Sub-vertical to steeply north-east dipping faults associated with rhyolite dykes.
East–north-east striking faults	Regional bounding faults at Heruga deposit.	Form prominent features on both magnetic and satellite images. Geological mapping shows a 500 m apparent dextral displacement of dykes and stratigraphic contacts across the faults.

Variations in bedding attitude recorded in both oriented drill core and surface outcrops define two orientations of folds at Oyu Tolgoi/EJV: a dominant set of north-east trending folds, and a less-developed set of north-west trending folds. These folds are well defined in bedded strata of both the Sainshandhudag Formation and Alagbayan Group. They may be present in stratified rocks throughout the property, but outcrop and drillhole data are insufficient to define them in many areas. There is no evidence of a penetrative fabric (e.g., cleavage) associated with folding.

Together, the two orientations of folds form a dome-and-basin interference pattern, but it is not possible to determine their relative ages. Both of the dominant fold orientations occur in Lower Carboniferous strata, indicating that both folding events post-date mineralisation.

Sedimentary facing direction indicators, including grading, scour and fill structures, load casts, and cross-bedding, are sporadically observed in drill core by Oyu Tolgoi geologists along the east flank of the Hugo Dummett deposit. These suggest that parts of the Alagbayan Group are overturned. However, no large isoclinal folds have been mapped from drill core. These folds are cut by dykes of the 366 Ma biotite-granodiorite suite and therefore were formed within the Late Devonian. Such folds and geopetal features are difficult to ascribe to regional tectonic events, and may simply be localised features of rapid facies changes in a proximal submarine volcanic environment.

When completed, a structural mapping programme currently underway at OT LLC may result in the revision of some elements of the interpretations.

7.3 Deposit Geology – EJV Property

7.3.1 Hugo North Extension

The Hugo North Extension is a term used to delimit that part of the Hugo North deposit that extends into the EJV property. The zone extends from the licence boundary north for approximately 700 m and appears to be closed off to the north; drilling on a section approximately 150 m north of the northernmost extent of the Hugo North Extension grade shell has indicated that mineralisation is truncated by an east–west-trending fault. North of the fault, the prospective stratigraphy has been down-dropped to depths greater than 2,000 m below the surface.

The Hugo North Extension geological setting is similar to that at Hugo North within the Oyu Tolgoi ML. Host rocks are an easterly dipping sequence of volcanic strata correlated with the lower part of the Devonian Alagbayan Group and quartz monzodiorite (Qmd) intrusive rocks.

The Devonian stratified host rock sequence in the Hugo North Extension deposit dips moderately (65° to 75°) to the east or south–east, except for a structurally induced strike flexure in the southern part of the deposit, within which dips are southward.

7.3.1.1 Lithologies

Host rocks at Hugo North are an easterly dipping sequence of volcanic and volcaniclastic strata correlated with the lower part of the Devonian Alagbayan Group and with quartz–monzodiorite intrusive rocks that intrude the volcanic sequence.

The stratigraphically lowest rocks in the host sequence are basalt flows and minor volcaniclastic strata, overlain by a basaltic tuff and breccia sequence. The basaltic tuff sequence has been affected by advanced argillic alteration to give it the appearance of a dacitic tuff. The host sequence basaltic volcanics are overlain by dacitic block and ash tuff and dacitic ash flow tuff. Weakly altered to unaltered sedimentary and volcanic rocks of the upper Alagbayan Group and Sainshandhudag Formation structurally overlie the mineralised sequence along the eastern flank of the deposit.

Intrusive rocks are dominated by quartz–monzodiorite bodies that underlie the entire deposit area and host a significant portion of the copper and gold mineralisation. Intrusive contacts are typically irregular but overall show a preferred easterly dip, sub-parallel to stratification in the overlying rocks. The sub-parallel position of the quartz–monzodiorite to the overlying strata may suggest that the intrusion was more of a sill emplacement that became tilted to the east, possibly due to the many intrusive events in the Carboniferous. More work is needed to confirm this theory. The quartz–monzodiorites are contemporaneous with alteration and mineralisation. The quartz–monzodiorite is considered to be the progenitor porphyry, and two zones are distinguished on the basis of alteration characteristics and position within the deposit.

A late- to post-mineralisation biotite granodiorite intrusion forms a northerly striking dyke complex cutting across the western edge and deeper levels of the deposit. At higher levels, the biotite granodiorite flares out considerably to form a voluminous body. Although this intrusion locally contains elevated copper grades adjacent to intrusive contacts or within xenolith-rich zones, it is essentially barren.

Based on correlations between drillhole intersections and measurements of individual contacts using oriented drill core, the positions and orientations of dyke contacts are reasonably well established in the Hugo North deposit area. Dominant dyke orientation varies with depth. At levels above approximately 250 m RL, where the biotite granodiorite cuts through the non-mineralised hanging wall strata, it is present as a single intrusive mass with contacts dipping moderately to steeply to the west. The hanging wall sequence model being prepared by OT LLC should identify the nature of the contact between the hanging wall strata and the biotite granodiorite and assist in modelling the subsidence zone. Below this level, the biotite granodiorite is more complex, found as multiple and sub-parallel to anastomosing dykes that cut through the quartz–monzodiorite intrusion and mineralised Alagbayan Group strata.

7.3.1.2 Structural Geology

The Hugo North deposit lies within easterly dipping homoclinal strata contained in a north–northeasterly elongate fault-bounded block. The northern end of this block is cut by several east–west- and northeast-striking faults near the northern boundary of the Oyu Tolgoi property. The structural geometry and deformation history of the Hugo North deposit generally similar to those of the Hugo South deposit.

Several iterations of the structural framework have been modelled between 2007 and 2014. Deformation of Hugo North and Hugo North Extension is dominated by brittle faulting. Major faults cutting the deposit can be grouped on the basis of orientation into the following sets:

- East–west-striking, moderately north-dipping faults (e.g, The 110 Fault defines the division between the Hugo North and Hugo South deposits)
- East–west-striking, steeply dipping faults with locally varying dips between north and south (Bogd, Bumbat, Dugant, Blacktail). These faults offset the lithology and mineralisation in oblique slip fashion (dextral displacement).
- Steep, north–northeast-striking faults (e.g., East and West Bat, 160, and Axial). The linear mineralised trend defined by the Central, Southwest, and Hugo Dummett deposits likely reflects the presence of a deep, north–northeast-striking crustal fault or fault zone controlling magma emplacement and mineralisation, termed the Axial Fault. The sub-vertical, north–northeast-striking West Bat Fault runs along the west side of the Hugo North deposit and cuts the western edge of the northern part of the deposit. The north–northeast-striking East Bat Fault follows the east flank of the Hugo Dummett deposit, well east of the known deposit extents. The 160 Fault can be traced through the southern part of the Hugo North deposit, where it cuts across stratigraphic contacts at moderate angles and forms a sharp break in alteration intensity and copper grade.
- North–northeast-striking, moderately east-dipping faults sub-parallel to lithological contacts (e.g., Contact, Lower, and Intermediate). The Contact Fault is a bedding-parallel detachment zone that normally lies at the contact between tectonized mudstones that stratigraphically overlie the deposit (unit DA3) and overlying basalt flows and volcaniclastic rocks (unit DA4). The Lower Fault at Hugo North is an intensely brecciated, locally foliated, clay-rich gouge zone within the middle or lower part of the

high-grade mineralised body, typically at a level 200 m to 400 m below the Contact Fault. The Intermediate Fault is subparallel to the Va and Ign contact.

- East–northeast-striking faults (e.g., Boundary Fault System, Kharaa, Eroo, and Rhyolite). The Boundary Fault follows the intrusive contact of the granitic complex in the northwest part of the Oyu Tolgoi Project area and juxtaposes strongly mineralised rocks against post-mineral Carboniferous strata near the northern property boundary. The North Boundary Fault juxtaposes Carboniferous granitic rocks against Carboniferous strata to the south. The sub-vertical, east–northeast-striking Rhyolite Fault cuts across the southern part of the Hugo North deposit and coincides with a wide zone of rhyolite dykes. The Khaara and the Eroo may be reactivated faults associated with the North Boundary Fault System.

- Northwest striking faults that offset (oblique slip) lithologies and in some case mineralisation (7100, Noyon, Gobi, Burged, Javkhlant). These faults may have an oblique slip component.

Fold styles and orientations in the Hugo North deposit are similar to those at Hugo South, with most folding restricted to the upper part of the Alagbayan Group and overlying Sainshandhudag Formation.

7.3.1.3 Mineralisation

The highest-grade copper mineralisation in Hugo North Extension is related to a zone of intensely stockworked to sheeted quartz veins known as the QV90 zone, so named because >90% of the rock has >15% quartz veining. The high-grade zone is centred on thin, east-dipping quartz–monzodiorite intrusions or within the apex of the large quartz–monzodiorite body, and extends into the adjacent basalt. In addition, moderate to high grade copper and gold values occur within quartz-monzodiorite below and to the west of the intense vein zone, in the Hugo North gold zone. This zone is distinct and has a high Au (ppm) to Cu (%) ratio of 0.5:1.

Bornite is dominant in the highest-grade parts of the deposit (3% to 5% Cu) and is zoned outward to chalcopyrite (2% Cu). At grades of <1% Cu, pyrite–chalcopyrite dominates. Within the upper levels where advanced argillically altered basaltic tuff is reported, the assemblage comprises pyrite–chalcopyrite ± enargite, tennantite, bornite, chalcocite, and more rarely covellite.

The high-grade bornite zone consists of relatively coarse bornite permeating quartz and disseminations in wall rocks, usually intergrown with subordinate chalcopyrite. Pyrite is rare to absent except locally where the host rocks are advanced argillically altered. Although chalcocite is commonly found with bornite at Hugo South, it is less common at Hugo North. High-grade bornite is associated with minor amounts of tennantite, sphalerite, hessite, clausthalite, and gold that occur as inclusions or at grain boundaries.

Elevated gold grades in the Hugo North deposit occur within the up-dip (western) portion of the intensely veined, high-grade core and within a steeply dipping lower zone cutting through the western part of the quartz–monzodiorite. Quartz–monzodiorite in the lower zone exhibits a characteristic pink to buff colour, with a moderate intensity of quartz veining (5% to 25% by volume), and is characterised by finely disseminated bornite and chalcopyrite. Sulphides are disseminated throughout the rock in the matrix as well as in quartz veins. The fine-grained bornite has a black "sooty" appearance. Red colouration of the rock type is attributed to fine hematite dusting, primarily associated with albite.

7.3.1.4 Alteration

Hugo North Extension is characterised by copper–gold porphyry and related styles of alteration similar to those of Hugo North and Hugo South. These include biotite–K-feldspar (K-silicate), magnetite, chlorite–muscovite–illite, albite, chlorite–illite–hematite–kaolinite (intermediate argillic), quartz–alunite–pyrophyllite–kaolinite–diaspore–zunyite–topaz–dickite (advanced argillic), and sericite–muscovite zones. The distribution of alteration zones is similar to that in the Hugo South deposit except that the advanced and intermediate argillic zones are more restricted and lie mainly along the outer and upper margins of the intrusive system.

Chlorite–illite marks the outer boundary of the advanced argillic zone, mainly in the coarse, upper part of the basaltic tuff/breccia.

Quartz–pyrophyllite–kaolinite–dickite (advanced argillic) is hosted mainly in the lower part of the basaltic tuff, although on some sections at Hugo North it extends into strongly veined quartz–monzodiorite. The advanced argillic zone is typically buff or grey, and late dickite on fractures is ubiquitous. Within the advanced argillic zone, a massive quartz–alunite zone forms a pink–brown bedding-parallel lens. As with elsewhere within the property, the advanced argillic alteration is texturally destructive and often obliterates the contact between the augite basalt and overlying basaltic tuff. As a result, a diffuse lithological and mineralisation contact typically characterises this zone.

Topaz is widespread as late alteration controlled by structures cutting both the advanced and intermediate argillic zone. In certain areas topaz appears to replace parts of the quartz–alunite zone. In addition, topaz may also occur disseminated with quartz–pyrophyllite–kaolinite.

Hematite–siderite–illite–pyrophyllite–kaolinite–dickite (intermediate argillic) is an inward zonation from the advanced argillic zone. It is commonly hosted by augite basalt but may also occur in basaltic ash-flow tuff. Hematite usually comprises fine specularite and may be derived from early magnetite or Fe rich minerals such as biotite or chlorite.

Hematite–chlorite–illite–(biotite–magnetite) (chlorite) is transitional to the intermediate argillic zone and is commonly hosted by augite basalt. It is characterised by a green colour and relict hydrothermal magnetite, either disseminated or in veins.

Muscovite–illite (sericite) generally occurs in the quartz-monzodiorite intrusions and is a feature of the strongly mineralised zone. Alteration decreases with depth in the quartz–monzodiorite.

At Hugo North Extension, the distribution of the alteration is strongly lithologically controlled: dacite tuff typically shows strong advanced argillic alteration, whereas basalt tends to be chlorite–muscovite–hematite altered with pyrophyllitic advanced argillic alteration in its uppermost parts. Pockets of advanced argillic alteration occur locally in the high-grade zone in the Qmd.

7.3.2 Heruga Deposit

The Heruga deposit is the most southerly of the currently known deposits at Oyu Tolgoi. The deposit is a copper–gold–molybdenum porphyry deposit and is zoned with a molybdenum-rich carapace at higher elevations overlying gold-rich mineralisation at depth. The top of the mineralisation starts 500 m to 600 m below the present ground surface.

On the Javhlant ML, the deposit has been drilled over approximately 2 km, is elongated in a north–northeast direction, and plunges to the north onto the Oyu Tolgoi ML. Exploration of the down-plunge extension was active as at 31 March 2012. The northern boundary of the mineralisation is assumed to be the Solongo Fault, which marks the southern boundary of the planned Oyut open pit.

Quartz–monzodiorite intrusions intrude the Devonian augite basalts as elsewhere in the district, and again are considered to be the progenitors of mineralisation and alteration. Within Heruga itself, quartz–monzodiorite intrusions are small compared to the stocks present in the Hugo Dummett and SOT areas, perhaps explaining the lower grade of the Heruga deposit. Non-mineralised dykes, which make up about 15% of the volume of the deposit, cut all other rock types.

The deposit is transected by a series of north–northeast-trending vertical fault structures that step down 200 m to 300 m at a time to the west and have divided the deposit into at least two structural blocks.

Mineralised veins have a much lower density at Heruga than in the more northerly Hugo Dummett and SOT deposits. High-grade copper and gold intersections show a strong spatial association with contacts of the mineralised quartz–monzodiorite porphyry intrusion in the southern part of the deposit, occurring both within the outer portion of the intrusion and in adjacent enclosing basaltic country rock.

At deeper levels, mineralisation consists of chalcopyrite and pyrite in veins and disseminated within biotite–chlorite–albite–actinolite-altered basalt or sericite–albite-altered quartz–monzodiorite. The higher levels of the orebody are overprinted by strong quartz–sericite–tourmaline–pyrite alteration where mineralisation consists of disseminated and vein-controlled pyrite, chalcopyrite, and molybdenite.

There is no oxide zone at Heruga. No high-sulphidation style mineralisation has been identified to date.

OT LLC updated the Heruga structural and geological model in 2013. The surface map shows a north-east trending Carboniferous syncline axial trace directly above the Heruga deposit footprint. Level plans 1 km down in the mineralised zone show a Devonian core with Carboniferous on the flanks, i.e., an anticline. The corresponding anticline axial trace at surface lies ~500 m to the east, suggesting that the axial surface dips in the order of ~60° to 70° to the west—north-west.

On level plans and cross-sections the anticline looks like a positive flower structure (i.e., transpressive—a pop-up structure) developed in an east-dipping homocline, but the surface map shows anticline and syncline fold closures. This may be a potentially important difference in trying to understand the genesis and geometry of the deposit, and may indicate the presence of more mineralisation in the immediate vicinity.

The current model has been built from serial cross-sections. Due to wide drillhole spacing on the flanks of the deposit, the model has an irregular, "saw-tooth" geometry when viewed in level plans. By concentrating on individual distinctive marker units and smoothing the interpretation to something that looks geologically reasonable, the geological setting of the deposit, in the faulted core of an anticline, becomes apparent.

Faults have been modelled as vertical. However, the easterly offset surface anticline axial trace and parallel related faults suggest that the NE-trending faults may also dip steeply west. This is also suggested by sequential level plans where the mineralised Qmd in the northern part of the deposit migrates across three fault panels while maintaining the same contact relationships and showing no sign of displacement. If faults seen in drillholes have been projected vertically to surface and to depth, then the modelling could conceivably have included more faults than are really there, instead of correlating fewer, steeply west dipping faults.

There is a generally modest to poor correlation between faults in the Heruga model and those mapped on surface. It is important to link poorly drill-defined faults, and often barely more than conceptual faults, to the well-defined surface fault traces. This is an important part of integrating the sub-surface geology with the surface in order to "de-risk" the interpretation. Interpreted faults that do not correspond with, or at least fit the pattern of, surface-mapped faults can be considered "high risk." The degree of non-correlation between modelled and surface-mapped faults is an indicator of the level of uncertainty and hence geological risk in the model.

7.3.3 Ulaan Khud Prospect, EJV Property

The geology of this area (also referred to Airport North target or discovery) was established in 2006 (through sterilisation drilling of possible airport locations) and is described in detail in Vann et al. (2008). The Ulaan Khud prospect is 8 km to the north of Hugo North Extension and comprises a narrow, steeply dipping zone of copper–gold porphyry mineralisation. The zone is 30–50 m wide and averages less than 0.3% Cu. The best intervals from the area were 18 m of 0.30% Cu and 1.01 g/t Au from 114 m downhole (EGD132) and 34 m of 1.08% Cu and 0.45 g/t Au from 668 m downhole (EGD127).

7.4 Shivee West (100% Entrée)

7.4.1 General Geological Setting

The bedrock geology of Shivee West (Shivee Tolgoi ML) comprises Devonian and Carboniferous volcanic and sedimentary rocks intruded by batholiths, plutons, and dykes of Carboniferous and possibly Devonian age.

Mapping at 1:10,000 scale (Panteleyev 2004, 2005, 2006, 2007, 2008, 2010, 2011) established a number of volcanic and sedimentary units (Figure 7.6 and Figure 7.7). Some of these are equivalent to Oyu Tolgoi project logging and mapping units, allowing correlation of the latter over a large area outside the confines of the Oyu Tolgoi ML and the EJV Property.

Volcanic mapping at Shivee West uses descriptive names based on field observations of rock composition, modified from McPhie et. Al. (1993):

Rhyolite	K-feldspar ± quartz (±Ca-poor plagioclase ± <5% ferromagnesian phase)
Dacite	Plagioclase ± 5%–10% ferromagnesian phase ± quartz (± K-feldspar).
Andesite	Plagioclase + ferromagnesian phase: amphibole > pyroxene ± biotite (± olivine)
Basaltic andesite	Plagioclase + pyroxene > amphibole (± olivine).
Basalt	Pyroxene + calcium-rich plagioclase ± olivine.

The following stratigraphic and intrusive sequence has been established at Oyu Tolgoi (see also Figure 7.3 and Figure 7.5 for individual Oyu Tolgoi mapping and core logging units):

- A volcanic and sedimentary assemblage assigned to the Devonian Alagbayan Group(DA units), intruded by late-Devonian Qmd plutons and dykes;
- A volcanic and sedimentary assemblage assigned to the Carboniferous Sainshandhudag Formation (CS units), intruded by granodiorites, and felsic dykes of Carboniferous age;
- The Permian aged Khanbogd alkaline granite complex; and
- Cretaceous and Quaternary terrestrial sedimentary rocks (clay, sand, and gravel) overlying the aforementioned assemblages.

Based on lithological, chemical, geochronological, and stratigraphic similarities, some of the Devonian and Carboniferous units at Oyu Tolgoi (including the EJV Property) have been correlated with a number of mapping units at Shivee West. Permian Khanbogd alkaline intrusives are not known to occur on Shivee West.

Geology of the three mapped areas (Devonian Corridor, Devonian Wedge and Camp Area) is described in more detail below. Stratigraphic and lithologic correlations between each mapped area are still tentative or unknown.

Figure 7.6 General Geology of Shivee West, Shivee Tolgoi ML

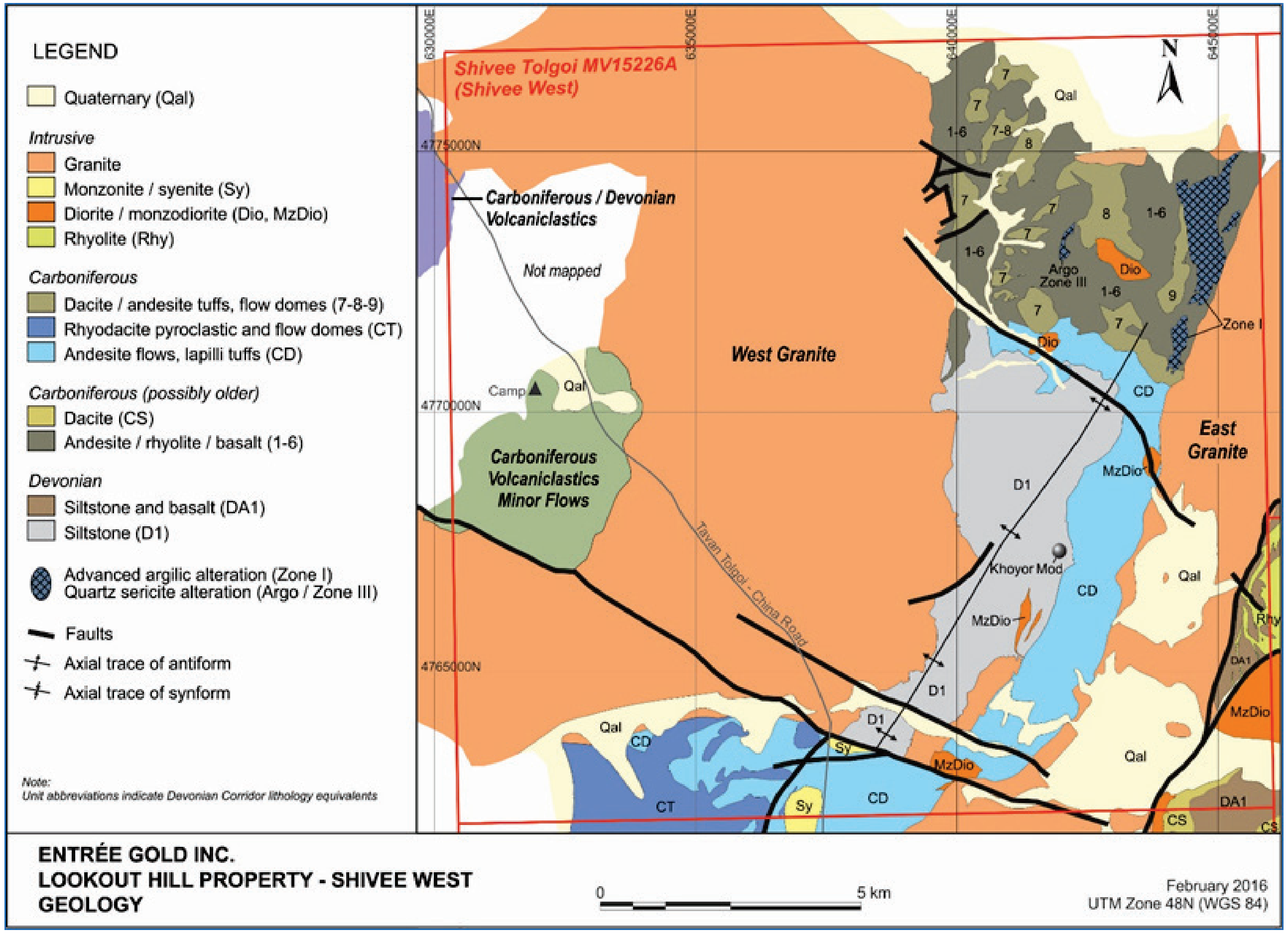


Figure by Entrée 2016

7.4.2 Devonian Corridor

Devonian and Carboniferous sedimentary and volcanic rocks form a north—north-east trending belt (informally known as the 'Devonian Corridor'), underlying the western portion of Shivee Tolgoi ML. The Devonian Corridor is bounded on the east and west by Carboniferous aged granitic plutons (East Granite and West Granite - Figure 7.7). The legend for Figure 7.7 is shown in Table 7.5.

Two drainages, the Tom Gol river and a tributary of Undai Gol, conveniently divide the Devonian Corridor into three geomorphic areas. These areas are also distinguished by the dominant bedrock lithologies:

1) The northern area comprises Devonian volcanics and volcaniclastics and lower to Upper-Carboniferous volcanics;
2) The central area is dominated by Devonian clastic sedimentary rocks with Middle-Carboniferous volcanics to the east; and
3) The southern area is underlain by Middle-Carboniferous volcanics.

7.4.2.1 Devonian Stratigraphy

Devonian lithologies at Shivee West have been assigned that age based on their lithological and geochemical similarities to the dated Devonian sequence at Oyu Tolgoi (including the EJV Property). As well, U–Pb age determinations of detrital zircons from two samples (AP unit D1 on surface and D1 greywacke from core hole EG-05-029) taken by Panteleyev, 2006, see also Mortensen, 2006) are *consistent with a Devonian age. The sample from EG-05-029 underlies Carboniferous lithologies* that outcrop out at surface.

Most of the Shivee West Devonian rocks are fine-grained clastic sedimentary lithologies which are correlated with Oyu Tolgoi Unit DA4b. Overlying and intercalated with these are basaltic volcanics and volcaniclastics.

- **Unit DA4s** (Devonian Alagbayan Group – sedimentary rocks correlated with Oyu Tolgoi Unit DA4b). In the Devonian Corridor the rocks are primarily north—north-east striking fine to medium-grained clastic sedimentary lithologies (siltstone, sandstone, pebble conglomerates) designated as DA4s. The conglomerates are fine-grained, heterolithic, and clast-supported. Maximum pebble size rarely exceeds 2.0 cm. Occasionally, vague to well-developed bedding is observed. DA4s rocks are very dark green to greenish-black or maroon, and well indurated. Bedding is locally very well developed on millimetre to centimetre scale in siltstones and, to a lesser extent, sandstones, but is often obscured by recrystallisation and alteration, particularly in siltstone layers. Siltstones can be preferentially altered by pervasive replacement with albite and epidote. DA4s rocks are interpreted to be deposits resulting from deep water turbidity currents.

- **Unit DA4v** (Devonian Alagbayan Group – volcaniclastic rocks). These are mostly sparsely feldspar porphyritic basaltic to andesitic lapilli tuffs found as narrow horizons within DA4s.

- **Unit DA4a** (Devonian Alagbayan Group – coherent volcanic rocks plus derived autoclastic and hyaloclastite breccias correlated with Oyu Tolgoi Unit DA4a). This unit comprises thin flows or sills of porphyritic augite basalt, flow breccias and hyaloclastite. Presence of amygdules distinguishes this from Oyu Tolgoi Unit DA1b augite basalts (see below). DA4a usually occurs as thin intercalated flows in DA4s. A basaltic sample collected by Panteleyev (2007) has a whole rock signature that, is the same as Oyu Tolgoi Unit DA4a.

- **Unit DA3c** (Devonian Alagbayan Group – carbonaceous sedimentary rocks tentatively correlated with Oyu Tolgoi Unit DA3b). DA3c has not been observed as outcrop but has been logged in drill core from deep holes testing the Tom Bogd IP target. DA3c rocks are clastic carbonaceous siltstones, sandstones and conglomerates. They may be equivalents of Oyu Tolgoi Unit DA3b, although the latter is usually very well laminated.

- **Unit DA1b** (Devonian Alagbayan Group – coherent volcanic rocks plus derived autoclastic rocks correlated with Oyu Tolgoi unit DA1b). These are augite-phenocrystic basalt flows and flow breccias, generally lacking amygdules. A whole rock analysis done by Alan Wainwright and reported in Panteleyev (2007) showed that a pyroxene-bearing basalt west of Zone III had a geochemical signature that was the same as that for Oyu Tolgoi Unit DA1b. Panteleyev (2007) reported that three additional samples, one at the Wainwright site and two other pyroxene-bearing basalts, also had DA1b chemical signatures. Whole rock sampling in 2010 and 2011 also confirmed their presence. At Shivee West, however, they are found stratigraphically above DA4a sedimentary rocks.

- **Unit DA1v** (Devonian Alagbayan Group – volcaniclastic rocks tentatively correlated with Oyu Tolgoi unit Daba). Based on the presence of fiamme in heterolithic lapilli tuff and juxtaposition with DA1b basalts, this unit is interpreted as an equivalent of Oyu Tolgoi unit Daba. It has only been recorded on the western side of the Devonian Corridor, north of Tom Gol.

Figure 7.7 Geology of the Devonian Corridor – Shivee West, Shivee Tolgoi ML

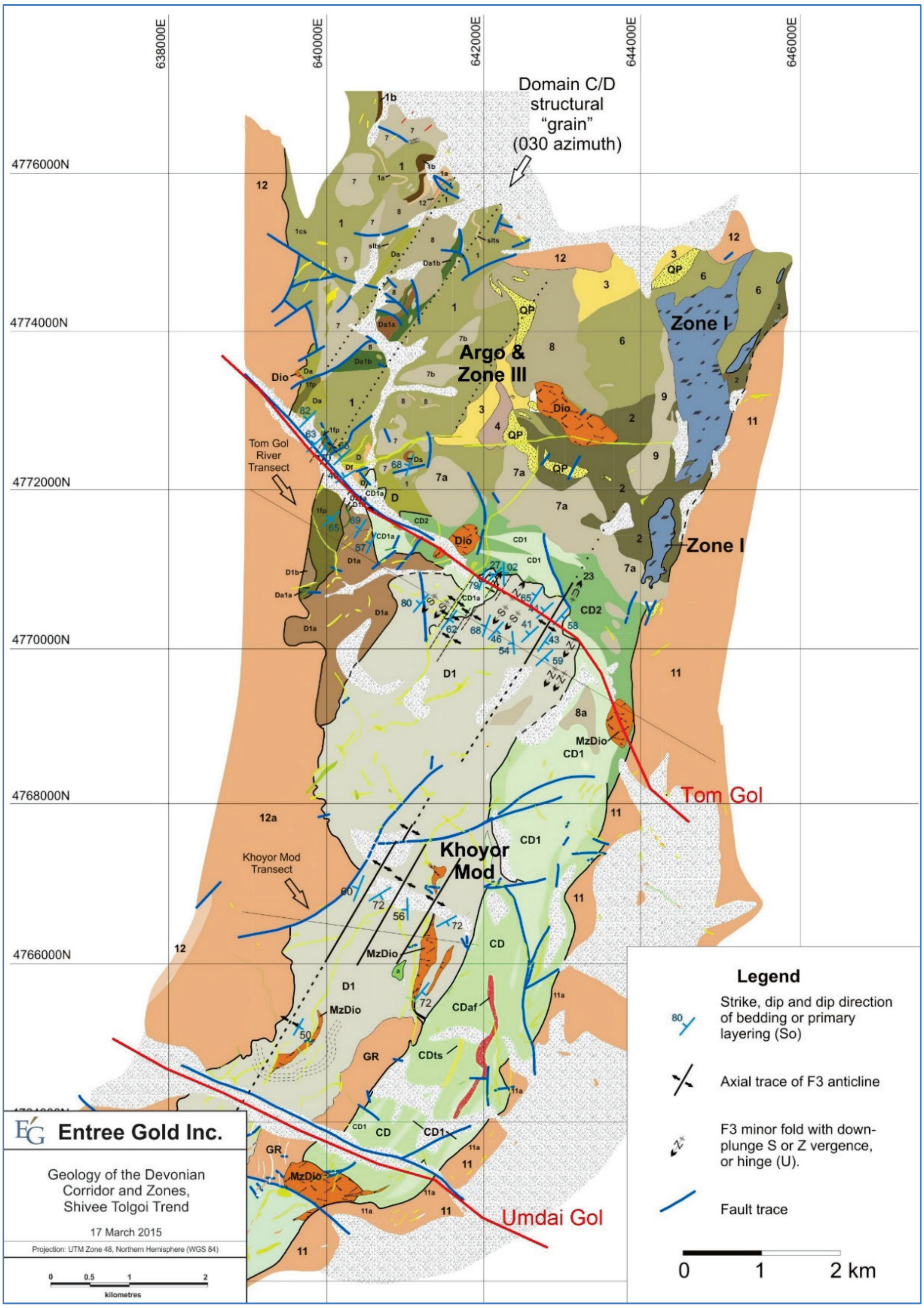


Figure by Entrée 2016

Table 7.5 Legend for Figure 7.7
(after Panteleyev, 2005, 2006, 2007, 2008, 2010, and 2011)

Qal	**Alluvium:** Quaternary alluvium, colluvium and river channel fill
DYKES	
	Mafic Dykes: Mainly andesite, (narrow) basalt dykes are younger
	Hornblende-plagioclase porphyry: Andesite, fine grained to porphyritic, pale to dark grey-green when fresh, weathers bright salmon pink. Massive to platy, locally closely fractured, notably near contacts; also other feldspar porphyries
	'Felsite': Pale grey, cream to buff colour, massive to flow laminated; aphanitic to fine granular ('aplite'). Includes minor quartz-porphyry and rare quartz-K feldspar-biotite bearing granite
	Note: Dykes are shown on the map with exaggerated widths to accentuate their distribution and geometry. They generally range from 2 to 20 metres in width. Mafic dykes (andesite, basalt and pyroxene porphyry) are commonly metre wide, or less, and are not shown
ALTERATION AND MINERALISATION ZONE	
	Zone I. Silica rock (mainly alteration products) rhyolite protoliths wholly, or in part, with hydrothermal silicification. Structurally controlled silicification along 030° trend and 070° extensional fractures; also probably by preferred lithologies. Silicified zones with argillic (illilte, smectite), advanced argillic (alunite, natroalunite, dickite, kaolinte, pyrophyllite, topaz, woodhauseite) and hematite alteration.
INTRUSIVE ROCKS	
13a	**Granite/Syenite: 13a:** brick red granite, quartz syenite. **13b:** hornblende K-feldspar phyric syenite, quartz syenite
GR	**'Central' Granite Stock**: medium to coarse grained pink granite
12	**'West' Granite**: **12**: coarse grained granite. K-feldspar porphyry dykes. **12a**: medium grained biotite-muscovite granite with aplitic matrix
11	**'East' Granodiorite**: **11**:m edium to coarse grained. **11a**: border phase hornblende K-feldspar -phyric dark grey/pink. **11b**: hornblende K-feldspar porphyry dykes +/- quartz
QP	**Quartz (feldspar) porphyry ('rhyolite'):** Grey to pale pink quartz-bearing dykes, sills, small plugs and domes. Zone III (small) dome has autobrecciated carapace and/or flanking breccias that co-mingle with rocks of Unit 3
Dio	**Diorite, monzodiorite:** Fine to medium grained, equigranular

CARBONIFEROUS

Stratigraphic Units

Unit	Description
RD	**Rhyodacite dome**: red brown to dark grey vitrophyric lavas
9	**Dacite/Rhyodacite:**welded ash flows; splintery pale grey, siliceous matrix with lithic lapilli and ash sized clasts. Possibly a flow portion of Unit 8 dacite/rhyolite dome, or precursor pyroclastic flow
8	**Dacite:** 'dome unit 2' - flow domes: extensively flow banded, with (auto)brecciated margins; chocolate brown to dark grey, vitreous to microcrystalline and fine grained with small feldspars but lacking quartz 'eyes'
7b	**Dacitic? andesite:** Dark grey to purple lithic vitric tuffs; compacted, possibly ignimbritic in part. Shown on older maps as either unit 4a or 8b1
7a	**Andesite flows,** lesser tuffs: Fine granular with plagioclase ranging from microlites to euhedral, equant phenocrysts. Thick flows display columnar jointing
7i	**Dacite dome and dyke complex:** In part autobrecciated. Pale aphanitic to cryptocrystalline flow dome and outflow tuffs
7	**Dacitic to andesitic ignimbrite and lithic tuff:** Breccia, lapilli and ash tuffs, extensive ignimbritic outflows. Massive to well layered with compaction, welding and eutaxitic foliation

~~~~~~~~~~~~~~~~ ***Unconformity*** ~~~~~~~~~~~~~~~~

Unit	Description
CD2	**Lithic ash, dust and lapilli tuffs:** Polylithic well layered to massive; locally monolithic with pale felsic clasts, includes welded ignimbritic members and units; minor felsic plugs with autobrecciated carapaces
CD1a	**Crystal ash and lapilli ash tuff:** Pale feldspar grains in dark matrix give distinctive black and white 'salt and pepper' appearance. Mainly massive, homogeneous crystal tuff; bedding rarely evident; accidental lithic clasts are mainly red sandstone of unit D1
CD1	**Plagioclase/porphyry (andesite) flows:** Plagioclase phenocrysts locally 2 cm in size as euhedral laths; 'crowded' porphyry textures
CD, *CD1*	**Andesite** (CD): fine to medium grained plagioclase-phyric flows. Includes hornblende pyroxene basaltic andestie and coarse pyroxene basalt. Dykes, sills and small intrustions. Intruded by coarse plagioclase-phyric andesite equivalent to CD1. Grey dark green, locally purple.
CDts	**Tuffaceous Siltstone** (CDts): dark grey/black.
CD, *Cdaf*	**Polylithic Lapilli Tuff Ashflows (CDaf).** In part biotite and rare quartz bearing dacite ignimbrited.
CD, *CDxaf*	**Polylithic lapilli tuff:**
CDxaf	**Polylithic lapilli tuff and breccias members/units:** lesser ash tuffs in CD. Minor conglomerate.
CDxa	**Basalt:** fine to medium grained, locally plagioclase-phyric flows
CDxaf, *CDx*	**Polylithic Ashflows, Lapilli Tuff:** **Andesite/Dacitic Andesite**: hornblende plagioclase-phyric with rare modal quartz. Commonly epidote altered with pink albitized feldspar. Lithologically similar to CD.

~~~~~~~~~~~~~~~~ ***Unconformity*** ~~~~~~~~~~~~~~~~

CARBONIFEROUS (possibly older)

Unit	Description
6	**Basalt/BasalticAndesite:** fine to medium grained pyroxene-bearing flows, minor flow breccias and lapilli tuff members. Plagioclase is present mainly as microlites in andesite flow units with phenocrysts up to 3 mm in size.
4	**Dacite:** Grey to mauve and purple, flow banded, vitreous to very fine granular feldspathic rock; (small) dome-forming unit ('Dacite dome unit 1')
3	**Rhyolite tuff and breccia:** Pale cream to grey, monomictic and locally polymictic pyroclastic rocks; lesser massive flows and/or dykes, in part autobrecciated. Quartz present as small grains or as microcrystalline constituent
2	**Volcanic sandstone and basaltic flows:** Bedded sequence of dominantly lithic andesitic tuffs, epiclastic sandstone and volcanic wacke; lesser thin basalt flows (sills?) many amygdaloidal or vesicular
1fp	**Crystal ashflow (porphyry?):** Flow dome? in part. Plagioclase with rare quartz and K-feldspar grains in densly welded vitric matrix. Mainly massive homogeneous holocrystalline, locally foliated. Outflow ignimbrite ***(1af)*** in south with welded vitric base
1cs	**Andesite porphyry plagioclase phyric flows:** Coarse grained equivalent to Unit 1
1b	**Quartzose arkose**, quartzite. Massive to locally well layered, medium to coarse grained
1a	**Siltstone**, fine grained sandstone, thin bedded
1 / Slts	**Basaltic andesite, andesite, basalt?:** Widespread fine granular pyroxene and plagioclase microlite to phyric flows with characteristic pink feldspars and epidote grains. Includes extensive polymictic tuff breccia, lapilli and ash tuffs, lesser units siltstone ***(Slts)*** and pale thin bedded to laminated tuffaceous sediments (felsic dust tuffs?). Rare mafic tuff units shown as vvvv

DEVONIAN?

Unit	Description
Da	**Basalt:** Fine grained, massive; lesser pyroxene-phyric. Includes greywacke beds and lenses***(SSt)***, interbedded siltstone; rare dirorite sills and dykes

DEVONIAN

Unit	Description
Ds	**Siltstone:** Thin bedded to massive mafic tuffaceous sediments, indurated. Present as thin units or interbeds in basaltic rocks of unit ***D***
Df	**Dacite:** Cream pale grey massive aphanitic to fine-granular; locally autobrecciated thin bedded to laminated (flow banded?); conchoidal fracturing, splintery with chloritic fracture filling
D	**Basaltic (trachy) andesite:** Includes fine grained homogeneous basalt flows petrochemically similar to Oyu Tolgoi unit ***DA4***, also densily welded basaltic hyaloclastite tuffs and fine grained indurated mafic ash tuffs similar to Oyu Tolgoi unit DAba; volcanic sandstone and siltstone interbeds
DA1b	**Pyroxene basalt:** Augite porphyritic to fine grained flows, in place amygdaloidal with amoeboid-shaped vesicles with chlorite infilling. Petrochemically similar to Oyu Tolgoi unit DA1b. Rare siltstone and greywacke lenses and interbeds. Polylithic volcanic breccia locally at contact with Unit***1*** and ***DA1a***
DA1a	**Siltstone:** Dark grey to brown and black, massive with rare evident bedding, similar to unit Ds; lesser greywacke
D1b / *pyroxene basalt*	**Mafic lithic lapilli and ash tuff, breccia, greywacke:** Includes pyroxene-phyric basalt flows. Most southerly outcrops shown on map have coarse pyroxene phenocrysts to 6 mm, lithologically similar to Oyu Tolgoi unit***DA1b***
D1a	**Siltstone, fine grained sandstone:** Includes lesser mafic tuffaceous rocks and/or thin flows or sills of pyroxene basalt. Dark grey to dark green black thin beds
D1	**Siltstone, sandstone, greywacke (volcanic sandstone):** Minor pebble conglomerate. 'Red beds' where oxidised, mainly along northern map unit exposures. In places variegated red/purple-green thin bedded units. Coarser clastic and thick bedded to massive sections are dark green/black, as throughout the central and southern part of map area and further south

From OT LLC

7.4.2.2 Carboniferous Stratigraphy

Unconformably overlying the Devonian stratigraphy are Carboniferous mafic to felsic volcanic rocks and derived sedimentary rocks. The Carboniferous volcanics are generally north striking, feldspar porphyritic intermediate-to-felsic volcaniclastic rocks, maroon to pale green in colour. The volcaniclastic rocks (in large part pyroclastic flow deposits) are usually heterolithic, poorly sorted to unsorted, with vague bedding; occasionally very well laminated base surge tuffs can be observed. Welded textures (fiamme, rheomorphic flow folding) are common.

The Carboniferous stratigraphy can be sub-divided into a number of mapping units, based on common characteristics (phenocryst abundance, and composition, presence of flow banding, and magnetics). In his 1:10,000 mapping, Panteleyev recognised lower, middle, and upper volcanic assemblages (Table 7.5). His mapping units have since been rationalised and simplified in 2012 to correlate geologic units over several mapping areas, and to reconcile surface geology with drillhole geology.

The first four mapping units described below comprise the lower volcanic / sedimentary assemblage.

- **Unit CS1**. The lowermost volcanic assemblage, CS1, is dominated by feldspar phyric basaltic to andesitic volcaniclastics (CS1v), basaltic to andesitic flows (CS1f), and intercalated sedimentary rocks (CS1s). Not seen in outcrop but present in drill core are carbonaceous clastic sedimentary rocks (CS1c). CS1 lithologies unconformably overlie the Devonian rocks of the Devonian Corridor, and may have undergone a deformation event prior to the deposition of succeeding Carboniferous units, such that the next four mapping units may constitute a separate lower to middle volcanic assemblage.

- **Unit CS2**. The CS2 volcanic assemblage is a bedded sequence of andesitic lithic tuffs (CS2v), volcaniclastic sandstone (CS2s), and thin amygdaloidal and vesicular basaltic flows (CS2f). These rocks outcrop primarily to the north of the Tom Gol.

- **Unit CS3**. CS3 rocks are felsic (dacite to rhyolite) volcaniclastic rocks (CS3v). There may be intercalated massive to auto-brecciated flows. Most CS3 rocks are obviously quartz-bearing with quartz phenocrysts – the massive flows are highly siliceous but lack quartz phenocrysts, and may be sub-volcanic intrusives. Occasionally, welding (CS3w) can be observed. Hyaloclastite (CS3v–5hxbx) is present, especially noted in RC drillhole chips. CS3 breccias can be monolithic (probable flow breccias) or heterolithic, and may in part be hydrothermal breccias.

- **Unit CS4**. CS4 dacite volcanics have only been recognised in the Zone III area. These are generally well banded welded to flow-banded tuffs, informally called ‘zebra rock’ because of their characteristic centimetre-scaled light and dark bands.

- **Unit CS6**. CS6 comprises fine to medium-grained pyroxene-bearing flows and related flow breccias (CS6f) and lapilli tuffs (CS6v). Plagioclase is present as microlites and as phenocrysts up to 3.0 mm in size. Similar to Unit CS2, CS6 crops out mostly to the north of the Tom Gol.

Correlation with Oyu Tolgoi mapping units has not been established. However, the overall stratigraphic position suggests that the CS1 and CS2 units are in part equivalent to Oyu Tolgoi units CS1 (andesitic volcaniclastics) and CS2 (clastic sedimentary rocks and basaltic volcanics). CS3 rhyolitic and CS4 dacitic volcanics at Shivee West are likely local phenomena, and may not have any equivalent in the Oyu Tolgoi mapping scheme.

An unconformity separates the lower volcanic / sedimentary and middle volcanic assemblages.

- **Unit CS10**. Unit CS10 is a distinctive, coarsely feldspar porphyritic basaltic to andesitic flow, flow breccia and volcaniclastic mapping unit with peperite inclusions (CS1b). Plagioclase feldspar laths may be up to a couple of centimetres in length. Crowded porphyritic texture is common in CS10 andesites. Peperite lenses, sometimes preserving contorted sedimentary laminations, have been observed in drill core. Coarse volcaniclastics in CS10 have been correlated with OT unit CS3c_2 (also known as basaltic andesite tuff (Bat), Panteleyev 2006). CS10v (volcaniclastics) are andesitic tuffs, lapilli tuffs, and heterolithic dacitic ash flows; the latter may form persistent mapping horizons within CS10. CS10 lithologies are primarily found south of the Tom Gol on the east flank of the Devonian Corridor, and south of the Undai Gol tributary. Two samples of CS10 have ages of 353.2 ± 1.1 Ma and 353.3 ± 0.4 Ma (Davis, 2006).

A second unconformity separates the middle and upper volcanic assemblages.

- **Unit CS7**. CS7 comprises andesitic to dacitic volcaniclastics (CS7v) and flows (CS7f). Pyroclastic flow deposits are usually heterolithic – eutaxitic foliation and welding are common. CS7 volcanics north of the Tom Gol form most of the highest and most rugged relief on Shivee West.

- **Unit CS8**. CS8 lithologies also form significant relief in the Devonian Corridor. These rocks are usually finely flow-laminated dark purple to chocolate brown magnetic dacite ash flows (?) or flow-laminated flows forming a dacite dome. In the area of Zone III there are carapace breccias on the western margin of a large CS8 flow domes.

- **Unit CS9**. The uppermost (?) stratigraphic mapping unit consists of dacitic welded ash flows. Although separate from the main CS8 dome, CS9 may be the lowermost part of that unit.

- **Unit 13**. Zone I is a persistent area of argillic, advanced argillic and siliceous alteration along the east side of the Devonian Corridor. It has been dated, based on a single alunite determination, to 341 Ma. Portable Infrared Mineral Analyser (PIMA) determinations by Thompson (2004) indicate the presence of dickite, pyrophyllite, kaolinite, montmorillonite, illite, illite / smectite, alunite, natroalunite, and the alumino-phosphate mineral woodhouseite. The alteration has destroyed original volcanic and sedimentary textures. For mapping convenience, the alteration has been treated as a separate unit (Unit 13, Panteleyev 2004, 2005). Nonetheless, geophysics, in particular magnetics, suggests that at least two of the Carboniferous mapping units (CD2 and CD6) on either side of Zone I can be traced through the alteration without any significant offset.

7.4.2.3 Intrusive Rocks

Intrusive rocks in the Devonian Corridor have been assigned to four suites. None have been shown to be of Devonian age, although the monzodiorite dykes within DA4s sedimentary rocks at Khoyor Mod may be late Devonian to early Carboniferous in age. From oldest (?) to youngest, these are:

- **Syngenetic Dyke (SD) Suite**. Dykes and possibly sills of no persistent strike length that cannot be shown to extend beyond the mapping unit that hosts them. Most are basaltic to andesitic dykes; some brecciated dacitic dykes within the Zone III area that appear to be confined to unit CS3 have been placed into this mapping unit.

- **Granitic Plutonic (GP) Suite**. Large Carboniferous composite plutons, usually medium-grained to weakly feldspar-porphyritic intermediate to felsic rocks. The Western Granite and Eastern Granite intrude the western and eastern boundaries respectively of the Devonian Corridor. South of Khoyor Mod, the Central Granite is a small granitic pluton intruding DA4s rocks.

- **Monzonite Plutonic (MP) Suite**. May in part be Devonian. These are syn-tectonic to late-tectonic mafic (diorite, monzodiorite) plutons and dykes within volcanic / sedimentary sequences. A diorite stock and a late hornblende plus feldspar dyke south of Undai Gol have ages of 350.9 ± 0.4 Ma and 341.3 ± 0.4 Ma (Davis, 2006).

- **Late Dyke (LD) Suite**. Late syenitic to felsic dykes, usually cutting all other plutonic suites. A late syenitic dyke assigned to this suite is a distinctive salmon pink to orange weathering hornblende plagioclase porphyry that represents a later intrusive event around 312.9 ± 1.5 Ma (Davis, 2006; Panteleyev, 2007) Felsic dykes are dacite to rhyolite in composition, and can have hornblende, feldspar and quartz phenocrysts. A late hornblende + feldspar dyke cutting CS10 units south of Undai Gol was dated at 341.3 ± 0.4 Ma (Davis, 2006).

7.4.3 Metamorphism and Structure

Devonian clastic rocks of Shivee West have undergone a pervasive mild regional metamorphism (prehnite–pumpellyite to low-grade greenschist facies) during deformation. This has imparted a very subtle foliation that is rarely measurable in the field. No significant stretching or flattening of pebbles or volcanic clasts is apparent. Carr (2007) studied core from EG-05-031, a drillhole that tested DA4s sedimentary rocks. The hole encountered poly-deformed clastic sedimentary rocks interpreted as Devonian, with tight F2 folds that fold bedding and an older local cleavage. Carr also observed two generations of spaced chlorite-bearing cleavages in the hinges of tight folds, or as sets of spaced, parallel cleavage planes oriented at a systematic angle with respect to bedding. From this, it was suggested that mineral growth logged as alteration mineralisation actually formed during regional metamorphism, and should be considered to be part of the mineral assemblage pervasive in the rock.

The Devonian stratigraphy in the Devonian Corridor forms an anticline, formed by strongly folded north-east striking sedimentary rocks, in which the geometry of the Devonian rocks is controlled by moderately south-west plunging asymmetric F3 folds (Carr, 2007). The anticline core comprises clastic sedimentary rocks equivalent to Oyu Tolgoi Unit DA4b. Dips are steep to sub-vertical, except in the nose of the anticline. Way-up criteria are almost exclusively confined to graded bedding; cross-stratification and flame structures are rarely observed. The clastic sedimentary rocks are generally upward facing, although there can be occasional bedding reversals. North of Tom Gol, clastic fiamme-bearing lapilli tuffs (Oyu Tolgoi Unit Daba?) and pyroxene-bearing basalts equivalent to Oyu Tolgoi Unit DA1b appear to conformably overlie the DA4b equivalents. This suggests the Devonian stratigraphic sequence at Shivee West is normal, and unlike the Oyu Tolgoi geology, lacks significant thrust faulting.

Carboniferous stratigraphy appears to be moderately dipping to relatively flat-lying. 'Way-up' criteria are usually always normal facing, with the exception of an area east of Zone III, where clastic sedimentary rocks assigned to CS2 show overturned and normal facing directions. No pervasive deformation is apparent in Carboniferous rocks on surface. However, the lowermost CS1 units appear to exhibit a subtle deformation lacking in the overlying middle and upper volcanic units. Strong foliation was observed in drill core of Carboniferous volcaniclastic rocks from two deep holes drilled on the Tom Bogd target. This deformation is attributed to the influence of a major shear zone of uncertain orientation.

Faults have not been extensively mapped in bedrock exposures of the Devonian Corridor. Most faults are interpreted from offsets in bedding or lithology across areas of overburden, by topographic lows exploited by the local drainage pattern, and by interpretation from geophysical and geochemical surveys. A fault may separate the Devonian and Carboniferous sequences on the east side of the Devonian Corridor but cannot be confirmed. There is also a prominent set of west–north–west trending faults (see Figure 7.8) that have strongly influenced the local drainage pattern.

7.4.4 Geology of the South-east Corner of Shivee West (Devonian Wedge)

The Devonian Wedge describes a triangular area of volcanic rocks and Qmd intrusions at the south–east corner of Shivee West (Figure 7.6). The northern apex of the 'wedge' starts at the Shivee West / Oyu Tolgoi boundary and continues 6 km south to the Shivee West southern boundary at approximately 4,762,400 mN. The south–western corner of the wedge is approximately 2 km west of the Oyu Tolgoi ML, near the contact of the East Granite. A major ductile shear zone with broad zones of cataclastic rocks, including mylonites, is developed along this contact, marking the western limit of the Devonian Wedge.

The Devonian Wedge appears to be a western extension of the Devonian succession at Hugo North deposit. Thin bedded to laminated black siltstone and pyroxene basalt units in the northern and western part of the wedge are identical to rocks of Oyu Tolgoi map units Dala (Vatl) and Da1b (Va). Further south are dacitic welded ash flows and coarse pyroclastic rocks that appear to be equivalent to Oyu Tolgoi map units Da2a, Da2b units, and thin bedded siltstone of probable Da3 affinity. A medium-grained, red-weathering quartzose monzodiorite that intrudes the pyroxene basalts is transected by the north–south property boundary.

Penetrative foliation is common in the Devonian volcanic and sedimentary rocks, especially upon approaching the cataclastic zone separating the Eastern Granite from the supracrustal rocks. This foliation predates emplacement of the numerous felsic dykes in the area.

7.4.5 Geology of the Camp Area

The informally named 'Camp Area' (also known as Baruun Grid) is the mapped area between the project camp and the West Granite (Figure 7.7). The Camp Area is underlain by predominantly dacitic pyroclastic rocks with subordinate rhyodacite and andesitic to basaltic units. All are interpreted to be Carboniferous in age. Some of the ignimbritic andesite rocks are lithologically similar to rocks of Oyu Tolgoi map unit CS1. The volcanic central part of the mapped area is flanked to the east and south by plutonic rocks. The eastern contact is intrusive, the south-western contact is faulted.

Country rocks in the northern two-thirds of the map area are primarily dacitic lapilli and ash tuffs made up of polylithic red-green and pale buff felsic clasts, with rare block-ash members (map unit 5). The aphanitic to fine granular clasts are matrix-supported and are deposited mainly as poorly sorted to massive, thick pyroclastic airfall accumulations with lesser pyroclastic flows. Bedding attitudes in tuff units are irregular but an overall north–east strike to volcanic layering and fold hinges is evident.

The southern and south-western region comprises four map units. The most westerly unit contains lapilli and ash tuffs with polylithic clasts, mainly andesite with lesser pyroxene basalt. These mafic rocks might extend further to the north and north–east as thin units or tapering lenses, but that region is largely covered by alluvium. The west–central map area is underlain by a thick accumulation of sub-aerial, dark grey-green coarse pyroclastic rocks with mafic to intermediate compositions. In places there is faint layering evident in the rocks resulting from orientation of clasts and weak flow layering. These rocks resemble the andesitic ignimbrites in the Oyu Tolgoi section designated as unit CS1 and are locally vesicular, blocky jointed, hard and durable.

The southern part of the map area has dacitic to rhyodacitic ashflows and coarser pyroclastic airfall lapilli and crystal-lithic ash tuffs. In the western part of the region there is an abundance of dark, massive to well jointed outcroppings of crystal ash tuffs. The rocks are made up of approximately equal amounts of black aphanitic to very fine-grained matrix and euhedral pale grey to chalky white plagioclase crystals of 1.0–3.0 mm in size. The rocks superficially resemble medium-grained, homogeneous diorite but invariably carry rare to abundant rounded polylithic lapilli clasts in crystal ash tuff matrix. Rhyolite and dacite plugs are emplaced in the tuffs.

The most south–easterly map unit consists of thin-bedded dust and ash tuffs, laminated and flow-banded / layered ashflows of dacite to rhyodacite and possibly rhyolite composition. The siliceous rocks are pale grey to buff coloured but can display weak iron staining derived from a small amount of oxidised pyrite. Some of the succession includes conglomeratic and fine-grained clastic lenses probably deposited as reworked, epiclastic deposits.

The plutonic body to the east and south of Shivee Camp is a pink to grey, medium to coarse-grained, equigranular to porphyritic granodiorite. Contact relationships between it and the host rock volcanics are different between the south–west and east. The contact 2–3 km east of camp is intrusive and is cut by a number of dykes that can be traced across the contact. It strikes roughly north–south and appears to be shallow dipping, at least in places. The intrusive contact in the south-west, approximately 3 km from camp, is faulted. The pluton contact is steeply dipping, strikes north-west, and is probably a large-scale structure of regional significance.

Two types of small intrusions, emplaced in the volcanic rocks, form a number of plugs and a multitude of dykes. The more abundant and widespread are massive to fine-grained and weakly plagioclase-phyric plugs, bulbous dykes, and possibly sills of dacite or latite. The larger dacite plugs are up to 200 m in size, but generally are much smaller. A single small stock of pale grey to cream coloured, aphanitic siliceous, flow banded rhyolite forms an elongate body about 200 m in length. A number of small dykes project outward from the central plug.

A large number of dykes are present, many in closely spaced, sub-parallel arrays probably marking old faults or extensional fracture zones. The majority of the dykes are steeply dipping to nearly vertical, but some have shallow dips and might be sills. Five main types are recognised according to their different compositions and cross-cutting relationships; all but the oldest dykes cut the granitic pluton.

The most abundant dykes are hornblende–plagioclase porphyry of apparently dioritic / andesitic composition. They occur throughout the Shivee Tolgoi map areas where they have been referred to in previous reports on the basis of their orange to pink weathered appearance as pseudosyenite.

7.4.6 Alteration and Mineralisation

To date, no economic zones of precious or base metals mineralisation have been outlined on Shivee West, however, zones of gold and copper mineralisation has been identified at Zone III / Argo Zone, Khoyor Mod and at Zone I, respectively (Figure 7.7). These are described in more detail below.

7.4.6.1 Zone III / Argo Zone

Gold mineralisation at Zone III and Argo has been traced over 700 m along strike and forms two distinct shallow zones hosted by quartz veined felsic volcanic rocks (Figure 7.8). Mineralisation remains open in several directions.

The area of gold mineralisation at Argo Zone has been defined by 23 RC drillholes, excavator trenching and surface sampling. The zone measures approximately 400 m long by up to 130 m wide. Zone III, as defined by outcrop, trenching, and drilling measures approximately 150 m north–south by 150 m east–west. The geometry, and therefore the true width of mineralisation, has not been determined.

At Zone III and Argo Zone, gold is associated with chalcedonic to fine granular quartz veinlets. The host rocks are siliceous and weakly clay altered, derived both from primary rhyolitic volcanic deposits and hydrothermally altered rocks. The clay minerals include illite, kaolinite, and mixed layer of illite–smectite. The siliceous altered zones are pyritic in places with pervasive and fracture-controlled fine-grained pyrite that locally can form up to 10% of the rock. Gold mineralisation in these silicified and pyritised zones is erratically distributed. The chalcedonic quartz veins appear to be small and formed in narrow zones as fracture fillings in the brittle, siliceous host rocks. No strong or dominant structural controls are evident.

Trench sampling in 2011 at Zone III returned 0.69 g/t Au over 6.0 m and a separate interval of 1.44 g/t Au over 6.0 m. Previously, trench and outcrop sampling returned gold values of up to 0.51 g/t Au over 22 m and 1.39 g/t Au over 18 m. Numerous grab samples of siliceous material in the Zone III area have returned between 0.2–29.2 g/t Au.

At the Argo Zone, hole EGRC-11-112 returned 14 m of 1.82 g/t Au and hole EGRC-11-111 returned 3.0 m of 2.21 g/t Au. Hole EGRC-11-123, located near the centre of Zone III, returned 8.0 m of 2.08 g/t Au. Sampled lengths may not reflect the true width of mineralisation.

Two very high-grade chip samples were taken to evaluate a quartz stockwork in dacitic volcanic rocks 50 m south–east of the nearest Argo Zone RC drillhole and returned 42.4 g/t Au over 4.0 m and 19.3 g/t Au over 3.0 m.

7.4.6.2 Khoyor Mod

Khoyor Mod is located approximately 6 km south of Argo (see Figure 7.7) and comprises a 250 m x 300 m area of quartz stockwork within Devonian sediments which are locally cut by syenite and monzodiorite intrusive bodies. The stockwork is anomalous in gold (trace to 0.58 g/t Au) and copper (67–505 ppm) and is indicative of a porphyry target. The zone has not been drill tested.

7.4.6.3 Zone I

Zone I is located 1.5 km east of Zone III / Argo Zone (see Figure 7.7) and is a prominent 2 km long area of argillic and advanced argillic alteration. This zone has received considerable attention using mapping, RC and core drilling, geophysics (IP), and excavator trenching. It features several texture-destructive alteration assemblages, imposed on intermediate to felsic Carboniferous volcanic and intrusive rocks. Dating of primary hydrothermal alunite from the southern end of Zone I returned early Carboniferous dates of 323 Ma and 328 Ma; however, the dates may have been reset by an adjacent probably Carboniferous intrusive body.

The silicified rocks that define Zone I form a discrete region of coalescing northerly trending ridges that outline a topographically prominent highland feature about 1.0 km by 3.8 km in size. The zone is dominated by large mounds of massive pale grey to cream coloured chalcedonic, cryptocrystalline to locally very fine granular quartz. In addition, steeply dipping ribs or 'ledges' form essentially massive silica bodies some metres to a few tens of metres in width. The host rocks for the silica ribs are rarely exposed but where they are, the rocks are propylitic volcanics.

In the few places where quartz veins are present in the massive silica rocks they occur in small zones and form white dilational gash fillings, short en echelon curvilinear lenses and weakly developed stockworks. The vein margins are not sharp and distinct against their siliceous host rocks and tend to blend into them.

The best drill results from Zone 1 were 0.1–0.2% Cu over widths of 2.0–4.0 m.

Figure 7.8 Zone III / Argo Zone Compilation – Shivee West

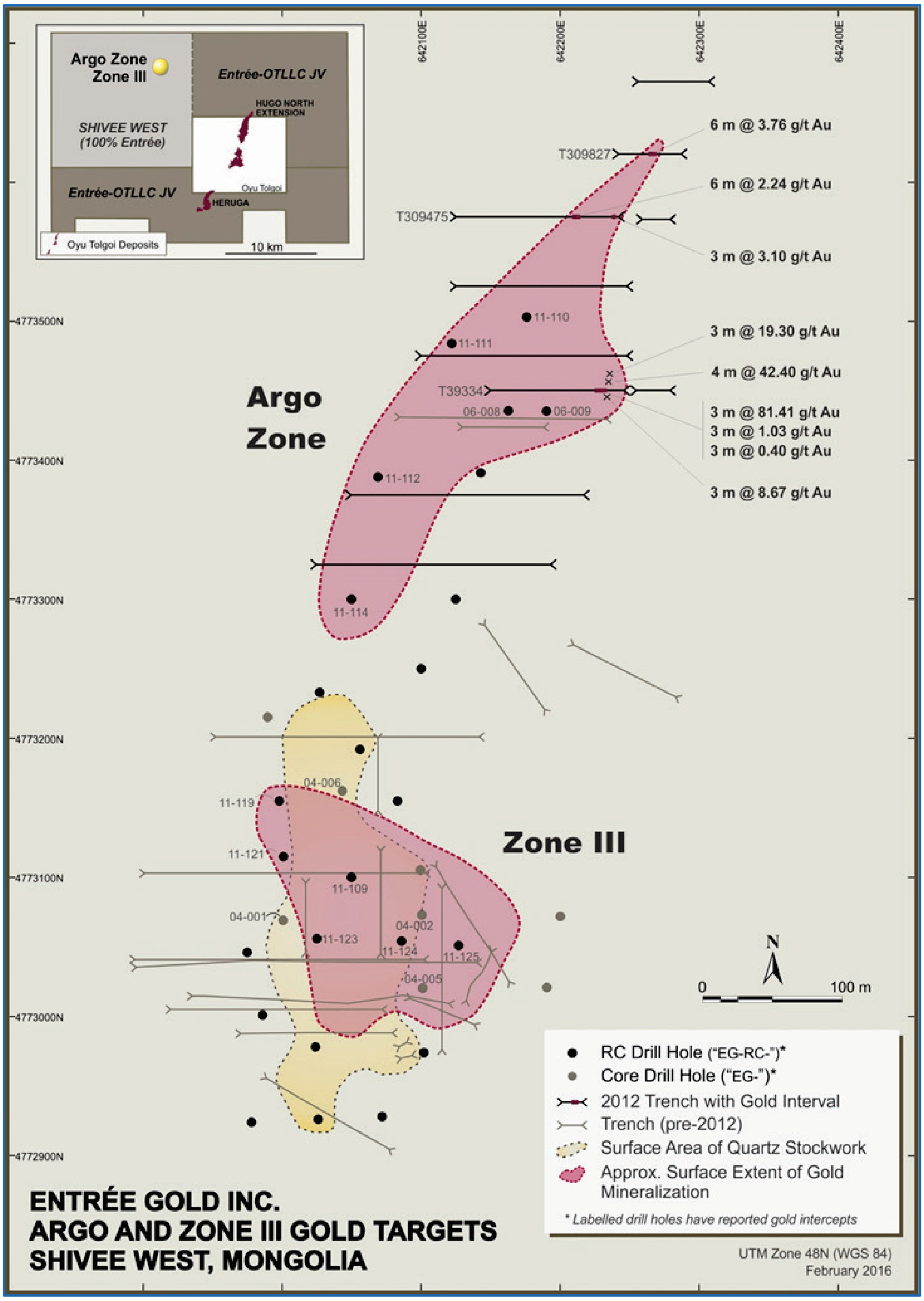


Figure by Entrée 2016

8 DEPOSIT TYPES

The Oyu Tolgoi group of deposits (Heruga, SOT, Hugo South, Hugo North and Hugo North Extension) are considered to be typical porphyry copper–gold deposits based on their styles of alteration and mineralisation, spatial and genetic association with intrusive units, moderate grades, and large size.

On Shivee West, the Zone III/Argo zone is typical of a low-sulphidation epithermal gold deposit based on the quartz±sericite alteration, quartz veins and stockwork, felsic volcanic association, restricted size, and the Au-As-Sb geochemical signature. Zone I alteration represents a moderately-sized high-sulphidation (also called advanced argillic alteration) zone (quartz-alunite-pyrophyllite-topaz-kaolinite-illite) but with low base and precious metal values.

High-sulphidation alteration may be transitional with the deeper porphyry copper environment, and the upper parts of the Central and Hugo South deposits on the Oyu Tolgoi ML display variable zones of high-sulphidation alteration with significant copper–gold mineralisation.

Deposit descriptions of copper–gold porphyries, and high-sulphidation epithermal and low-sulphidation epithermal deposits are taken from Panteleyev (1995, 1996a, and 1996b).

8.1 Porphyry Copper Geology

Porphyry-copper systems commonly define linear belts, some many hundreds of kilometres long, and some occurring less commonly in apparent isolation. The systems are closely related to underlying composite plutons, at paleo-depths of 5–15 km's, which represent the supply chambers for the magmas and fluids that formed the vertically elongate (>3 km) stocks or dyke swarms and associated mineralisation.

Commonly, several discrete stocks are emplaced in and above the pluton roof zones, resulting in either clusters or structurally controlled alignments of porphyry-copper systems. The rheology and composition of the host rocks may strongly influence the size, grade, and type of mineralisation generated in porphyry-copper systems. Individual systems have life spans of circa 100,000 years to several million years, whereas deposit clusters or alignments, as well as entire belts, may remain active for 10 million years or longer.

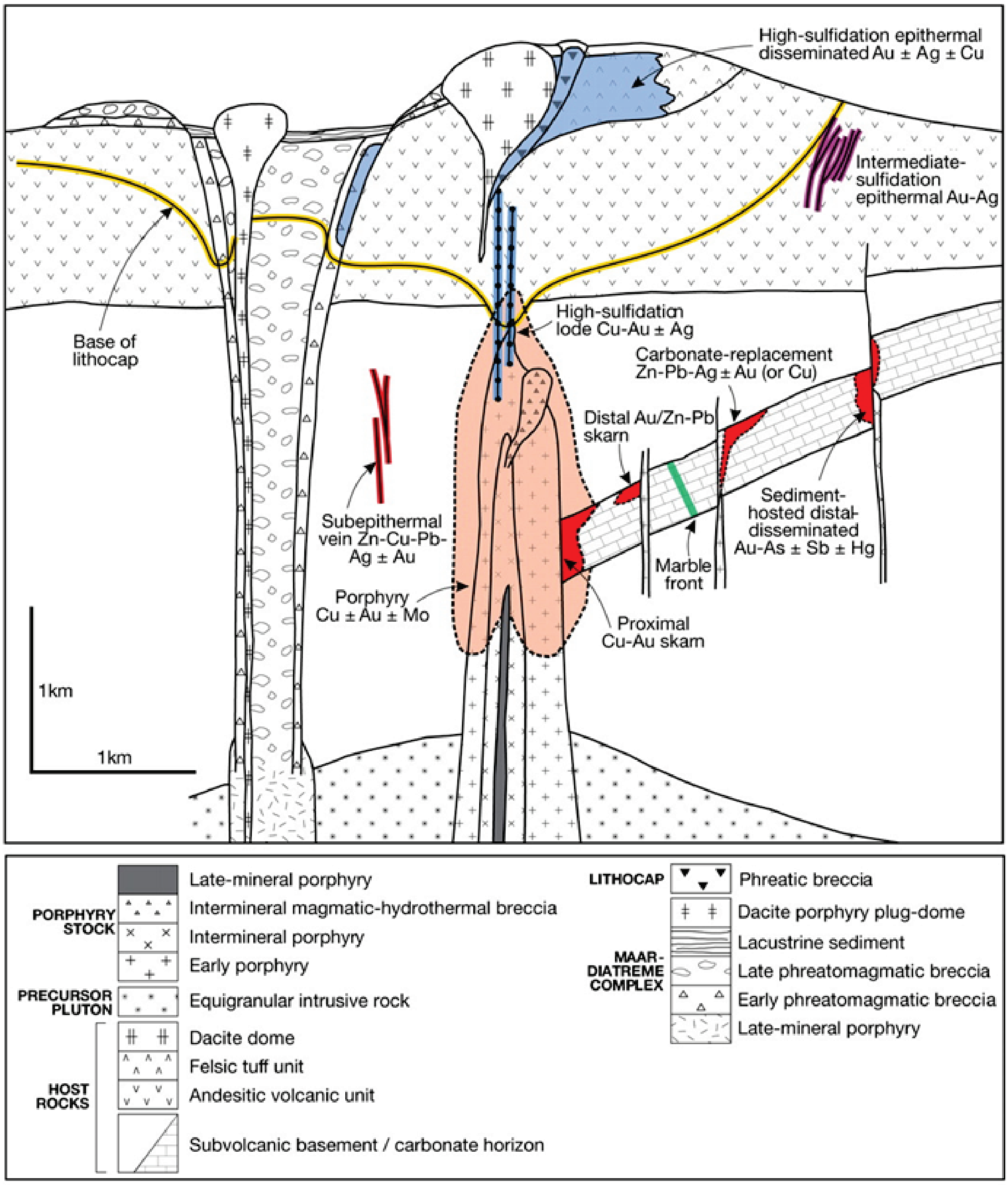
Deposits are typically semicircular to elliptical in plan view. In cross-section, ore-grade material in a deposit typically has the shape of an inverted cone with the altered, but low grade, interior of the cone referred to as the 'barren' core. In some systems, the barren core may be a late-stage intrusion.

The alteration and mineralisation in porphyry-copper systems are zoned outward from the stocks or dyke swarms, which typically comprise several generations of intermediate to felsic porphyry intrusions. Porphyry copper–gold–molybdenum deposits are centred on the intrusions, whereas carbonate wall rocks commonly host proximal copper–gold skarns and less commonly, distal base metal and gold skarn deposits. Beyond the skarn front, carbonate-replacement copper and/or base metal–gold deposits, and/or sediment-hosted (distal-disseminated) gold deposits can form. Peripheral mineralisation is less conspicuous in non-carbonate wall rocks, but may include base metal or gold-bearing veins and mantos. Data compiled by Singer et al. (2008) indicate that the median size of the longest axis of alteration surrounding a porphyry copper deposit is 4–5 km, while the median size area of alteration is 7–8 km^2.

High-sulfidation epithermal deposits may occur in lithocaps above porphyry-copper deposits, where massive sulfide lodes tend to develop in their deeper feeder structures, and precious metal-rich, disseminated deposits form within the uppermost 500 m.

Figure 8.1 shows a schematic section of a porphyry-copper deposit, illustrating the relationships of the lithocap to the porphyry body and associated mineralisation styles.

Figure 8.1 Schematic Section of Porphyry-Copper Deposit



Note: Figure from Sillitoe (2010).

8.2 Porphyry Mineralisation

Porphyry-copper mineralisation occurs in a distinctive sequence of quartz-bearing veinlets as well as in disseminated forms in the altered rock between them. Magmatic-hydrothermal breccias may form during porphyry intrusion, with some breccias containing high-grade mineralisation because of their intrinsic permeability. In contrast, most phreatomagmatic breccias, constituting maar–diatreme systems, are poorly mineralised at both the porphyry copper and lithocap levels, mainly because many such phreatomagmatic breccias formed late in the evolution of systems, and the explosive nature of their emplacement fails to trap mineralising solutions.

Copper mineral assemblages are a function of the chemical composition of the fluid phase and the pressure and temperature conditions affecting the fluid. In primary, unoxidised or non-supergene-enriched ores, the most common sulfide assemblage is chalcopyrite ± bornite, with pyrite and minor amounts of molybdenite. In supergene-enriched ores, a typical assemblage can comprise chalcocite + covellite ± bornite, whereas in oxide ores a typical assemblage could include malachite + azurite + cuprite + chrysocolla, with minor amounts of minerals such as carbonates, sulfates, phosphates, and silicates. Typically, the principal copper sulfides consist of millimetre scale grains, but may be as large as 1–2 cm in diameter and, rarely, pegmatitic (larger than 2 cm).

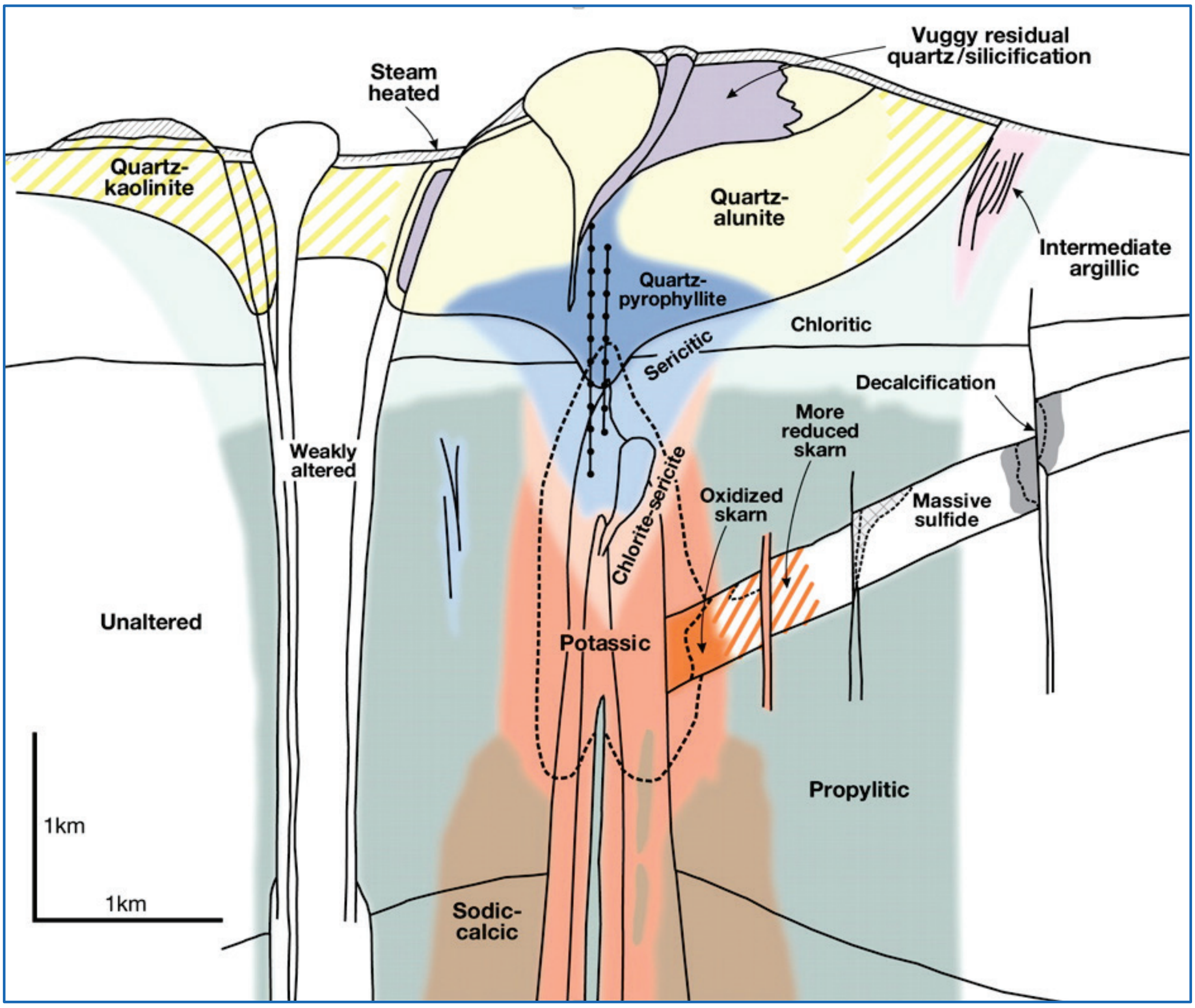
8.3 Porphyry Alteration

Alteration zones in porphyry-copper deposits are typically classified on the basis of mineral assemblages. In silicate-rich rocks, the most common alteration minerals are K-feldspar, biotite, muscovite (sericite), albite, anhydrite, chlorite, calcite, epidote, and kaolinite. In silicate-rich rocks that have been altered to advanced argillic assemblages, the most common minerals are quartz, alunite, pyrophyllite, dickite, diaspore, and zunyite. In carbonate rocks, the most common minerals are garnet, pyroxene, epidote, quartz, actinolite, chlorite, biotite, calcite, dolomite, K-feldspar, and wollastonite. Other alteration minerals commonly found in porphyry-copper deposits are tourmaline, andalusite, and actinolite. Figure 8.2 shows the typical alteration assemblage of a porphyry-copper system.

Porphyry-copper systems are initiated by injection of oxidised magma saturated with sulfur- and metal-rich, aqueous fluids from cupolas on the tops of the subjacent parental plutons. The sequence of alteration and mineralisation events is principally a consequence of progressive rock and fluid cooling, from >700°C to <250°C, caused by solidification of the underlying parental plutons and downward propagation of the lithostatic–hydrostatic transition. Once the plutonic magmas stagnate, the high temperature, generally two phase hyper-saline liquid and vapour responsible for the potassic alteration and contained mineralisation at depth and early overlying advanced argillic alteration, respectively, gives way, at <350°C, to a single-phase, low to-moderate-salinity liquid that causes the sericite–chlorite and sericitic alteration and associated mineralisation. This same liquid also is a source for mineralisation of the peripheral parts of systems, including the overlying lithocaps.

The progressive thermal decline of the systems combined with syn-mineral paleo-surface degradation results in the characteristic overprinting (telescoping) and partial to total reconstitution of older by younger alteration and mineralisation types. Meteoric water is not required for formation of this alteration and mineralisation sequence, although its late ingress is commonplace.

Figure 8.2 Schematic Section Showing Typical Alteration Assemblages



Note: Figure from Sillitoe (2010).

8.4 Applicability of the Porphyry Model to Oyu Tolgoi

Features that classify the Oyu Tolgoi deposits, which include the EJV deposits, as porphyry-copper-type deposits include:

- Mineralisation is in or adjoining porphyritic intrusions of quartz-monzodiorite composition.
- Multiple emplacements of successive intrusive phases and a variety of breccias are present.
- Mineralisation is spatially, temporally, and genetically associated with hydrothermal alteration of the intrusive bodies and host rocks.
- Large zones of veining and stockwork mineralisation, together with minor disseminated and replacement mineralisation, occur throughout large areas of hydrothermally altered rock, commonly coincident wholly or in part with hydrothermal or intrusion breccias.

- Hydrothermal alteration is extensive and zoned, which is common to porphyry-copper deposits. Major alteration minerals in the biotite–chlorite, intermediate argillic, sericite, and K-feldspar alteration zones include quartz, chlorite, sericite, epidote, albite, biotite, hematite–magnetite, pyrophyllite, illite, and carbonate. Advanced argillic alteration zones can contain minerals such as kaolinite, zunyite, pyrophyllite, muscovite, illite, topaz, diaspore, andalusite, alunite, montmorillonite, dickite, tourmaline, and fluorite. In the leached cap, smectite and kaosmectite can also occur. The alteration assemblages are consistent with the physio-chemical conditions of a porphyry environment.
- Pyrite is the dominant sulfide, reflecting the typical high-sulfur content of porphyry-copper deposits. The major ore minerals include chalcopyrite, bornite, chalcocite, covellite, and enargite. In some zones, minerals such as tennantite, tenorite, cubanite, and molybdenite have been identified. Gold typically occurs as inclusions in the sulfide minerals.
- Copper grades are typical of the range of porphyry-copper grades (0.2% to >1.0% Cu).

The Oyu Tolgoi porphyry-copper deposits display a range of mineralisation styles, alteration characteristics, and deposit morphologies that are likely to reflect differences in structural controls, host rock lithology, and depth of formation. For the most part, structural influences account for the differences in shape and distribution of mineralisation within the deposits. The more typical copper–gold porphyry style alteration and mineralisation tend to occur at deeper levels, predominantly within basalt and quartz-monzodiorite.

High-sulfidation mineralisation and associated advanced argillic alteration are most common within the wall rocks (basaltic tuffs and fragmental rocks) to the quartz-monzodiorite, where it intrudes to levels high in the stratigraphic succession and in narrow structurally controlled zones. High-sulfidation mineralisation often forms in steam condensate zones and then collapses back into the hypogene zone, causing overprinting and textural destruction.

The Hugo Dummett deposits have several features that are unusual when compared with typical porphyry-copper systems, including:

- Anomalously high copper and gold grades, particularly in the northern part.
- An unusually weakly altered pre-mineral volcano-sedimentary cover sequence that lies just above the porphyry system.
- Quartz + sulfide vein contents commonly exceeding 15%, and locally in excess of 90%, in the high-grade part of the deposit.
- A highly elongate, gently plunging tabular shape to the high-grade stockwork system.

The formation of the known, 800 m extent, high-grade portion of the Hugo Dummett deposits as a tabular, intensely veined, sub-vertical body contrasts markedly with most porphyry-copper deposits, which tend to have steep, roughly cylindrical, or elongate forms. The unusual form of the Hugo Dummett deposits could be the result of emplacement within a structurally restricted zone. The lack of alteration in the overlying sequence is likely a reflection of the chemical inertness of the siltstone sequences.

The Heruga deposit is also slightly unusual in that, unlike the other Oyu Tolgoi deposits, it has distinctly higher grades of molybdenum, which form a molybdenum-rich carapace at higher elevations overlying gold–copper-rich mineralisation at depth.

8.5 Low-Sulphidation Epithermal Deposits

Low-sulphidation epithermal deposits, similar to Zone III/Argo on Shivee West, are high-level hydrothermal systems that vary in crustal depths from 1 km to surficial hot spring settings. Host rocks are extremely variable, ranging from volcanic rocks to sediments. Calcalkaline andesitic compositions predominate as volcanic rock hosts, but deposits can also occur in areas with bimodal volcanism and extensive sub-aerial ash flow deposits. A third, less common association is with alkalic intrusive rocks and shoshonitic volcanics. Clastic and epiclastic sedimentary rocks in intra-volcanic basins and structural depressions are the primary non-volcanic host rocks.

Mineralisation in the near surface environment takes place in hot spring systems, or the slightly deeper underlying hydrothermal conduits. At greater crustal depth, mineralisation can occur above, or peripheral to, porphyry (and possibly skarn) mineralisation. Normal faults, margins of grabens, coarse clastic caldera moat-fill units, radial and ring dyke fracture sets and hydrothermal and tectonic breccias can act as mineralised-fluid channelling structures. Through-going, branching, bifurcating, anastomosing, and intersecting fracture systems are commonly mineralised. Mineralisation forms where dilatational openings and cymoid loops develop, typically where the strike or dip of veins change. Hanging wall fractures in mineralised structures are particularly favourable for high-grade mineralisation.

Deposits are typically zoned vertically over a 250–350 m interval, from a base metal poor, Au–Ag rich top to a relatively Ag rich base metal zone and an underlying base metal rich zone grading at depth into a sparse base metal, pyritic zone. From surface to depth, metal zones grade from high Au–Ag–As–Sb–Hg zones to high Au–Ag–Pb–Zn–Cu zones, to basal

Ag–Pb–Zn rich zones.

Silicification is the most common alteration type with multiple generations of quartz and chalcedony, which are typically accompanied by adularia and calcite. Pervasive silicification in vein envelopes is flanked by sericite–illite–kaolinite assemblages. Kaolinite–illite–montmorillonite ± smectite (intermediate argillic alteration) can form adjacent to veins; kaolinite–alunite (advanced argillic alteration) may form along the tops of mineralised zones. Propylitic alteration dominates at depth and along the deposit margins.

Mineralisation characteristically comprises pyrite, electrum, gold, silver, and argentite. Other minerals can include chalcopyrite, sphalerite, galena, tetrahedrite, and silver sulphosalts and / or selenide minerals. In alkalic host rocks, tellurides, roscoelite and fluorite may be abundant, with lesser molybdenite as an accessory mineral. Low-sulphidation, Comstock-type ‘Bonanza’ deposits typically contain <1.0 Mt and average around 110 g/t/ Ag.

9 EXPLORATION

Exploration at Lookout Hill from 2002 through 2015 is summarised in Table 9.1 below. Geophysical methods and diamond drilling have been the most important exploration tools. Exploration done from 2002 to 2011 is summarised below while more recent exploration is described in greater detail. Drilling is described in Section 10.

Table 9.1 2002–2015 Exploration Summary on EJV Property and Shivee West

Year	Contractor	Company	Type of Exploration Activity	Quantity
2002	–	Entrée	Prospecting and reconnaissance litho-geochemistry	75 samples
2002	–	Entrée	Trenching Zone III (576 m)	450 chip samples
2002	SJ Geophysics	Entrée	IP survey using pole–dipole array and 50 m electrode spacing. Two initial lines	7–8 line-km
2002–2003	–	Entrée	Soil geochemistry. Samples every 50 m along lines; five lines 200 m apart with another 11 lines 100 m apart	2,140 samples
2003	Scott Geophysics	Entrée	IP survey using pole–dipole array and 50 m to 100 m electrode spacing. Lines spaced 200 m apart	109 line-km
2003	Scott Geophysics	Entrée	Ground magnetics survey. Readings 12.5 m along the lines. Ten lines spaced 100 m apart and five lines spaced 200 m apart	55.4 line-km
2003–2004	Abitibi Geophysics	Entrée	Gravity survey. Sixteen lines spaced 200 m apart	114 line-km
2004	XDM	Entrée	1:10,000 scale geological mapping	–
2004	Can Asia Drilling	Entrée	Diamond drilling at the X-Grid (Oortsog) prospect	Six holes for 573 m
2004–2005	OT LLC.	Entrée–OT LLC	Gradient array IP survey. Fifty-six lines spaced 100 m; 11 km A-B electrode spacing initially, then 1.2 km, 2 km , 3.1 km, 5 km and 6.6 km electrode spacing in smaller areas	Approximately 1,562 line-km
2005	OT LLC.	Entrée–OT LLC	Diamond and RC drilling. Diamond drilling on sections 150 m apart with a nominal 75 m vertical spacing of pierce points. RC drilling used to define bedrock geology and as a geochemical exploration tool	55 diamond drillholes for 43,800 m; 57 RC holes for 3,700 m

Year	Contractor	Company	Type of Exploration Activity	Quantity
2005	–	Entrée	Acquisition and analysis of Aster satellite imagery	
2005	CanAsia Drilling and AIDD	Entrée	Diamond drilling	26 holes for 14 018.31 m
2005	Quantec Geoscience	Entrée	IP and resistivity surveys	250 line-km
2006	OT LLC.	Entrée–OT LLC	Geophysical survey interpretation	
2006	OT LLC.	Entrée–OT LLC	Quarried rock for use as aggregate in concrete for the shaft foundations and lining at Oyu Tolgoi; operations discontinued	
2006	OT LLC.	Entrée–OT LLC	Diamond and RC drilling. Includes 12,400 m on the zone east of the proposed Northern Airport location (Ulaan Khud); approximately 26,400 m on the Hugo North Extension and 1,200 m of geophysical drilling (collared in Shivee Tolgoi ML and drilled back into Hugo North)	40,215 m of core and 850 m of RC
2006	Major Drilling	Entrée	Diamond drilling	11 holes for 8,614.1 m
2006	AIDD	Entrée	RC drilling	18 holes for 3290.0 m
2006	–	Entrée	Geological mapping at 1:10,000 scale	–
2006	–	Entrée	Gradient IP and resistivity geophysical surveys	40 line-km
2006	–	Entrée	Reconnaissance exploration; 16 targets on Shivee Tolgoi ML and Togoot	624 rock chip samples
2006	Dr. Sharon Carr	Entrée	Detailed structural and stratigraphic analysis of Devonian Wedge prospect	–
2006	–	Entrée	Mobile metal ion (MMI) soil sampling	31 samples
2006	PCIGR, UBC / Geochron Lab, U of T	Entrée	Age dating	8 samples
2006	PetraScience Consultants Inc.	Entrée	Petrographic and spectral analysis	34 drill core samples and 15 rock samples
2007	Dr. Sharon Carr	Entrée	Detailed structural and stratigraphic analysis of Khoyor Mod prospect	–

Year	Contractor	Company	Type of Exploration Activity	Quantity
2007	Major and AIDD	Entrée	Diamond drilling	17 holes for 7,712 m
2007	Geocad	Entrée	Grid surveying	Approx. 178 line-km
2007	Geosan	Entrée	Ground magnetometer surveying	1,739 line-km
2007	Geosan	Entrée	Airborne magnetic surveying	5,890 line-km
2007	XDM	Entrée	1: 20,000 and 10,000 scale geological mapping	–
2007	–	Entrée	Soil sampling	3,859 samples
2007	–	Entrée	MMI soil sampling	2,065 samples
2007	–	Entrée	Excavator trenching + samples	970 m, 485 samples
2007	Major Drilling	OT LLC	Diamond drilling – Ulaan Khud	3 holes for 878 m
2007	Major Drilling	OT LLC	Diamond drilling – Heruga	27 holes for 27,422 m
2007	Major Drilling	OT LLC	Geotech drilling – Shivee Tolgoi ML	3 holes for 6,247.2 m
2008	AIDD	Entrée	Diamond drilling	3 holes for 955 m
2008	–	OT LLC	Ground magnetometer survey – Heruga and Hugo North Extension	44.2 line-km
2008	Major Drilling	OT LLC	Diamond drilling – Heruga	14 holes for 24,234 m
2008	Major Drilling	OT LLC	Diamond drilling – Ulaan Khud	1 hole for 721 m
2009	–	OT LLC	Deep penetrating IP – Hugo North Extension and Heruga	281 line-km
2009	Geosan	OT LLC	Ground magnetometer survey	27.83 km2
2010	–	Entrée	Mapping: 1:10,000 and 1:2,000 scales	–
2010	–	Entrée	MMI soil sampling	4,610 samples
2010	–	Entrée	Rock sampling	131 samples
2010	–	Entrée	Whole rock sampling	34 samples
2010	–	Entrée	Excavator trenching + samples	107 m, 5 samples
2010	Geosan	Entrée	Gravity surveying	47 line-km
2010	Geosan	Entrée	IP surveying	183 line-km
2010	Major and AIDD	Entrée	Diamond drilling	22 holes for 11,634 m
2010	–	OT LLC	Deep penetrating IP – north of Hugo North Extension, Shivee Tolgoi ML	339.7 line-km

Year	Contractor	Company	Type of Exploration Activity	Quantity
2011	–	Entrée	Mapping: 1:10,000 and 1:2,000 scales	–
2011	–	Entrée	Rock sampling	17 samples
2011	–	Entrée	Whole rock sampling	14 samples
2011	–	Entrée	Excavator trenching and samples	1,212 m, 629 samples
2011	Geosan	Entrée	Magnetometer surveying	1,670 line-km
2011	Landdrill	Entrée	RC drilling	19 holes for 2,470 m
2010–2011	Major Pontil	OT LLC	Diamond Drilling on Shivee Tolgoi ML	10 holes for 12,861 m
2010–2011	Major Pontil	OT LLC	Diamond drilling on Javhlant ML	Nine holes for 10,489.50 m
2011	Fugro	OT LLC	High resolution magnetotelluric survey, Shivee Tolgoi and Javhlant MLs	1,006 stations
2011	–	OT LLC	Geologic Mapping – Javhlant ML	–
2011	Geosan	OT LLC	Ground magnetometer survey	31.53 km2
2012	–	Entrée	Mapping: 1:2,000 scale	–
2012	–	Entrée	Excavator trenching and samples	1,723 m, 547 samples
2012	–	Entrée	Whole rock sampling	Six samples
2012	–	Entrée	Rock sampling	37 samples
2012	–	Entrée	Oriented outcrop chip samples	23 samples
2012	Major Pontil	OT LLC	Drilling Shivee Tolgoi ML	52 PCD holes for 3,327 m; three core holes for 3,322 m
2012-2013	Major Pontil	OT LLC	Drilling Javhlant ML	Six holes for 86,212 m (including hole 44)
2014-2015	No activity			

9.1 Exploration – EJV Property

From 2002 to 2004, Entrée undertook mapping, prospecting, completed extensive soil sampling and conducted IP, gravity, and magnetometer surveys over the area immediately north of the Oyu Tolgoi ML boundary. After signing the Earn-in Agreement in October 2004, all work was conducted by OT LLC, the EJV operator.

On the Javhlant ML, drilling commenced testing chargeability anomalies for deep mineralisation, similar to that in the Hugo North deposits and SOT zones, in March 2007. Copper, gold, and molybdenum mineralisation was intersected in a number of holes but an intercept of 501.2 m of 0.50% Cu, 0.29 g/t Au and 182 ppm Mo in hole EJD0008 indicated the significant potential in the area. As geological understanding of the deposit increased, it was clear that early, weakly mineralised holes at the northern end of the deposit were too shallow and subsequent deepening of these holes confirmed that the mineralisation continued but deepened to the north. Since the start of Heruga drilling in 2007, 42 holes totalling 53,765 m have been completed on the Heruga deposit. Of those, 14 diamond drillholes totalling 22,190.8 m were completed on the Heruga deposit in 2008 to better delineate the mineralisation for an Inferred Mineral Resource estimate completed in 2009.

From June to November 2009 an extensive geophysical survey was completed over Hugo North Extension and over Heruga using a proprietary deep-penetrating IP system. The results were used to target additional drilling, primarily deepening existing holes to test deeper anomalies. Two diamond drillholes were completed to test the South Heruga IP anomaly. The IP survey was extended in 2010 and outlined an anomaly on the northern portion of the Shivee Tolgoi license, the Luuwan IP target, in the vicinity of the Khanbumbat airport.

In 2010–2011, high-resolution magnetotelluric (MT) surveying was completed over much of the Shivee Tolgoi and Javhlant licenses. The MT survey covered the Heruga deposit and the Heruga Southwest IP anomaly. Ground magnetometer surveying was also completed on either side of the previous surveys. These surveys are used as further tool in target generation.

Other relatively recent exploration work includes continued RC and diamond drilling, geological mapping and ground magnetics on Javhlant ML, and additional structural studies using existing data on the Hugo North Extension area.

Drilling on the Shivee Tolgoi ML focused five holes on testing the strike extension of the deposits or down-dip of mineralised holes. One additional target was drilled as a test of newly defined IP anomaly, the Luuwan anomaly, to the north of Hugo North Extension in the vicinity of the Khanbumbat airport. In addition to exploration drilling, nine engineering holes totalling 13,587 m were drilled to test the geotechnical character of Hugo North Lift 1 and to test the area of a planned ventilation shaft (Shaft 4) to the west of Hugo North Extension.

On the Javhlant ML, two holes previously drilled into the Heruga deposit were deepened, another hole tested for mineralisation just west of the southern boundary of the Heruga deposit, and three additional holes were drilled to test the Heruga Southwest target.

Exploration work since January 2012 on the eastern portion of the Shivee Tolgoi ML and the Javhlant ML comprised only diamond drilling. On the Shivee Tolgoi ML, a shallow drill programme of 52 holes was designed to determine the lithology underlying an area of

Cretaceous cover that overlies the new Airport geophysical target. Based on information from the shallow drilling two deeper holes were completed to determine the source of the geophysical anomalies. The target is located about 7 km north of Hugo North Extension and to the west of Ulaan Khud. Targeting the along-strike continuation of Hugo North Extension, an additional drillhole (EGD157) was completed approximately 750 m north of Hugo North Extension on EGD147 (see Figure 10.1).

On the Javhlant ML, three exploration diamond drillholes were completed around the Heruga deposit and one daughter hole was drilled on the east side. Three additional holes tested for mineralisation east of Heruga along the length of the deposit and another was drilled in the Heruga Southwest target.

This work is described in more detail in Section 10. No exploration has been completed at Lookout Hill since early-2013.

9.2 Exploration – Shivee West, Shivee Tolgoi ML (100% Entrée)

Exploration by Entrée in 2002–2003 included prospecting, soil geochemical sampling of seven separate areas, chip sampling and some orientation silt and pan concentrate sampling in selected areas. Five areas were subject to 239.2 line-km of pole dipole IP surveying, and 255.8 line-km of magnetometer surveying. Gravity surveying (85.1 line-km) was carried out north of the Oyu Tolgoi ML, and on selected lines over Zone I and Zone II. Figure 9.1 shows the exploration targets at Lookout Hill.

Figure 9.1 Exploration Targets Map – Lookout Hill Property

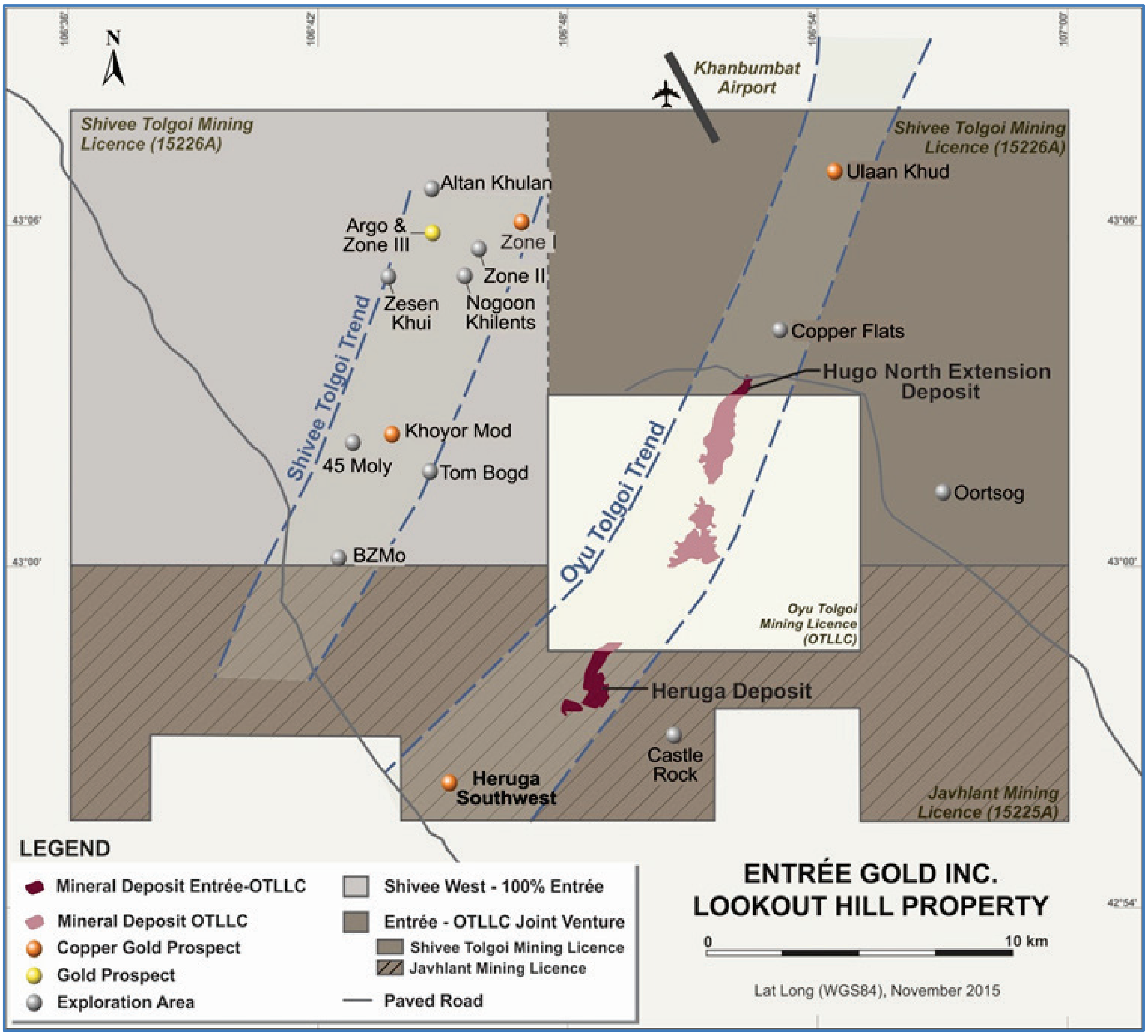


Figure by Entrée 2016

Geological mapping was done at 1:2,000 scale over Zone III, 1:5,000 scale over X-Grid (Oortsog, east of the Oyu Tolgoi ML and on the EJV Property), and 1:10,000 scale on the area immediately north of the Oyu Tolgoi ML on the Shivee Tolgoi ML (formerly called Copper Flats). Three trenches totalling 546 m were excavated on Zone III. Follow-up work by Entrée during 2004 comprised ground geophysical surveys and diamond drilling on the Copper Flats, Zone I, Zone III, and Oortsog.

Subsequent to the Earn-in Agreement with OT LLC, Entrée continued exploring the Devonian stratigraphy on its 100%-owned western portion of the Shivee Tolgoi ML (known as Shivee West). From 2005 through 2011 exploration at Shivee West included satellite image interpretation, reconnaissance exploration, geophysical surveys (IP, gravity, airborne magnetics and radiometrics, and ground magnetics), detailed geological mapping, rock sampling, soil and MMI sampling, trenching, and diamond and RC drilling.

Details of the earlier exploration can be found in previous Technical Reports on SEDAR (See listing in Section 27). A summary table of work done on Shivee West is included in Table 9.1.

Exploration for porphyry copper mineralisation at Shivee West was driven primarily by geophysical surveying, in particular IP, which had been successful for finding porphyry copper mineralisation on the EJV Property. However, drilling of IP chargeability features on Shivee West up to 2008 did not lead to the discovery of any deposits.

From 2004 through 2007, Entrée drilled a number of holes to test for epithermal gold mineralisation at Zone I, Zone II, and Zone III, returning sporadic gold results but no continuous zones of mineralisation. In 2007, MMI soil sampling was used to define gold targets, including the known mineralisation at Zone III and a previously unknown gold target at Altan Khulan (Figure 9.1). Drilling intersected gold mineralisation in 2008, but did not define a significant target.

In 2010, Entrée returned to exploring the Shivee Tolgoi ML for deep copper porphyry deposits. Whole rock geochemical sampling that year confirmed that rocks geochemically equivalent to the main mineralisation host (Unit DA1b) at Oyu Tolgoi also occurred on the Shivee Tolgoi ML. Mapping established that the Devonian rocks form a north–east trending elongate steep-sided dome that is strongly folded and generally north–east striking. Additional MMI sampling indicated a large area of anomalous MMI–Au results at Khoyor Mod, defining a north trending area approximately 200 m x 825 m. Within this area, 11 MMI soil samples returned values from 11.6–36.8 ppb Au.

Drilling in 2010 on porphyry copper targets within the Devonian Corridor (primarily Zesen Khui and Zone 1 targets (Figure 9.1) showed strong hydrothermal alteration systems with barren pyrite mineralisation (Section 10).

Work in 2011 comprised mapping, rock sampling for assay and whole rock analyses, excavator-assisted trenching, 1,670 line-km of magnetometer surveying, and 2,470 m of RC drilling in 19 drillholes on near-surface gold mineralisation at Zone III (Figure 9.2). This resulted in the discovery of moderate to high-grade gold mineralisation in a new zone called Argo Zone, which lies to the north of Zone III. Gold intercepts in excess of 0.25 g/t Au were encountered in 11 holes.

Both Zone III and Argo Zone lie within a well-defined, northerly trending magnetic low, which extends for at least 2.5 km along strike.

The Argo Zone was defined by six RC holes (holes EGRC-11-110 to EGRC 11-115), two trenches and surface chip sampling. Two chip samples, taken to evaluate a quartz stockwork in dacitic volcanic rocks 50 m south–east of the nearest 2011 RC drillhole, averaged 42.4 g/t Au over 4.0 m and 19.3 g/t Au over 3.0 m.

The primary focus of the 2012 exploration programme was the further evaluation of high grade gold mineralisation at the Argo Zone / Zone III Targets and trenching of the copper–gold target within Devonian stratigraphy at Khoyor Mod. Target areas are shown in Figure 9.1.

Ten trenches totalling 999 m were excavated on the Argo Zone in 2012. All were oriented east–west, and excavated to a maximum depth of 2.5 m. Two east–west trenches totalling 241 m were dug to test the southern extension of Zone III. At Altan Khulan, nine trenches were excavated with a total length of 433 m; a single 50 m trench was dug at Khoyor Mod.

The best trench sample results for gold in came from the trenches excavated on the Argo Zone (Figure 9.3 and Table 9.2). Three chip samples were also taken of the outcrop where the two high-grade chip samples were collected in 2011. The 2012 samples returned 0.75 g/t Au over 2.4 m, 0.33 g/t Au over 2.3 m, and 8.67 g/t Au over 3.3 m.

Figure 9.2 Trench and Drillhole Locations – Zone III

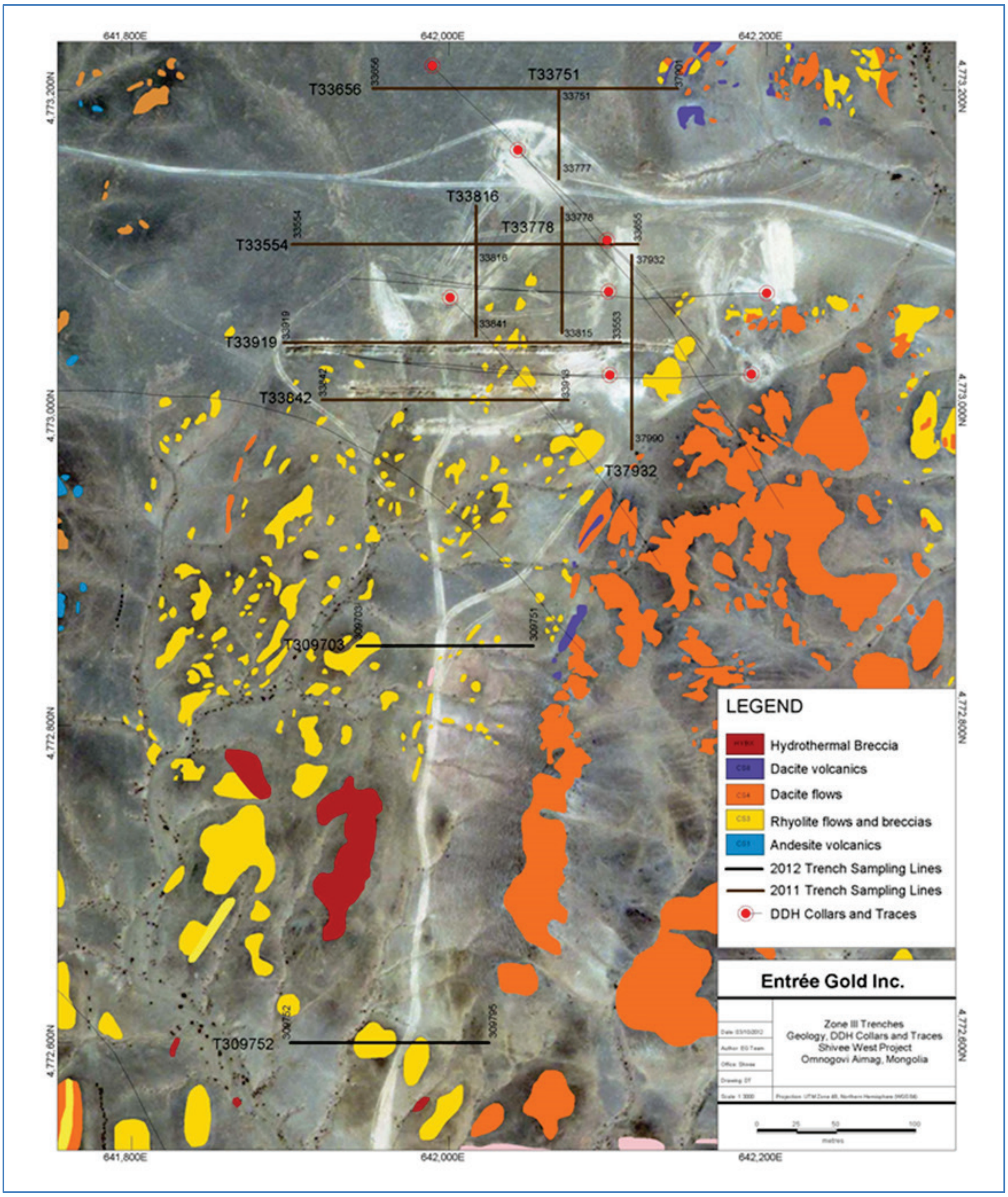


Figure by Entrée 2016

Figure 9.3 Trench and Drillhole Locations – Argo Zone

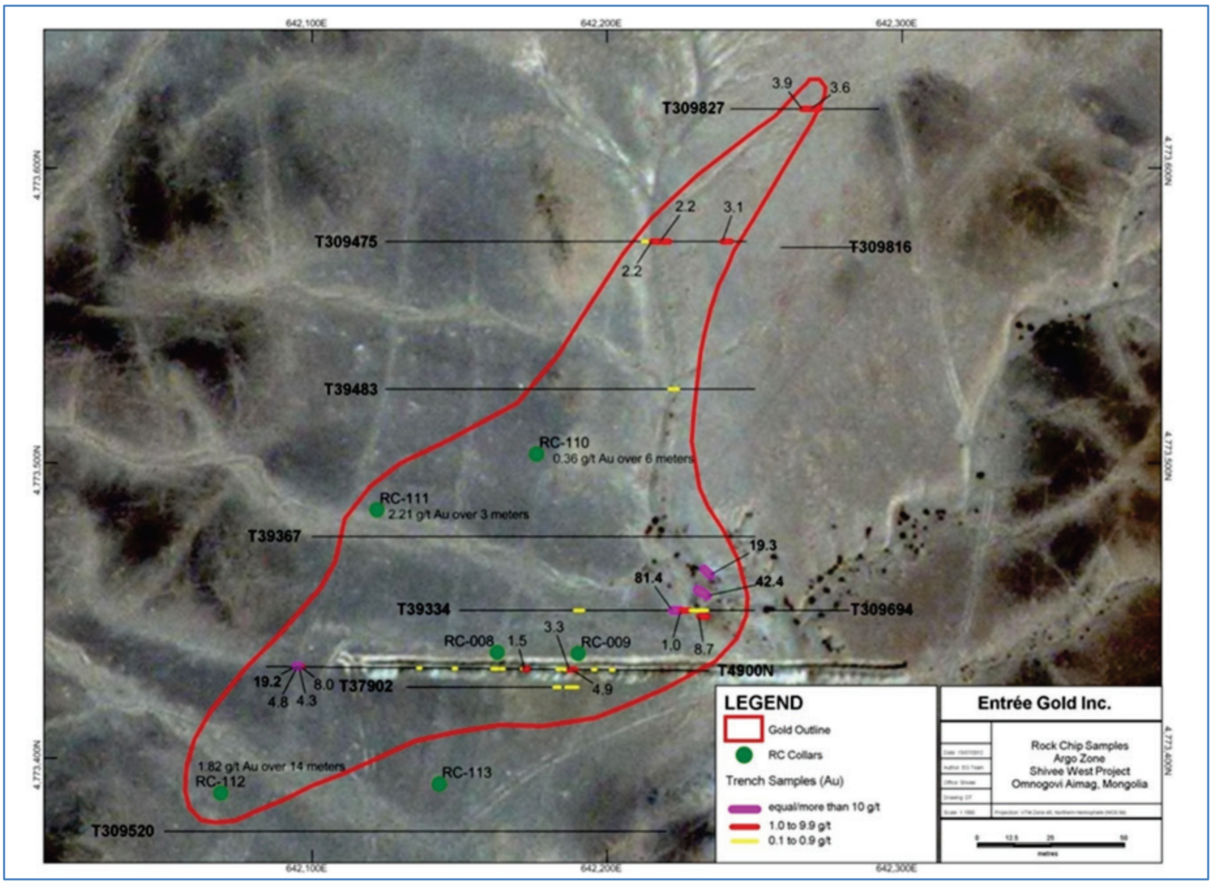


Figure by Entrée 2016

Table 9.2 2012 Argo Trench Sampling Summary

Trench	Zone	Azimuth	From (m)	To (m)	Length (m)	Au (g/t)
T39334	Argo	090	72.0	81.0	9.0	27.61
T309475	Argo	090	92.0	98.0	6.0	2.24
T309475	Argo	090	116.0	119.0	3.0	3.10
T309827	Argo	090	26.0	32.0	6.0	3.76

Note: Reported mineralised lengths may not reflect the true width of mineralisation.

The average intercept in Trench T39334 is strongly biased by the first three metres, which ran 81.4 g/t Au within rhyolite. Trench T309475, located 125 m to the north, returned 2.24 g/t Au over 6.0 m and 3.10 g/t Au over 3.0 m. Gold mineralisation in T309827, the most northerly trench, averaged 3.76 g/t Au over 6.0 m.

Two trenches were excavated on the southern strike extension of Zone III approximately 225 m and 465 m south–south–west of gold mineralisation exposed on surface in this target. Neither trench returned any significant gold or base metals assays.

Mapping was undertaken over Khoyor Mod in 2012 to explain the source of a large MMI–Au anomaly.

A subtle very poorly developed stockwork of quartz veinlets was mapped over an area of some 250 m x 300 m. The quartz veinlets are up to several centimetres thick, can usually be traced along their strikes over several metres, and are sub-vertical to steeply dipping.

Monzodiorite outcrops approximately 500–600 m south-west of the trench are cut by numerous quartz veins that form a moderately developed stockwork indicative of a porphyry-style target. A single 50 m long excavator trench over the zone returned several chip samples anomalous in Cu and Au (e.g. up to 283 ppm Cu with 0.04 g/t Au over 6.0 m and 85 ppm Cu with 0.35 g/t Au over 4.0 m).

9.3 Sampling Methods and Approach

9.3.1 Introduction

Sampling at Lookout Hill has been completed by both Entrée on Shivee West and by OT LLC on the EJV Property. Sampling programmes on the EJV Property have included soil, rock chip, drill core and RC techniques.

All of the sampling on the EJV Property is carried out by OT LLC personnel or contractors, except for early-stage sampling by Entrée, prior to the Earn-in Agreement being signed in October 2004. All of the early-stage sampling methods have been superseded by the drilling, which forms the basis of the Mineral Resource estimates discussed in this report, and therefore the early-stage sampling methods on the EJV Property are not discussed in this report.

Sampling programmes at Shivee West include soil, soil-MMI, rock chip, drill core and RC samples. All of the sampling was carried out by Entrée personnel or its contractors.

9.3.2 Sampling Methods – EJV Property

9.3.2.1 Diamond Drill Core Sampling – Hugo North Extension

Sampling for resource estimation has been conducted on diamond drill core obtained from OT LLC holes drilled between 2002 and 2008.

The current diamond core sampling protocol is as follows:

- The uncovered core boxes are transferred on wooden pallets from the logging area to the cutting shed (approximately 50 m) by fork lift.
- Long pieces of core are broken into smaller segments with a hammer.
- Core is cut with a diamond saw, following the line marked by the geologist. The diamond saw is regularly flushed with fresh water.

- Both halves of the core are returned to the box in their original orientation.
- The uncovered core boxes are transferred from the cutting shed to the sampling area (approximately 50 m) by fork lift.
- Regular 2 m sample intervals are measured and marked on both the core and the core box with permanent marker; a sample tag is stapled to the box at the end of each 2 m sample interval; sample numbers are pre-determined and account for the insertion of QA/QC samples (core twins, standards, blanks).
- Half of the core samples are bagged. These samples are collected from the same side of the core. Each sample is properly identified with inner tags and outside marked numbers. Samples are regularly transferred to a sample preparation facility, operated by Mongolia LLC (SGS Mongolia), which is located approximately 50 m from the sample bagging area.
- The unsampled half of the core remains in the box, in its original orientation, as a permanent record. It is transferred to the on-site core storage area.
- Barren dykes that extend more than 10 m along the core length are generally not sampled.

9.3.2.2 Diamond Drill Core Sampling – Heruga

The procedures described in Section 9.3.2.1 of this report are also applicable to drilling on Heruga between 2007 and 2009.

9.3.2.3 Review of Sampling Procedures

The sampling and handling of core has been subject to external reviews and audits and OreWin concluded that the sampling is adequate, appropriate, and sufficient for the purposes of resource estimation on porphyry-style deposits.

9.3.3 Sampling Methods – Shivee West

9.3.3.1 Introduction – Shivee West

Sampling programmes on Shivee West have included soil, soil-MMI, rock chip, and diamond core and RC drilling techniques. All of the sampling was carried out by Entrée personnel or its contractors. Rock chip sampling was conducted most recently in the 2012 programme.

9.3.3.2 Diamond Drill Core Sampling Procedures – Shivee West

The core sampling protocol is as follows:

- The logging geologist determines sample interval, based on geology or on a pre-determined interval (generally 2.0 m or less), and places a uniquely numbered sample tag at the start of the core interval to be sampled. Sample numbers are pre-determined and account for the insertion of QA/QC samples (core twins, standards, blanks). A line is marked along the core to indicate the line of cut.

- Uncovered core boxes are transferred from the logging area to the cutting shed by van.
- Long pieces of core are broken into smaller segments with a hammer.
- Core is cut with a diamond saw following the cut-line, conforming to the sample length selected by the geologist. The diamond saw is regularly flushed with fresh water.
- One half of the core is placed into a plastic sample bag pre-marked with the sample tag number along with the sample tag retrieved from the core box. The other half of the core is returned to the core box as a permanent record. When complete, the sample bag is sealed with a cable tie. The box is transferred to the on-site core storage area.
- Five to eight bagged samples are placed into rice bags, which are also secured with a cable tie, prior to dispatch on a truck to the analytical laboratory (in this case, SGS Mongolia laboratory in Ulaanbaatar).
- The samples are loaded, together with a chain-of-custody document, into a wooden box on the transport truck; the box is then padlocked. Keys for the padlock are held on site, by the driver who has to allow police authorities to search the truck as requested, and by laboratory staff.
- On arrival at the SGS Mongolia laboratory in Ulaanbaatar, staff unlock the box and unload the samples. A signed confirmation of sample receipt is given to the driver, and subsequently handed to the geologist on the driver's return to the Entrée camp.

9.3.3.3 RC Chip Sampling Procedures

All chip logging and sampling took place at the drill rig around the clock. Sampling was done on 1.0 m intervals as determined by the driller. Different sampling protocols were required, based on wet / dry chip return.

Dry samples were retrieved in 5 gallon plastic pails from the rig (EDM2000) cyclone by Entrée personnel. Dry samples were split in a riffle splitter on a 7 : 1 reject ('C') sample : analytical ('B') sample split. The B sample was placed into a numbered cloth bag with a sample assay tag and tied closed. The C sample was placed into a rice bag marked with the hole number, metreage and corresponding assay sample tag number.

Wet samples were retrieved in 5 gallon plastic pails from the rig (EDM2000) cyclone by Entrée personnel. Because wet samples cannot be split readily in a riffle splitter, Entrée personnel scooped roughly 1/8th of the sample from the pail and placed it into a numbered cloth bag with a sample assay tag and tied closed ('B' sample). The remaining sample ('C' sample) was placed into a rice bag marked with the hole number, metreage, and corresponding assay sample tag number.

A portion of dry or wet the C sample was brought to a mobile chip logging container for washing and chip description ('A' sample). Representative chips from the A sample were archived in plastic chip trays for future reference.

After each hole was complete an additional sample ('D' sample) was collected from the C sample for potential future metallurgical work. The dry C samples were split in a riffle splitter on a 1 : 1 reject : metallurgical D sample split. Because wet samples cannot be split readily in a riffle splitter, Entrée personal scooped roughly half of the reject sample from the rice bag into a numbered plastic bag and sealed it with a cable tie.

The D sample was placed into a numbered plastic bag and sealed it with a cable tie. The reject was returned to the original rice bag.

Five to eight of the analytical (B) samples were placed into rice sacks, which were also cable tied, prior to dispatch on a truck to the ActLabs Asia LLC laboratory in Ulaanbaatar.

9.3.3.4 Soil Sampling – MMI–M

A total of 4,610 Mobile Metal Ion (MMI™) soil samples have been collected on the Shivee West over the Devonian and Carboniferous stratigraphy similar to that exposed at Oyu Tolgoi. MMI samples were collected every 25 m from lines established by hand-held GPS spaced 200 m apart (100 m spacing in areas of greater detail). Each sample was collected from depths ranging from 25–35 cm, using a stainless steel trowel and sieved to –¼-inch mesh at the collection site. Each sample was placed in a uniquely numbered plastic bag corresponding to the uniquely numbered sample tag inserted within. No additional processing or drying was done. Samples were submitted on an 'as-is' basis to the SGS laboratory in Ulaanbaatar, and eventually shipped to SGS in Mississauga for MMI–M analyses.

9.3.3.5 Rock Sampling

Rock sampling for assaying in 2012 included 37 grab samples and 23 oriented chip samples collected from outcrops. In addition, 547 chip samples were collected from trenches that were excavated on the various mineralisation targets in 2012.

Grab samples were taken from lithologies or mineralisation of interest encountered during mapping. Oriented chip sample traverses were collected from outcrops with known or suspected gold mineralisation over sample length(s) determined on lithological or mineralisation criteria, with azimuth, inclination, and length of the individual chip line recorded.

Trench samples were collected on regular intervals usually 2.0 m or 3.0 m, continuously over the trench length or as exposed outcrop allowed. Due to the friable or crumbling nature of trenched bedrock, no attempt was made to take rigorous channel samples; instead, a series of walnut-sized chips for each sample length were collected from one or the other trench wall. Each chip sample traverse or trench sample series is identified by the first sample in the traverse plus a 'T' prefix.

Regardless of type, all rock samples were inserted into plastic bags with uniquely numbered sample tags, bagged in rice bags, and sent by secure transport to SGS Mongolia or to ActLabs in Ulaanbaatar for analyses.

10 DRILLING

10.1 General

Approximately 250,000 m of drilling has been completed at Lookout Hill from 2004 to 2013 (Table 10.1 and Figure 10.1) by OT LLC and by Entrée. Drilling has been predominantly core and, on the EJV Property, undertaken by project operator OT LLC. The majority of the diamond drilling has been exploration related and includes 118 holes totalling 95,748 m on the Hugo North Extension deposit and 45 holes totalling 56,957 m on the Heruga deposit. Six early-stage core holes were drilled by Entrée at the X-Grid (Oortsog) prospect, located east of the Oyu Tolgoi ML, prior to the Earn-in Agreement being signed in 2004. Diamond drilling has been the source of all geological and grade data in support of the Mineral Resource estimates completed for Hugo North Extension and Heruga. A very small percentage of the drilling (two holes totalling 736 m) is from combined RC / core drilling, with RC drilling at the top of the hole in barren rock and core drilling once mineralisation was encountered.

Since 2002, Entrée has completed 65 diamond core holes totalling 38,244 m and 34 RC holes totalling 4,145 m at Shivee West.

There has been no drilling on the 100%-Entrée ground, Shivee West, since 2011.

Table 10.1 Drilling Summary – Lookout Hill

Location	No. of Diamond Core Holes	Length of Diamond Holes (m)	No. of RC Holes	Length of RC Holes (m)	No. of RCD Holes[4]	Length of RCD Holes (m)	Total No. of Holes[1]	Total Length (m)[1]
Shivee West Property								
Zone I	19	10,583	6	914	0	0	25	11,497
Zone II	2	419	0	0	0	0	2	419
Zone III	10	4,293	28	3,231	0	0	38	7,524
45 Moly	3	694	0	0	0	0	3	694
Altan Khulan	3	767	0	0	0	0	3	767
BZMo	2	245	0	0	0	0	2	245
Khoyor Mod	5	2,831	0	0	0	0	5	2,831
Nogoon Khilents	1	967	0	0	0	0	1	967
Tom Bogd	4	4,812	0	0	0	0	4	4,812
West Grid	11	8,614	0	0	0	0	11	8,614
Zesen Khui	5	4,019	0	0	0	0	5	4,019
Total	**65**	**38,244**	**34**	**4,145**	**0**	**0**	**99**	**42,389**
EJV Property								
Hugo North Ext[2]	118	95,748	73	4,868	2	736	193	101,352
Condem / Water	0	0	67	4,401	0	0	67	4,401
Engineering	9	10,049	0	0	0	0	9	10,049
Airport PCD Lith	52	3,327	0	0	0	0	52	3,327
Airport	2	942	0	0	0	0	2	942
Ulaan Khud	36	17,401	28	2,500	0	0	64	19,901
X-Grid (Oortsog)[3]	6	573	0	0	0	0	6	573
Heruga	45	56,957	0	0	0	0	45	56,957
East of Heruga	1	2,005	0	0	0	0	1	2,005
Castle Rock	2	2,098	0	0	0	0	2	2,098
SW Mag Anomaly	1	1,152	0	0	0	0	1	1,152
Heruga Southwest	5	5,277	0	0	0	0	5	5,277
Total	**277**	**195,529**	**168**	**11,769**	**2**	**736**	**447**	**208,034**

Grand Total	**342**	**233,773**	**202**	**15,914**	**2**	**736**	**546**	**250,423**

1. Includes all holes drilled to 31 March 2013 on Shivee West, up to and including EGD159 on Shivee Tolgoi EJV Property and up to and including EJD0045 on Javhlant ML.
2. A portion of these holes were collared in the Shivee Tolgoi ML of the EJV Property and drilled into the Oyu Tolgoi Property.

3. These holes were drilled by Entrée prior to the Earn-in Agreement being signed.
4. RC holes with diamond drillhole tails.

10.2 Drilling – EJV Property, Shivee Tolgoi ML

10.2.1 Introduction

OT LLC has completed drilling on the EJV Property over an eight-year period, with most drilling focused on the Hugo North Extension and Ulaan Khud (Airport North) zones on the Shivee Tolgoi ML and at Heruga deposit on the Javhlant ML (Table 10.1). In addition, OT LLC has completed a significant amount of condemnation, engineering, and water exploration drilling (RC and core) in the vicinity of the Hugo North Extension (76 holes totalling 14,450 m). These holes have been to assist in the determination of suitable sites for proposed tailings and other infrastructure purposes and to find water sources for the proposed mining operation at the Oyu Tolgoi Project (including the EJV Property). The condemnation and water exploration holes are not considered in detail in this report.

A geophysical target outlined in 2012 near the Airport North area located to the north of Hugo North Extension was tested with a series of shallow holes (PCD – 52 holes totalling 3,322 m) to determine the lithology underlying the thick Cretaceous cover. Based on the PCD holes two deeper holes were drilled for a combined 942 m.

There has been no drilling on the EJV Property since February 2013.

Drillholes on the EJV Property are identified in the 'Property' database with either the prefix 'EG', for holes located on the Shivee Tolgoi ML, or by 'EJ', for holes located on the Javhlant ML. The prefix is followed by 'D' for diamond drillholes, 'RC' for reverse circulation holes, and 'RCD' for RC holes with diamond tails. Geotechnical, water exploration, and condemnation drillholes do not receive a special prefix, and are identified by the drilling method.

Exploration diamond drilling is contracted to Major Pontil Pty Ltd. (Major), based out of Australia, who are using a variety of rigs, some with depth capabilities close to 2,000 m. Rigs that have recently been, or are currently on site, include UDR-1000, UDR-1500, and UDR-5000 and Major 50 drills. The vast majority of core at the project has either been PQ size (85 mm nominal core diameter) or HQ size (63.5 mm nominal core diameter), with a small percentage using NQ size (47.6 mm nominal core diameter). Most holes are now collared with PQ core and are reduced to HQ at depths of around 500 m prior to entering the mineralised zone. A few holes have continued to depths of about 1,300 m using PQ diameter equipment.

Core drilling and database procedures have been extensively described in reports by Cinits and Parker (2007) and Peters et al. (2006). Additional details on material handling are provided in Section 11.

The following descriptions are based on work completed at both the Hugo North (on the adjacent Oyu Tolgoi project) and the EJV's Hugo North Extension deposits. Since both deposits represent one continuous zone of mineralisation, the supporting database was evaluated as a whole and one block model was constructed to estimate the Mineral Resources. Later, the resources were cut at the EJV Property boundary for reporting purposes; thus discussion of drilling protocols that were in place during the exploration for the

Hugo North and Hugo North Extension deposits is warranted.

Figure 10.1 Drillhole Locations – EJV Property

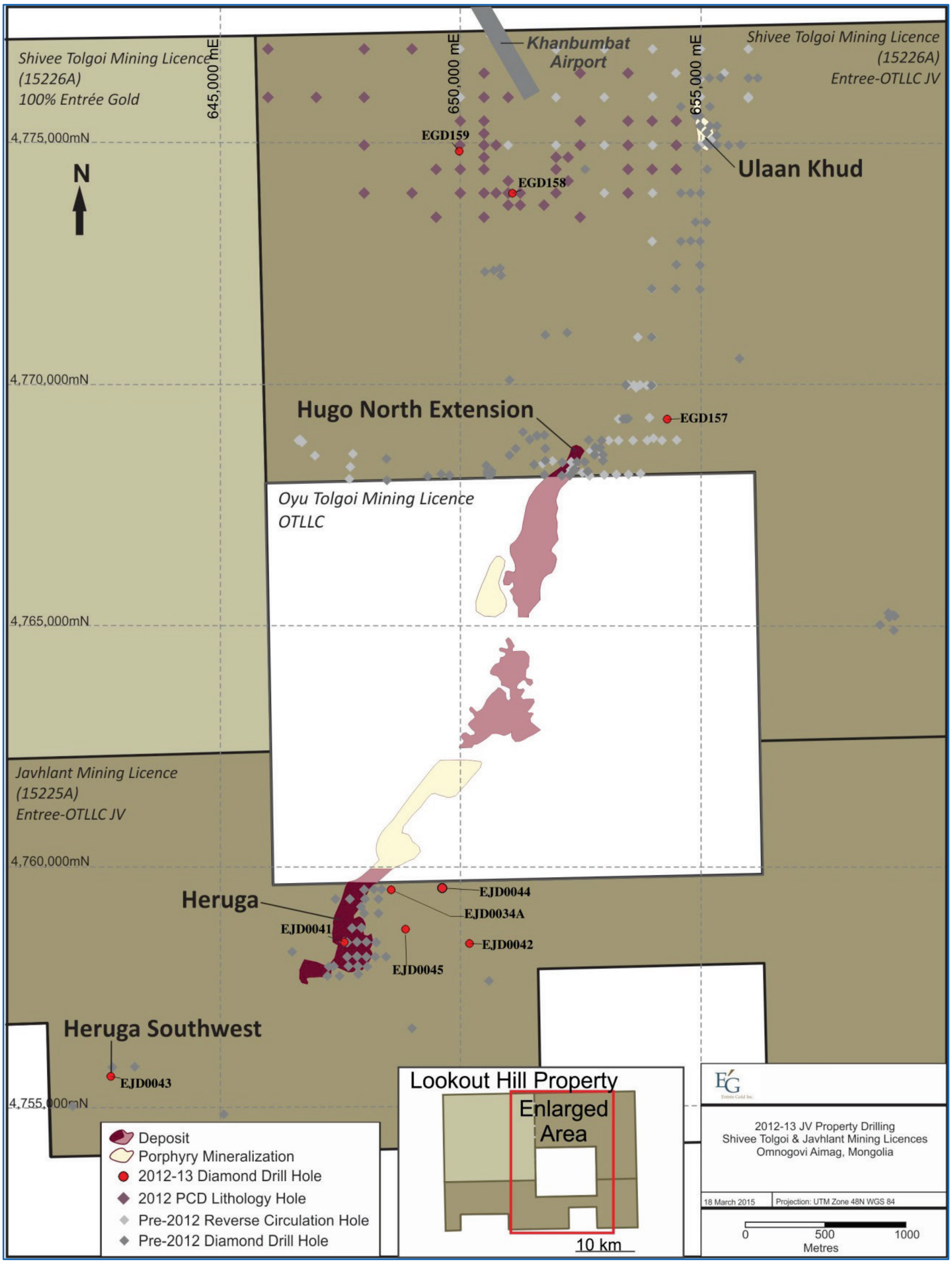


Figure by Entrée 2016

10.2.2 Resource Drilling – Shivee Tolgoi ML

No new resource drilling has been carried out at Hugo North Extension deposit since 2012. Details of previous drilling can be found in LHTR13 and previous studies.

A typical drill cross section through Hugo North Extension is shown in Figure 10.2 Figure 10.2 with drill locations shown in Figure 10.3.

Figure 10.2 Section 4,768,100 mN – Hugo North Extension, Shivee Tolgoi ML

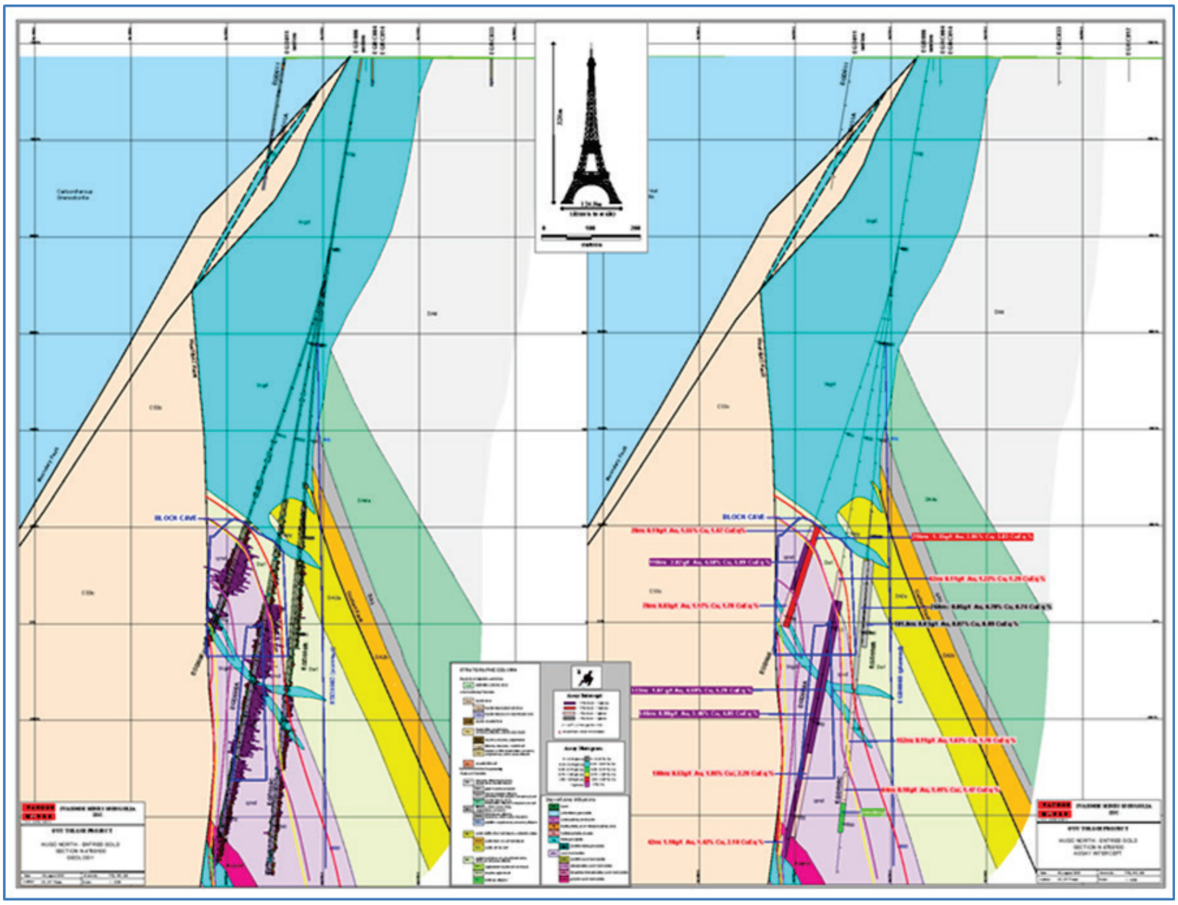


Figure by Entrée 2016

10.2.3 2012 Drilling – Shivee Tolgoi ML

Two targets were explored with diamond drilling in 2012; the new Airport anomaly west of Ulaan Khud (near the Khanbumbat airport) and targets along strike from Hugo North Extension. Drillhole locations are shown in Figure 10.1 and Figure 10.3. The total drilling undertaken on the Shivee Tolgoi ML from January 2012 to March 2013 was 5,626 m.

In mid-2012, diamond drilling was completed over a Cretaceous covered area above an IP / gravity target, located 7 km north of Hugo North Extension and to the west of Ulaan Khud. A total of 52 shallow PCD holes totalling 3,327 m were completed on 165–330 m spacing. Results were used for geological modelling and for locating subsequent diamond drillholes. The best assay result from this shallow drilling was 11.1 m (from 52 m depth) averaging 0.15% Cu with 0.26 g/t Au (EGPCD165 – located near EGD0158).

Figure 10.3 Drillhole Locations – EJV Property, Shivee Tolgoi ML

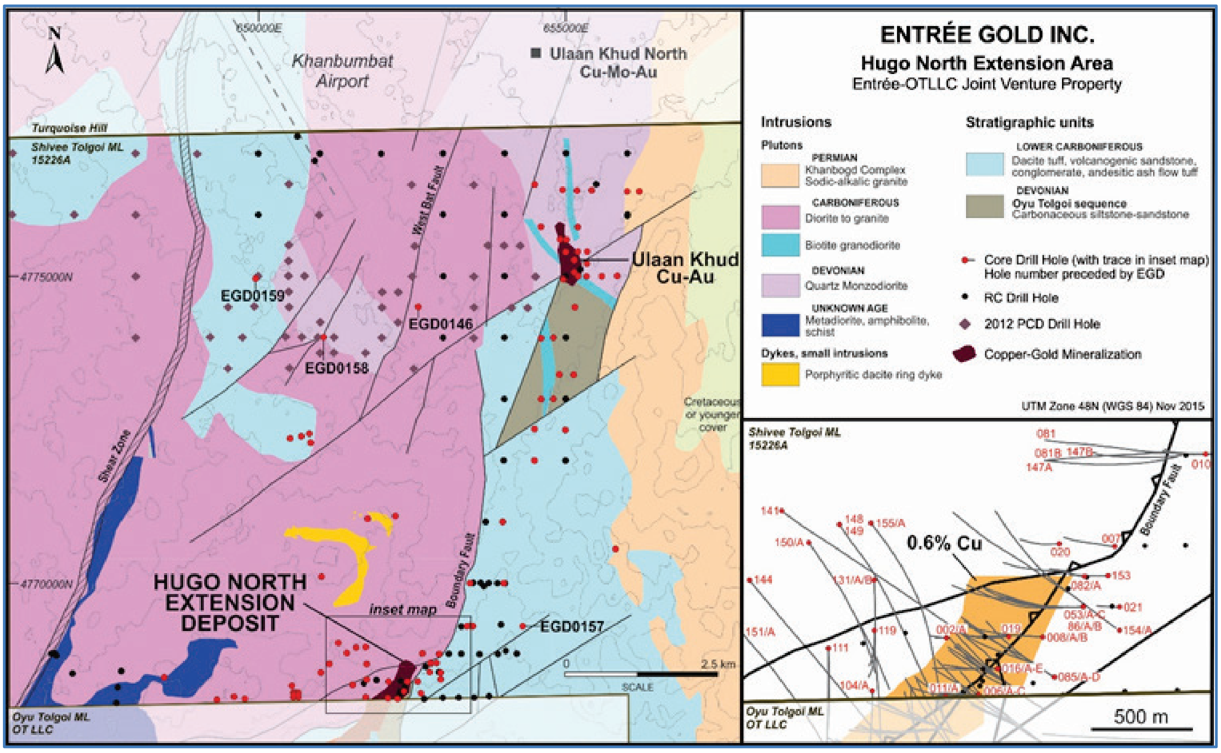


Figure by Entrée 2015

10.2.4 Ulaan Khud Diamond Drilling

No new drilling was carried out on the Ulaan Khud prospect. Details of previous drilling can be found in the March 2008 Technical Report (Vann et al., 2008).

10.2.5 Geotechnical Drilling

There has been no geotechnical drilling done on the property since 2011.

10.3 Resource Drilling – EJV Property, Javhlant ML

To the end of March 2013, over 68,000 m had been completed on Javhlant ML in 54 holes. All of the drilling has been by core methods and was completed by OT LLC as part of the EJV Agreement. The majority of the drilling has been focused on delineating the Heruga deposit where 45 holes have been drilled since 2007 for a total of 56,957 m.

Exploration diamond drilling at Heruga has been completed by diamond coring methods, with drilling using PQ, HQ, or NQ core sizes. Drilling has not used triple tube to date. Most holes are collared in PQ and reduced to HQ and in some instance NQ at depth. Drillholes on the EJV Property are identified in the 'Property' database with 'EJ', for holes located on the Javhlant ML.

The prefix is followed by 'D' for diamond drillholes, 'RC' for reverse circulation holes, and 'RCD' for RC holes with diamond tails. Geotechnical, water exploration, and condemnation drillholes do not receive a special prefix, and are identified by the drilling method.

Diamond core drilling and database procedures have been extensively described in reports by Vann et al. (2008), Cinits and Parker (2007), and Peters et al. (2006).

The general treatment and handling of core for Heruga is as described in Section 9.3.3.2.

10.3.1 Downhole Surveys – Heruga

Where possible, the diamond core was oriented, initially using BallMark but then using the ACE core orientation system (a fully electronic system based on accelerometers).

10.3.2 Recoveries and RQD – Heruga

Core recovery at Heruga is generally very good. Average recovery at Heruga to date is above 97%, with the relatively rare poorly recovered intervals invariably correlated to shearing and faulting.

RQD was not recorded for Heruga core, nor was geotechnical logging undertaken. Geotechnical logging should be undertaken on future programmes.

10.3.3 Bulk Densities – Heruga

Independent ausits and reviews were undertaken by OT LLC during the drilling programmes and Heruga resource and exploration periods.

10.3.4 Exploration Diamond Drilling – EJV Property, Javhlant ML

In 2012 and 2013, OT LLC drilled six holes within the Javhlant ML for a total of 6,736 m. Three exploration holes were completed to the east of Heruga; one hole (EJD0041) was collared into the core of the deposit but lost at 418 m; a daughter hole (EJD0034A) was completed on the eastern side of the Heruga deposit; and another hole tested the Heruga Southwest target. Details of previous drilling can be found in previous technical reports: Vann et al., 2009; Peters et al., 2010a; Peters et al., 2010b, Peters et al., 2012, and Peters et al., 2013. Drillhole locations are shown in Figure 10.4.

Hole EJD0034A was drilled as a daughter hole starting at 848 m below the original to a depth of 1,884.5 m. Assays returned three mineralised intervals. The most outstanding is 590 m of 0.33% Cu, 0.70 g/t Au and 56 ppm Mo. The hole shows strongly increasing gold with depth and extends mineralisation another 150 m below the previous limit of mineralisation in EJD0034. The hole is shown in cross section in Figure 10.5.

Holes EJD0042, EJD0043, and EJD0044 failed to intersect significant mineralisation.

Hole EJD0045 tested mineralisation on the east side of the Heruga Qmd but was terminated at 1,450.3 m after hitting a late fault prior to intersecting the target. The target remains valid.

No drilling has been completed on the Javhlant ML since February 2013.

Figure 10.4 Drillhole Locations – EJV Property, Javhlant ML

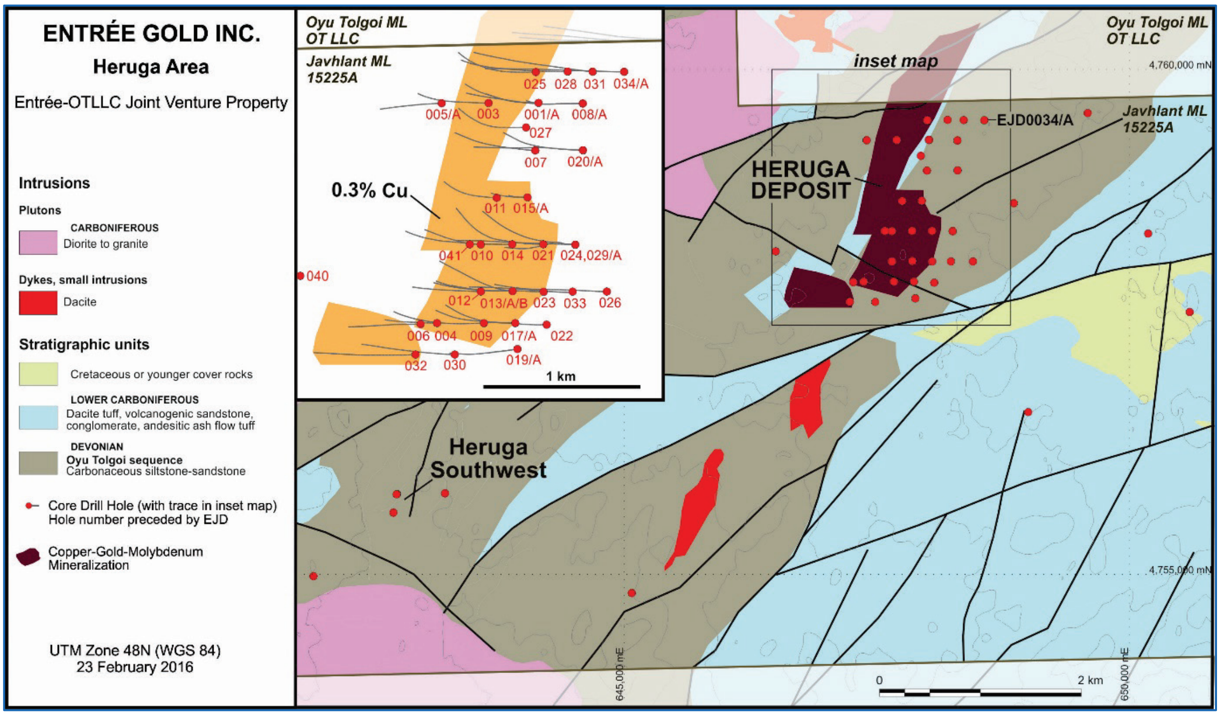


Figure by Entrée 2015

Figure 10.5 Section 4,759,500 mN, Looking North – Heruga Deposit

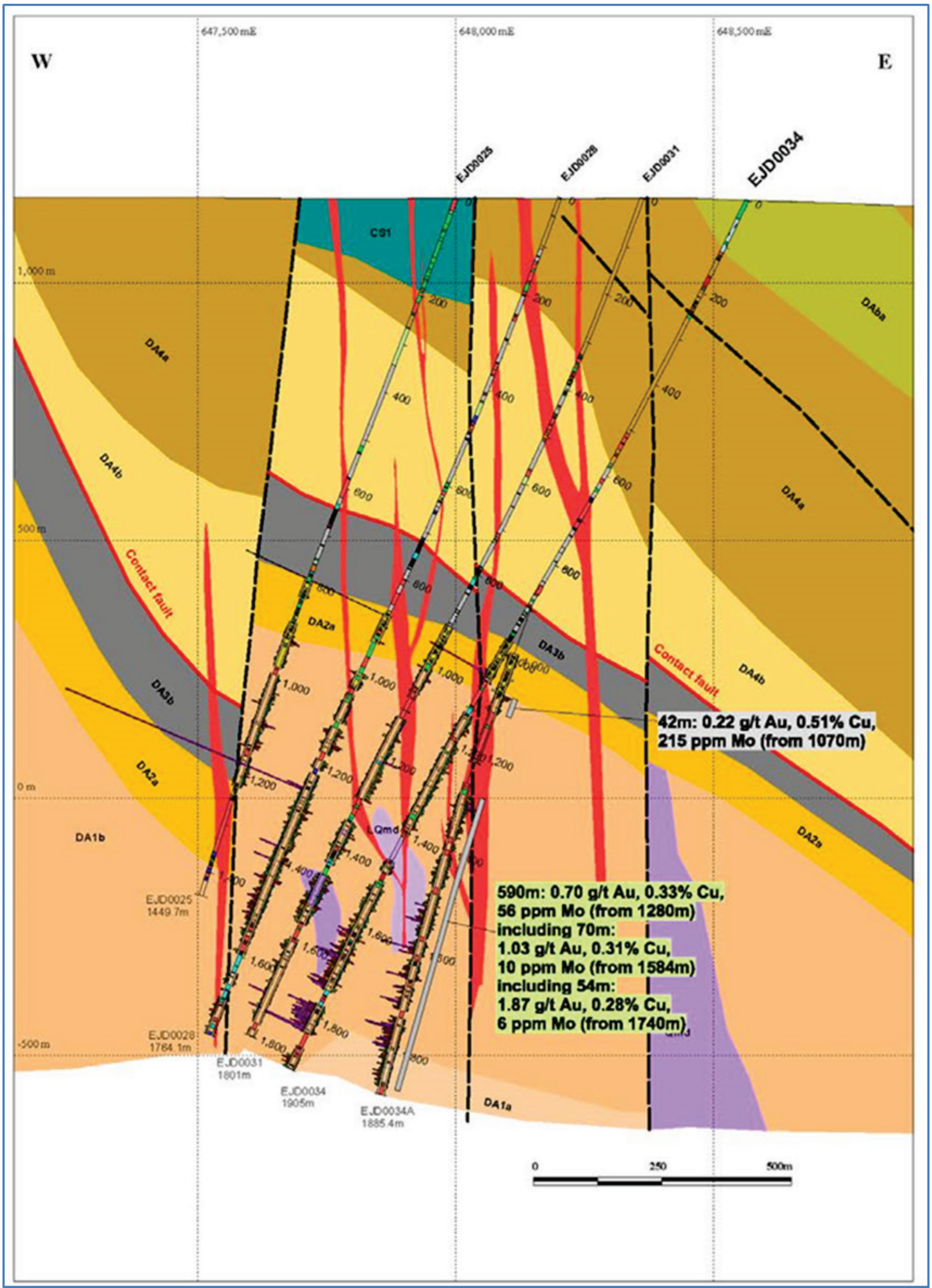


Figure from OT LLC 2014.

10.4 Drilling – Shivee West (100% Entrée), Shivee Tolgoi ML,

There has been no drilling on Shivee West since 2011. Details of the previous programmes are provided in various Technical Reports found on SEDAR: Reid et al., 2003; Reid et al., 2004; Cann, 2004; Panteleyev, 2004a; Panteleyev, 2004b; Panteleyev, 2005; Cherrywell, 2005; Juras, 2005; Forster, 2006; Forster and Crane, 2007, Cinits and Parker, 2007; Forster et al., 2008; Vann et al., 2008; Vann et al., 2009; Peters et al., 2010a; Peters et al., 2010b, Peters et al., 2012, and Peters et al., 2013.

In November 2011, a total of 2,470 m of RC drilling in 23 vertical holes was completed by Entrée in the vicinity of Argo Zone / Zone III (see Figure 9.2). Drilling operations, conducted under contract with Landdrill International LLC used a custom-built EDM2000 rig. PVC casing with 8-inch (20.32 cm) diameter was set to at least 4.0 m and up to 7.0 m in depth, and the holes continued to their planned depth using a 5½-inch (13.97 cm) face-sampling hammer.

The programme was designed to follow up on previous positive results from surface and trench sampling and from drilling. Drilling was completed over an area of 200 m x 600 m. Gold values were associated with quartz veinlets in felsic volcanic rocks. The Argo Zone is north of previously known Zone III mineralisation.

Best results from 2011 RC drilling are from hole EGRC-11-123, located near the centre of Zone III, which returned 8.0 m of 2.08 g/t Au. Additional results are summarised in Table 10.2.

Table 10.2 2011 RC Drilling Results – Zone III and Argo Zone

Hole_ID	Target	From (m)	To (m)	Interval (m)	Au (g/t)	Comment
EG-RC-11-109	Zone III	63	67	4	0.27	–
EG-RC-11-110	Argo Zone	34	40	6	0.36	–
EG-RC-11-111	Argo Zone	67	70	3	2.21	EOH in mineralisation
EG-RC-11-112	Argo Zone	46	51	5	0.91	–
		47	48	1	3.35	–
		63	77	14	1.82	–
		71	75	4	5.13	Includes 9.32 g/t Au 2.4 g/t Ag over 2 m
EG-RC-11-113	Argo Zone	14	15	1	0.53	–
EG-RC-11-114	Argo Zone	17	20	3	0.76	Hole ended in 0.175 g/t Au over 6 m
EG-RC-11-117	Argo Zone	60	61	1	0.49	–
EG-RC-11-119	Zone III	66	71	5	0.36	–
		76	78	2	0.35	–
EG-RC-11-121	Zone III	65	67	2	0.74	–
EG-RC-11-123	Zone III	31	32	1	0.70	–
		67	75	8	2.08	First sample of intercept is 9.34 g/t Au over 1 m
		67	69	2	5.60	–
		73	75	2	2.08	–
EG-RC-11-130	Zone III	84	90	6	0.23	–

Note: Reported intervals may not refelect the true width of mineralisation.

11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

11.1 Introduction

Sampling at Lookout Hill has been completed by both Entrée on Shivee West and by OT LLC on the EJV Property. Sampling programmes on the EJV Property have included soil, rock chip, drill core, and RC techniques.

All of the sampling on the EJV Property is carried out by OT LLC personnel or contractors, except for early-stage sampling by Entrée, prior to the Earn-in Agreement being signed in October 2004. All of the early-stage sampling methods have been superseded by the drilling, which forms the basis of the Mineral Resource estimates discussed in this report, and therefore the early-stage sampling methods on the EJV Property are not discussed in this report.

Sampling programmes on Shivee West include soil, soil-MMI, rock chip, drill core, and reverse circulation samples. All of the sampling was carried out by Entrée personnel or its contractors.

11.2 EJV Property

11.2.1 Sample Preparation and Shipment

During resource drilling, split core samples were prepared for analysis at the on-site sample preparation facility operated by SGS Mongolia LLC (SGS Mongolia). The prepared pulps were then shipped by air under the custody of OT LLC to Ulaanbaatar, where they are assayed at a laboratory facility operated by SGS Mongolia.

The facility is well-equipped and the staff well-trained by SGS Mongolia. All sample preparation procedures and QA/QC protocols were established by OT LLC in consultation with SGS Mongolia. The maximum sample preparation capacity has been demonstrated to be around 600 samples per day when fully staffed.

The facility has one large drying oven, two Terminator jaw crushers, and two LM2 pulverisers. The crushers and pulverisers have forced air extraction and compressed air for cleaning. Smee, (2008) noted that some the equipment, in particular the crushers were in poor condition and deficient in a number of areas but also noted that all concerns had been addressed as of 10 April 2008.

The samples were initially assembled into groups of 15 or 16 samples, and then 4 or 5 quality control samples are interspersed to make up a batch of 20 samples. The quality control samples comprise one duplicate split core sample, one uncrushed field blank, a reject or pulp preparation duplicate, and one or two standard reference material (SRM) samples (one <2% Cu and one >2% Cu if higher grade mineralisation is present based on visual estimates). The two copper SRMs are necessary because SGS Mongolia uses a different analytical protocol to assay all samples >2% Cu.

The split core, reject, and pulp duplicates were used to monitor precision at the various stages of sample preparation. The field blank can indicate sample contamination or sample mix-ups, and the SRM was used to monitor accuracy of the assay results.

The SRMs were prepared from material of varying matrices and grades to formulate bulk homogenous material. Ten samples of this material were then sent to each of at least seven international testing laboratories. The resulting assay data was analysed statistically to determine a representative mean value and standard deviation necessary for setting acceptance / rejection tolerance limits. Blank samples were also subjected to a round-robin programme to ensure the material is barren of any of the grade elements before being used for monitoring contamination.

The sample preparation protocol for EJV samples is as follows:

- Coding: an internal laboratory code is assigned to each sample at reception.
- Drying: the samples are dried at 75°C for up to 24 hours.
- Crushing: the entire sample is crushed to obtain nominal 90% at 3.35 mm.
- Splitting: the sample passes twice through an approximate 1-inch (approximately 2.5 cm) Jones Splitter, reducing the sample to approximately 1 kg. The coarse reject is stored.
- Pulverisation: the sample is pulverised for approximately five minutes to achieve nominal 90% at 75 µm (200-mesh). A 150 g sample is collected from the pulveriser and sealed in a Kraft envelope. The pulp rejects are stored on site.
- The pulps are put back into the custody of OT LLC personnel and SRM control samples are inserted as required.
- Shipping: the pulps are stored in a core box and locked and sealed with tamper-proof numbered tags. Sample shipment details are provided to the assaying facility both electronically and as paper hard copy accompanying each shipment. The box is shipped by air to Ulaanbaatar where it is picked up by SGS personnel and taken to the analytical laboratory. SGS confirms to OT LLC staff by electronic transmission that the seal on the box is original and has not been tampered with.
- Storing and submitting: The pulp rejects are stored on site at the laboratory for several months and then returned to OT LLC in Ulaanbaatar for storage.

All equipment is flushed with barren material and blasted with compressed air between each sample that is processed. Screen tests are done on crushed and pulverised material from one sample taken from the processed samples that comprise part of each final batch of 20 samples to ensure that sample preparation specifications are being met.

Reject samples are stored in plastic bags inside the original cloth sample bags and are placed in bins on pallets and stored at site. Duplicate pulp samples are stored at site in the same manner as reject samples.

11.2.2 Analyses

All routine sample preparation and analyses of the EJV samples was carried out by SGS Mongolia, who operate an independent sample preparation facility at Oyu Tolgoi site and an analytical laboratory in Ulaanbaatar. The preparation facility was installed in 2002 as a dedicated facility for OT LLC's project during their exploration and resource definition stages. Although the facility has mostly dealt with samples from the Oyu Tolgoi area, it also prepares some samples from other OT LLC projects in Mongolia. This Oyu Tolgoi facility closed in November 2008, after completion of Heruga drilling but reopened again in late-2011. In March 2014 the facility again suspended operations when drilling ceased.

All samples were routinely assayed by SGS Mongolia for Au, Cu, and Mo. Gold is determined using a 30 g fire assay fusion, cupelled to obtain a bead, and digested with Aqua Regia, followed by an AAS finish, with a detection limit of 0.01 g/t. Prior to 2011, Cu and Mo are determined by acid digestion of a 0.5 g sub-sample, followed by an AAS finish. Samples are digested with nitric, hydrochloric, hydrofluoric and perchloric acids to dryness before being leached with hydrochloric acid to dissolve soluble salts and made to volume with distilled water. The detection limits of the Cu and Mo are 0.001% and 10 ppm, respectively. The same acid digestion is also used for analyses of Ag and As, with detection limits of 1.0 ppm and 100 ppm respectively. In 2011, following concerns related to lower level precision of Ag, As, and Mo assaying, OT LLC decided to switch methods for Cu, Mo, Ag, As, and a suite of other elements to ICP-OES / MS.

The SGS Mongolia analytical laboratory in Ulaanbaatar and the SGS laboratory in Perth were recognised as having ISO 9001 : 2000 and ISO / IEC 17025 accreditation respectively (SGS 2006). The National Association of Testing Authorities Australia (NATA) has accredited Genalysis to operate in accordance with ISO / IEC 17025 (1999), which includes the management requirements of ISO 9002 : 1994.

11.2.3 QA/QC Programme

A formal QA/QC programme was set up for TRQ in March 2002 under the direction of Dr. Barry Smee, P. Geo., an independent quality control consultant. This work included development of procedural guidelines, laboratory audits, and preparation of reference materials, with initial on-site monitoring conducted by designated Ivanhoe Mines and later OT LLC staff.

Samples were initially assembled into groups of 15 or 16 samples, and then four or five quality control samples were interspersed to make up a batch of 20. The quality control samples inserted by TRQ (then Ivanhoe Mines) consisted of one duplicate split core sample, one uncrushed field blank, a reject or pulp preparation duplicate, and one or two standard reference material (SRM) samples (<2.0% Cu and >2.0% Cu if higher grade mineralisation was present based on visual estimates). The two copper SRMs were necessary because SGS Mongolia used a different analytical protocol to assay all samples >2.0% Cu. The SRMs were matrix-matched to ensure consistency with routine analytical samples. OT LLC has continued this procedure.

All sampling and QA/QC work before 2007 was overseen on behalf of TRQ by its QA/QC Manager Dale A. Sketchley, M.Sc., P. Geo. QA/QC reviews were intermittent in the period 2007 to late-2010.

TRQ had also retained independent geologist / geochemist Dr. Barry Smee to conduct semi-annual audits of both the preparation and analytical facilities from March 2002 through 2008 (Smee, 2008). Dr. Smee's reports over this period are available through OT LLC.

The most recent audit of QA/QC data was completed on behalf of TRQ by Dale Sketchley in 2011.

11.2.4 Standard Reference Materials

Standard reference materials (SRMs) routinely used at Oyu Tolgoi (including the EJV Property) are matrix-matched and developed from drill core crushed rejects. Materials are pulverised, screened to minus 75 µm, homogenised, and tested for homogeneity, and then sets of randomly selected samples are sent to international laboratories for round-robin testing.

Tolerance limits for SRMs were set at two and three standard deviations from final round-robin mean value of the reference material. A single batch failed when SRM assays were beyond the 'three standard deviations' limit, and any two consecutively assayed batches failed when SRM assays were beyond the 'two standard deviations' limit on the same side of the mean.

11.2.5 Blanks

Barren material was procured from a local site and tested to ensure its barren nature for use as field blanks. Tolerance limits for field blanks were set at 0.06 g/t Au, 0.06% Cu, and 10 ppm Mo. Batches are automatically failed and re-assayed if these tolerance limits are exceeded, unless values are extremely low, in which case a barren override is applied in the database, and the batch remains as is.

Evaluation of the blank samples submitted to the laboratory in the period 2002–2007 indicated a low incidence of contamination for the analytical programmes for the SOT and Hugo Dummett deposits. A few cases of sample mix-ups were identified during the review of the blank performance, which were investigated at site and corrected.

No evidence of systematic contamination was noted for the review of data from 1 January 2008 to 1 November 2010 (Sketchley, 2011).

11.2.6 Duplicate Samples

Duplicates routinely used at Oyu Tolgoi (including the EJV) include core, coarsely crushed rejects, and pulps. Core duplicates are taken in the field from one half of core that has been split along a continuous line marked along the middle of the core, parallel to the long axis. Coarsely crushed rejects and pulp duplicates are taken in the laboratory by using a riffle splitter. Assays of each type follow the parent sample in a batch.

Laboratory check pulp samples sent to an umpire laboratory were only used up to the end of 2005 for the SOT and Hugo Dummett deposits. Other duplicate sample types employed in the QA/QC programme were core, coarse reject, and pulp.

In the period 2002–2007 copper generally performed very well with absolute relative difference results well within expected limits; gold absolute relative difference results are were higher than copper but considered acceptable. Core duplicates for both copper and gold were above the ideal arbitrary absolute relative difference value of 30%, which was related to an uneven distribution of mineralisation between core halves as typically caused by quartz vein and fracture-controlled mineralisation.

11.2.7 Sample Security

Sample security relies on the fact that the samples were always attended to or locked in a sample dispatch facility. Sample collection and transportation were always undertaken by company or laboratory personnel using company vehicles. Chain-of-custody procedures included filling out sample submittal forms that were sent to the laboratory with the sample shipments to ensure that the laboratory received all the samples.

11.3 Databases

Before August 2010, all geological and geotechnical drillhole data were entered into an MS Access relational database that had been developed in-house. Data were exported from the main database to meet end-user requirements.

In August 2010, OT LLC elected to migrate the Access database to a full Oracle content (OCDB) acQuire database with links to the end-user software programmes. The database is read-only for these programmes, preventing accidental overwriting and ensuring up-to-date live and centralised data, rather than distributed databases.

Before August 2010, all drillhole data were initially manually recorded in the field or in the core logging shed on paper logging sheets. The logging geologist then introduced logging information into the MS Access database, which had a series of embedded checking programmes to look for obvious errors. Formational names were subsequently assigned according to the accepted geological interpretation and position within the stratigraphic column.

With the move to the acQuire database, which instituted direct digital data capture, the design stubs for the logging sheets do not permit any invalid data. No drillhole can be completed and entered into the database until the logging is correctly entered.

SGS Mongolia reports the results digitally by email and submits signed paper certificates. General turn-around is approximately seven days. All hard copy assay certificates are stored in a well-organised manner in a secure location on-site.

Before August 2010, the digital assay results were imported to the MS Access files once the assay data had been received from the laboratory in Ulaanbaatar. With the subsequent direct import to the acQuire database, none of the assay data are entered manually. Project personnel visually check each assay on the signed paper certificate against the assay entry in the digital database.

Final surveyed collars (total station) are entered manually into the database and are visually checked against the preliminary, hand-held GPS readings. No double data entry is applied during the entry of the final collar coordinates. Digital data is backed up regularly.

11.4 Shivee West

Sampling programmes on Shivee West have included soil, rock chip, drill core and RC samples. All of the sampling was carried out by Entrée personnel or contractors. All samples were analysed at SGS Mongolia or at Actlabs in Ulaanbaatar.

The sampling and QAQC procedures are summarized below and additional details can be found in previous reports (Cinits and Parker, 2007; Forster et al., 2008; Vann et al., 2008, Vann et al., 2009; Jackson et al., 2010; Peters et al., 2010 and Peters et al., 2012 and Peters et al., 2013)

11.4.1 Drill Core Analyses (SGS Mongolia)

Field blank, duplicate (quarter samples), and commercial Standard Reference Material (SRM) samples are included in the sample submissions. The blank sample can indicate instances of sample mix-up's or sample contamination; the SRM is used to monitor the accuracy of sample assay values, and the duplicate sample is used to monitor precision during sample preparation phases.

Routine sample preparation and analyses of Entrée's diamond drill core samples was carried out by SGS Mongolia LLC at the Ulaanbaatar facility, an ISO9000:2001 accredited lab. SGS Mongolia benchmark testing is restricted to confidential internal-SGS round-robins.

SGS Mongolia sorts the samples, verifying the sample numbers on bags to the sample submission sheets, and assigns a laboratory job number. Sample weights are recorded; weights range from 1 to 15 kg, depending on core diameter and amount of core loss during drilling/sampling.

The 2-stage sample crushing protocol involves firstly crushing core in a jaw crusher to 100% passing nominal -6 mm, and secondly crushing in a TM Engineering Terminator to 85% passing 3.35 mm. The crushed sample is split using an 8 bin TM Engineering rotary splitter. The sample from one bin is placed into a stainless-steel tray, with a sample number tag, for drying, and becomes the primary sample. The remaining seven bins, which form the coarse reject, are emptied back into the original sample bag.

The primary sample is dried at about 65 to 70°C in a stainless steel tray, and then pulverised in a Labtech LM2 pulverizer using low-Cr bowls to 90% passing 75 µm. On request from Entrée on specific samples, approximately 100 g of the sample is bagged into a paper Kraft bag. More normally, the entire sample is funnelled into a paper bag for analysis.

Sizing tests are performed to assess whether the SGS Mongolia pulverising techniques are performing adequately. Sizing data is reported both in digital data and hard-copy assay certificates.

Gold analysis is undertaken using the SGS Mongolia FAE303 assay method, comprising a 30 g fire assay, with an AAS finish after DIBK solvent extraction. The lower detection limit is 1 ppb Au. Samples that assay over 1 g/t Au are automatically rerun, using the same analytical method.

SGS Mongolia reports assay results digitally to Entrée via email, and submit hard-copy signed paper certificates. Electronic versions of the assays are maintained in a Datamine Century Systems database.

11.4.2 RC Chip Sample Analyses – ActLabs

All recent RC samples were submitted to ActLabs Asia LLC in Ulaanbaatar, Mongolia.

Samples were crushed to a nominal -10 mesh (1.7 mm), mechanically riffle-split to obtain a representative sample and then pulverized to at least 95% -150 mesh (106 micron). ActLabs routinely uses cleaner sand between each sample to avoid inter-sample contamination. All were analysed for gold using ActLabs analytical method 1A2-30 (Au – Fire Assay Atomic Absorption Finish on 30-gram splits (detection limits 1 – 3,000 ppb).

Samples in excess of 1000 ppb Au were run using a 29.16-gram split from the initial pulp using ActLabs analytical method 1A3-30 (Au – Fire Assay Gravimetric Finish (detection limits 0.03 – 1,000 ppm). Silver was analysed for all samples using ActLabs analytical method Code 1E M-Ag (Ag – Aqua Regia Digestion Atomic Absorption Finish on 30-gram splits (detection limits 1 – 3,000 ppb.

Samples are being analysed for Au and Ag only using the following analytical methods:

- Prep – RX1 – Crush (<5 kg) up to 90% passing 2 mm, split (1,000 g) & pulverize (hardened steel) to 95% passing 75 micron.
- Au – All samples will be analysed for Au using method 1A2-30 with AA finish; gavimetric (1A3-30) confirmation for samples reporting >1.00 ppm.
- Ag – All samples will be analysed for Ag using method 1EM (2 acid digestion).

11.4.3 Soil Sampling – MMI

A total of 4,610 Mobile Metal Ion (MMI™) soil samples have been collected on the Shivee West over the Devonian and Carboniferous stratigraphy similar to that exposed at Oyu Tolgoi. MMI is an analytical technique used to detect very low concentrations of elements in bedrock buried below thick overburden and cover rocks. Samples were collected from a grid established by hand-held GPS or by chain-and-compass; lines were spaced on 200 m centres, and samples collected on 25 m centres. Each sample was collected from depths ranging from 25 cm to 35 cm, using a stainless steel trowel and sieved to -1/4-inch mesh at the collection site. Each sample was bagged in a uniquely-numbered ziploc plastic bag corresponding to the uniquely-numbered sample tag inserted within. Duplicate samples were inserted into the sampling stream at a rate of one per 20 samples. No sample processing or drying was done in the field – samples were submitted on an "as-is" basis to the SGS laboratory in Ulaanbaatar, and eventually shipped to SGS in Mississauga for MMI-M analyses.

MMI™ technology uses proprietary extractants. MMI-M is a single multi-element leach that measures the concentration of a broad selection of mobile elements. Target elements are extracted using weak solutions of organic and inorganic compounds rather than conventional aggressive acid or cyanide-based digests. MMI solutions contain strong ligands, which detach and hold metal ions that were loosely bound to soil particles by weak atomic forces in aqueous solution.

This extraction does not dissolve the bound forms of the metal ions. Thus, the metal ions in the MMI solutions are the chemically active or 'mobile' component of the sample. Because these mobile, loosely bound complexes are in very low concentrations, measurement is by conventional ICP-MS and ICP-MS Dynamic Reaction Cell™ (DRC II™), allowing very low detection.

11.4.4 Rock Sampling and Shipping

All rock samples were inserted into plastic bags with uniquely- numbered sample tags, bagged in rice bags, and sent by secure transport to SGS Mongolia or to ActLabs in Ulaanbaatar for analyses.

11.4.5 Entrée QA/QC Programme

11.4.5.1 Quality Assurance and Quality Control

Field duplicates, field blanks and standards were inserted at random into the drilling sampling stream at a rate of one per 20 samples.

On receipt of analytical results for drilling, the lab sample weights were compared to field sample weights, which were checked for discrepancies. The quality of the data received from the laboratory was verified by the QA/QC module within the Century Systems Database. Batches failed if the Cu and/or Au values returned for a standard were greater than 3 standard deviations from their accepted value, or if the Cu and/or Au values of a field blank were above a certain threshold.

The standards used were prepared by CDN Resource Laboratories Ltd, British Columbia. The field blanks consisted of locally derived granite.

Gold and copper control charts for each of the standards and the field blank were produced. Max-Min plots were prepared for Au and Ag.

A check assay programme at a secondary lab has not yet been implemented.

The QC data processing to date at ActLabs indicates good results.

During future RC drilling programmes, especially in zones of mineralization, it is recommended that the QC insertion programme be modified to include the insertion of coarse and fine duplicates, as well as fine blanks (Table 11.1). In addition a check assay programme at a secondary lab should be initiated at various times during the programme.

Table 11.1 Suggested QC Programme for RC Drilling

Type	ID	Description	Frequency (per 50 reg samples)	Freq (%)
Duplicate	Field duplicate	Collected at rig	1	2%
	crush dup	prep lab inserts	1	2%
	pulp dup	prep lab inserts	1	2%
Subtotal of Duplicates			3	6%
Standard	high	95th% percentile	1	2%
	med	average grade	1	2%
	low	cut-off	1	2%
Subtotal of Standards			3	6%
Blank	coarse		1	2%
	fine		1	2%
Subtotal of blanks			2	4%
Check assays		3	6%	
Total			–	11

For core drilling substitute the RC field duplicate for a core twin sample.
RC Field Duplicate data indicate that sampling variances are within acceptable ranges.
No coarse or pulp duplicate samples were collected and therefore a conclusion cannot be reached regarding subsampling and analytical variances.
The coarse blanks did not reveal any potential cross-contamination events during preparation and/or assaying. For future programmes a pulp blank should accompany the coarse blank (inserted immediately before it) to determine whether sample contamination is occurring at the pulverization and analytical stage. When possible, the core logging geologist should attempt to insert the two blanks immediately following a high grade sample.
The standard insertions indicate that analytical accuracy for Au is within acceptable ranges

12 DATA VERIFICATION

12.1 External Reviews 2002-2012

A number of data reviews have been undertaken by independent third-party consultants as part of preparation of technical reports on the Oyu Tolgoi project (including the EJV Property), including the following:

- Roscoe Postle Associates (RPA), 2002 – Review of exploration information from earlier work by BHP and Ivanhoe and visited the project site in Mongolia and the Analabs assay laboratory in Ulaanbaatar. A suite of independent core samples was collected and assayed. Duplicate analytical datasets were examined. No biases or errors were noted that would affect Mineral Resource estimates.

- AMEC and AMEC Minproc, 2002–2007 and 2012 – Review of QA/QC data and databases in support of Mineral Resource estimates undertaken in 2002, 2003, 2005, 2006, 2007 and 2012, and independent core check sampling. QA/QC reviews showed acceptable analytical precision, low contamination, and a small number of sample mix-ups. The database iterations reviewed were considered sufficiently error-free to support Mineral Resource estimation.

- Barry Smee, 2002–2008 – Review of sample preparation, analytical, and QA/QC data. Inspections and reports were completed in 2002, 2003, 2004, 2005, 2006, and 2008. No significant biases or errors were noted that would affect Mineral Resource estimates.

- Quantitative Geoscience, 2007–2008, 2010 – Data verification of previous AMEC estimates, review of on-site sample preparation facility, independent sampling, and review of geology, mineralisation, core sampling, sample preparation, QA/QC, and Mineral Resource modelling for the Heruga and Heruga North (New Discovery) areas and for geotechnical drilling underway at Hugo North. No biases or errors were noted that would affect Mineral Resource estimates.

Other than the issues noted above, all reviewers have concluded the Oyu Tolgoi project (including the EJV Property) drillhole dataset was sufficiently free of errors, reasonably accurate, precise, and free of contamination, and suitable for use in estimating Mineral Resources.

12.2 Internal QA/QC Reviews 2011-2012

In 2011, TRQ carried out a review of the QA/QC system. The review covered laboratory audits, quality assurance procedures, quality control monitoring, and database improvements at Oyu Tolgoi for the period 2008 to 2010. Recommendations arising from the review included:

- QA/QC improvements at site:
  - Updating SRM inventory and sample storage.
  - Re-designing batch layouts.
  - Re-instating bias charts, failures table, load statistics, failure rates.
  - Upgrading analytical suites.

- Improving density measuring techniques.
- Rectifying SRM failures and duplicates mix-up's.
- Completing check assaying.
  - Completing regular progress reports.
- Preparation laboratory improvements:
  - Minimising fine particle extraction biases.
  - Using correct pulverising amounts.
  - Rectifying safety issues.
  - Using correct sizing test amounts.
  - Proper archiving.
- Database improvements:
  - Improving functionality.
  - Correcting integrity issues.
  - Fixing operational issues.

Implementation of the recommendations by OT LLC continues, with a number of the recommendations either already addressed, such as changes in analytical methods for multi-element exploration suite, or under advisement.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Summary

The Oyu Tolgoi project (including the EJV Property) is being developed in phases:

- Phase 1 – was all the work required to bring OT LLC's Southwest zone into full commercial production through commissioning and ramp-up of Lines 1 and 2, by the addition of essential services and infrastructure. The Phase 1 concentrator was commissioned in early-2013. Nameplate capacity of 96 ktpd was achieved 6 August 2013. Operating data acquired since that time have been used in Phase 2 design, which addresses the delivery of underground plant feed via Hugo North Lift 1 in conjunction with open pit mining.

- Phase 2 – all additional work required to process Hugo North (including Hugo North Extension) Lift 1 production plus open pit plant feed to match Phase 1 SAG mill capacity, including:

  - The addition of a fifth ball mill to achieve a finer primary grind P_{80} of 150–160 µm for a blend of Hugo North and open pit feeds, compared to 180 µm for Southwest.
  - Additional roughing and cleaner column flotation capacity to process the higher level of concentrate production when processing the higher grade Hugo North (including Hugo North Extension) plant feed.
  - Additional concentrate dewatering and bagging capacity.

- Minimal allowance for incremental expansion beyond Phase 2, other than to ensure that Phase 2 will not interfere with possible future expansion.

The Oyu Tolgoi project currently has three areas scheduled for production: the Southwest and Central zones of the SOT deposit, and Hugo North (including Hugo North Extension) Lift 1.

The Southwest zone is currently being mined by open pit mining methods. Central zone ore will also be mined by open pit mining. Hugo North (including Hugo North Extension) will be mined by underground block caving.

A substantial amount of metallurgical test work has been conducted at the project, as reported in the IDOPTR of 2012 and in LHTR13.

The latest work has focused on verifying assumptions made during design with actual operation experience gained from the start of commissioning the concentrator. In addition, further flotation variability tests have been conducted on Hugo North, Central zone, and blends of Southwest zone and Hugo North mineralisation.

On completion of the variability flotation test work on the individual deposits a series of locked cycle tests were conducted on further composites representing chronological blends of ore planned to feed the mill in the mine plan.

Locked cycle tests on the Southwest zone and Hugo North blend responded better than either the Hugo North or Southwest zone composites individually. The composite with 25% Hugo North and composites containing 50% Hugo North achieved 92.8% copper recovery to a 30.2% Cu grade and 92.5% copper recovery to a 27.3% Cu concentrate respectively.

13.2 Evaluation of Test Work and Process Modelling

13.2.1 Grinding Capacity and Flotation Feed Size Modelling

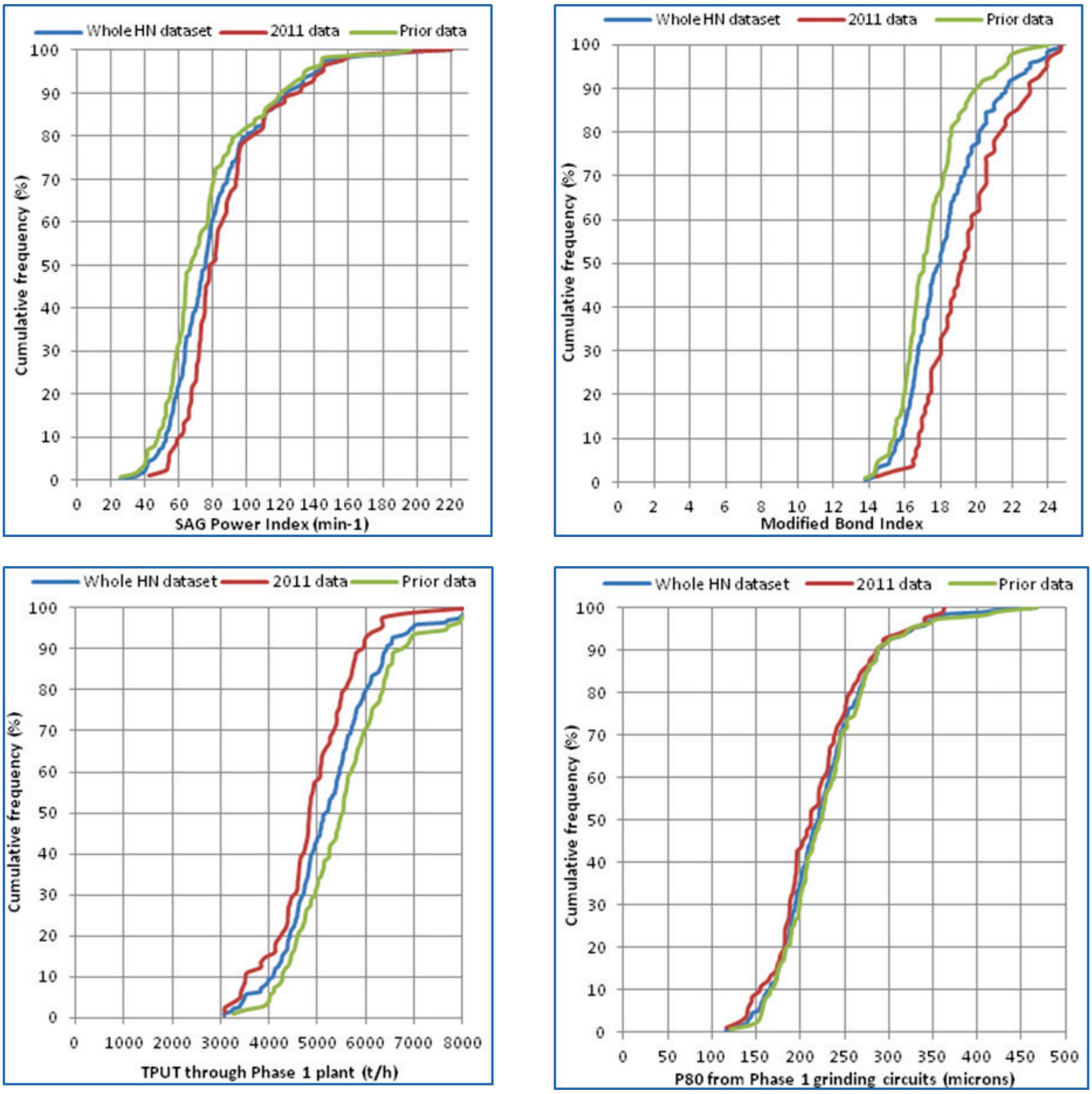
For Phase 1, Minnovex Minerals Services (Minnovex) derived two generic equations to describe the capacity and the flotation feed sizing expected from Southwest zone ore. Both equations use the same comminution parameters as developed for use in its Comminution Economic Evaluation Tool (CEET):

- Semi Autogenous Grinding (SAG) Mill Power Index (SPI), (in minutes) – a closed-circuit small-scale, dry grinding test conducted on –12.7 mm ore.
- Modified Bond Index (MBI) (in kWh/t) – a short form of the Bond Ball Mill Work Index (BWI) test, which is calibrated or validated by several full Bond Index tests.
- Minnovex Crushing Index (Ci) – developed from the sample preparation process for SPI, which is a predictor for the fraction of material already finer than SAG discharge closing screen size.

These parameters were used to model a large number of conventional SAG mill / ball mill (SABC) circuits, with successful prediction of capacity (or throughput (TPUT), the instantaneous tonnage per hour (tph) achievable through grinding x 8,059.2 hpa) and P_{80} (the 80% passing size of grinding circuit product). The Phase 1 plant has achieved and exceeded design production rates with primary grind P_{80} in-line, or better than predicted by the model. The exercise was not repeated for Hugo North (including Hugo North Extension) ore.

Because the equations developed are generic, good agreement is to be expected on any ore fed to the same circuit configuration, which is within the range of comminution indices presented by the majority of Southwest zone ore. Figure 13.1 shows the range of all 336 comminution samples as a cumulative frequency distribution of SPI and MBI. Also plotted are the distributions of 137 samples from Hugo North testing in 2007, a further 82 samples from the more northerly set tested in 2011, and 74 Central samples. All the Hugo North samples fall within the Southwest zone range tested and modelled, while half of Central zone ore samples fall within the Southwest zone SPI data range.

Figure 13.1 Cumulative Frequency Distributions of SAG Power Index, Modified Bond Index, TPUT, and P_{80} of Flotation Feed at 100% through Phase 1 Circuits – Hugo North Samples



These correlations effectively describe the capacity and the product sizing from the Phase 1 circuit and will not be improved upon unless operational experience indicates that fine-tuning of the constants with actual operating data is required. It is an empirical, power-based method that allows capacities and product sizings with different ores to be estimated from the same constants and exponents applied to new comminution parameters, as long as the SAG circuit configuration and closing screen aperture are kept constant. These equations assume that the SAG mill can be kept near full loading on soft ore (e.g. with a high percentage of Central zone ore).

With the planned feed change to softer and higher grade underground Hugo North ore, the mill volumetric constraint becomes one of concentrate handling and tailings handling capacities. The volumetric capacity limit is a capped throughput at 5.5 ktph (equivalent of 121 ktpd and 44.3 Mtpa,), this value is derived from tailings handling capacity.

The constraint is experienced on Central zone chalcocite and covellite ores in 2036 and 2037 when Central zone ore exceeds 40% of the feed and the balance is primarily Hugo North ore.

13.2.2 Validation of the Minnovex Comminution Predictions

The prediction of throughput and transfer size is fundamental to the mine planning process and is the basic determinant of annual production capacity. It is also fundamental to predicting the capacities of the operation in a variable ore source environment. However, it is necessary to validate the predictions in early operation so that they can either continue to be used with increased confidence; or if the predictive power is poor, be replaced by a better system.

Plant surveys were carried out in November 2013 and survey samples were submitted for comminution testing. This allowed correlation of plant capacity against orebody characteristics. Besides SPI, MBI, and Ci measurements, other tests performed on the samples included the Julius Kruttschnitt Mineral Research Centre (JK) drop weight tests to evaluate potential alternative predictive methods.

It was concluded that the actual SAG mill capacity in Surveys 1 and 2 was in excess of the generic model by about 10%, when corrected for charge level. In addition, the SAG mill appeared to be producing more fines than anticipated, leading to a finer P_{80} in flotation feed than expected. The surveys recorded P_{80} values of 130–150 µm on relatively hard ore with a work index of 22.6 kWh/t, Ci of 19.5, and SPI of 117.3. These parameters are at the 40th percentile for Southwest zone ore SPI, but at the 80th percentile for Hugo North SPI, and above the 90th percentile for both orebodies for MBI. With the same material, the generic model used in the mine plan would have predicted a P_{80} of 218 µm.

Due to the difficulties in representative sampling of coarse SAG mill feed and the impact of belt cuts on survey stability, these results must still be considered indicative, but encouraging, for Phase 2 performance. Sensitivity analysis to JK drop weight parameters around Survey 2 was also carried out by simulation. When the survey hardness parameters were replaced with values representing the softest and hardest Southwest zone ores, SAG capacity increased by 19% and decreased by 15.5%, respectively, while achieving product P_{80} values of 130–134 µm. This is in line with the capacities indicated by the generic capacity prediction model, although P_{80} appears to be more conservatively estimated by the Minnovex model.

13.3 Sample Spatial Representation and Selection Criteria

The number of samples and tests for each orebody is listed in Table 13.1. The major recent additions are as follows:

- Twenty variability composites from 72 holes throughout the Hugo North block cave, for abrasion index and crusher work index. Sub-samples were taken for mineralogy, head grade, and rougher flotation testing.

- Thirteen variability samples from Central zone, selected based on copper mineralogy, pyrite grade, and location, for Bond ball mill, Bond rod mill, and crusher work index. A blended sample of covellite ores was taken for JK tests, and flotation tests were carried out on samples categorised as chalcocite, covellite and chalcopyrite, based on dominant copper speciation.

- Seven composites from the Southwest zone, designed to represent the first seven years of the mine's life, subjected to mineralogy and flotation testing. Two master composites represent the years when Southwest zone ore is processed individually and then as a blend with Hugo North.

Table 13.1 Number of Comminution Samples per Orebody

Deposit / Zone	Years of Scheduled Production	No. of Holes Sampled	No. of Samples Tested
Southwest Zone	0–9, 13–30	77	204
Central Zone	10–30	25	74
Hugo North (including Hugo North Extension)	7–25+	79	239
Hugo South	Sensitivity cases	6	15

13.3.1 Sampling of Other Reserve Case Orebodies

With the completion of the Phase 1 design for Southwest zone ore, the primary design focus for sample selection for the study was better definition of the northern third of the Hugo North Lift 1 (HNL1) block cave envelope, as can be seen from a comparison of the charts in Figure 13.2.

Cave initiation is in the vicinity of 4,767,700 mN and 651,650 mE. Ore located south of 4,766,800 mN would not report to the current block cave drawpoints, but would be mined as a separate Hugo South block cave. Comminution test sampling density is given in Table 13.2.

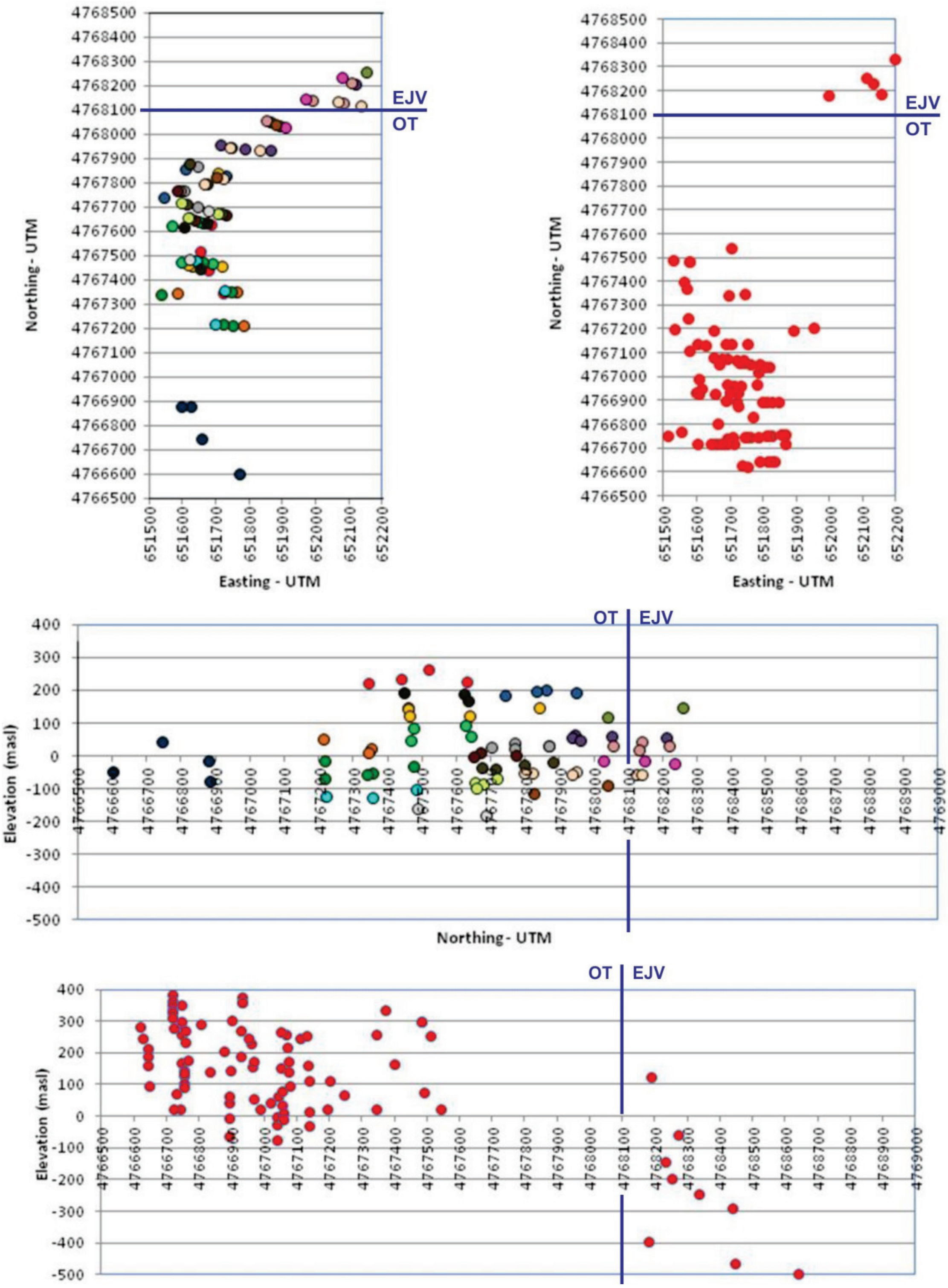
The sample density on a life of mine (LOM) basis was doubled in the Hugo North block cave compared to the open pit orebodies because of the inability to re-sample a block cave by drilling once fragmentation has commenced. Sample density in the open pit orebodies is 2–4 times higher in the early production years than for the LOM as a whole, and as such meets the criteria normally applied in the SPI methodology for new orebodies.

Table 13.2 Minnovex Comminution Test Result Density for Reserve Case Orebodies

Orebody	SPI Tests	Ci Tests	MBI Tests	BWI Tests	Reserve Case LOM Production (Mt)	SPI Density (tests / Mt)
Southwest Zone	219	106	209	31	699	0.31
Central Zone	73	13	71	5	263	0.28
Hugo North / Entrée	239	218	237	18	436	0.55
Total	**514**	**206**	**480**	**54**	**1,398**	**0.37**

Note: SPI is SAG Mill Power Index; MBI is Modified Bond Index; Ci is Minnovex Crushing Index; BWI is Bond Work Index.

Figure 13.2 Sample Locations for New Hugo North Samples, Compared to Previous Comminution Samples (in red)



A secondary focus was better definition of the LOM response of the Central zone, which will be processed with Hugo North and Southwest zone ores.

The earlier Hugo North comminution dataset was populated more densely to the south of the prior block cave envelope. The cave initiation point subsequently moved north to the orebody inflexion point to access a high gold core that has recently accounted for more value at higher long-term gold price projections (Table 13.3).

Table 13.3 Comparison of Mean Values for Hugo North (including Hugo North Extension) Comminution Indices

Dataset	SPI (min^{-1})	MBI	Ci	TPUT (tph in Phase 1)	P_{80} (Phase 1 P_{80} in µm)
2011 dataset	88.1	16.1	19.5	4,906	219
Prior dataset	76.2	19.6	17.4	5,557	231
Combined dataset	81.4	18.1	18.3	5,279	226

The 2011 dataset is compared to the prior dataset and the combined dataset in Figure 13.1. TPUT and P_{80} are derived from the generic Minnovex formulae and reflect the hypothetical situation where Lines 1–2 are fed with 100% Hugo North ore.

Comparison of the combined dataset with the previous dataset indicates a 5.0% reduction in the predicted capacity to 5,279 tph from 5,557 tph, compared to that currently attributed in the block model. This potential bias has been corrected by inclusion of the 82 sample results in the Hugo North block model update for OTFS14.

Minnovex's MBI results were checked against the Standard Bond Index test on 18 samples, with generally good agreement, moderate scatter, and no evidence of bias. This indicated that the MBI results can be used to populate the block model and wherever else Standard Bond index results may be required, as in the calculation of incremental ball milling requirements.

13.4 Mineralogy

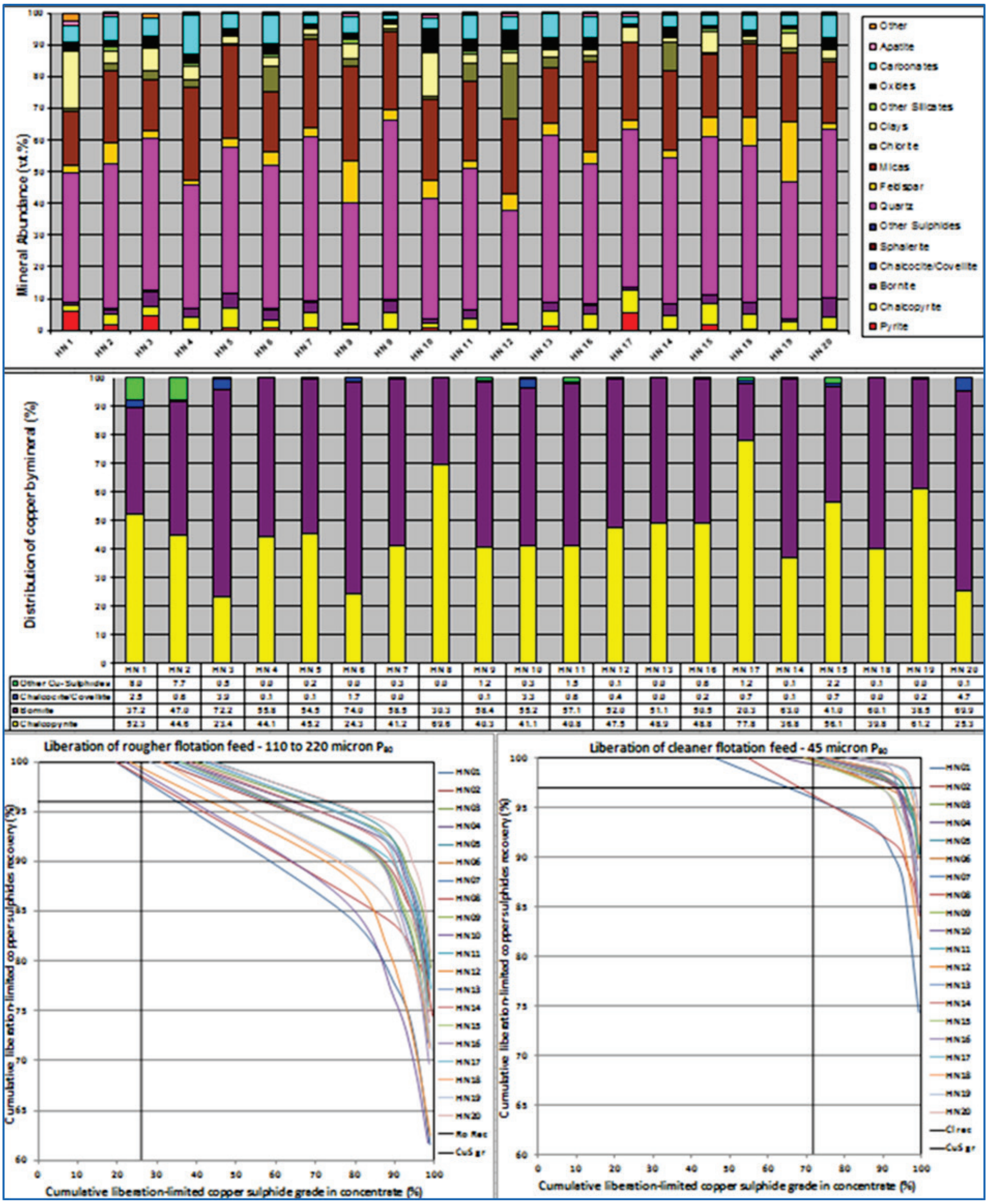
A large number of direct and indirect mineralogical assessments have been carried out on ore and flotation products, in the following categories:

- Routine thin sections on intervals of core in conjunction with logging to qualitatively assess the nature of the copper mineral and gangue mineral assemblages.
- Routine semi-quantitative clay mineral measurements by infrared spectroscopy to assist with alteration classification and to potentially identify rheology-modifying species that could be problematic in processing.
- Visual logging of all core with respect to estimated sulphide mineral totals.
- Mineralogical assessment of ore sections from all orebodies by Terra Mineralogical Services (Terra), including analysis of gold association, fluorine deportment in ore and concentrate, copper mineral associations in tailing, and leach residues (49 reports and memos from 2002–2005).

- The production by Terra of a spatial 'metallurgical index' block model of metallurgical degree of difficulty, primarily for the Southwest and Central zones, but also with some coverage of Hugo North (including Hugo North Extension).
- Diagnostic leach work on oxide and secondary copper zones to distinguish between chalcocite, chalcopyrite, and covellite.
- QEMSCAN on particulate Southwest and Hugo North composites (flotation feed and rougher concentrates).
- Full QEMSCAN analysis on all 20 flotation feed composites from Hugo North and Central zone test work programmes (Blue Coast / SGS).
- X-ray diffraction and QEMSCAN on composites of flotation tailings produced for NAF / PAF characterisation.
- Mineralogy as inferred from 48 element ICP-OES / MS assays on 24,000 intervals over all deposits.
- Liberation analysis by conventional particle counts on Heruga.

A graphical summary of QEMSCAN results for the 20 Hugo North composites, are given in Figure 13.3.

Figure 13.3 Presentation of QEMSCAN Results for 20 Hugo North Composites



The first bar graph in Figure 13.3 displays mineral abundance by weight in the feed, summing to 100%. Sulphides are at the bottom in the stacked chart, with pyrite in red. Pyrite is only present at significant levels in three of the 20 composites, and when present is usually accompanied by higher than average levels of copper sulphides, which leads to easier separation. Little dilution of concentrate by pyrite has been observed in previous flotation work, as expected from this mineralogy.

Copper sulphides plus pyrite rarely form more than 10% of the total weight, with chalcopyrite, bornite, and chalcocite–covellite present at 3.9%, 2.7%, and 0.04%, respectively by weight. Quartz is the dominant rock-forming mineral (46% on average), followed by sericite mica (24%), chlorite (3.0%), and feldspar (5.0%). Clays account for 1.0%–18% of the mineral components in the composites, but average less than 5.0% overall. The broad footprint of the cave is likely to minimise daily variation in clay content to very manageable levels in the grinding and flotation circuits.

Oxides, primarily of iron (magnetite, hematite, and goethite), average only 2.8% of the mineral components, and carbonates 5.4%. The former are too low to provide much benefit from magnetite recovery, while the latter present useful buffering capacity to minimise acid mine drainage from tailings. Apatite is present at 0.6 wt%, and is moderately variable. It can locally form a significant source of fluorine in feed and thus, by entrainment, in concentrate. Overall, the previous work has indicated less fluorine contributed by apatite, than by sericite and fluorite.

The second bar graph shows the relative contributions of chalcopyrite, bornite, and chalcocite–covellite to the total copper content of the feed. Due to its high stoichiometric grade, on average bornite contributes 52.3% of the copper, followed by 45.5% from chalcopyrite, only 1.1% from chalcocite–covellite, and 1.2% from other copper sulphides. The latter will also include the sulphosalts tennantite and, to a much lesser degree, tetrahedrite. Tennantite is the predominant arsenic source for Hugo North and is difficult to depress, even at high pH. In Central zone ore, arsenic reports to concentrate at 78% of the copper recovery and is likely to be similarly related in Hugo North. The high bornite content implies a limiting average grade of 46% copper in concentrate. The metallurgical correlations from flotation test work include the dilution contributed by pyrite flotation, by entrained free gangue minerals, and by incomplete liberation of both minerals from the copper sulphides. This results in an average 35% reduction in copper grade below the theoretical limit established by quantitative mineralogy.

Incomplete liberation also results in incomplete copper sulphide recovery, as indicated by the lowest pair of line graphs. The left hand side line graph shows the rougher feed Cumulative Liberation Yield (CLY) profile. A copper sulphide mineral grade versus incremental recovery plot is obtained by including progressively less liberated particles from the lower right to the upper left, until all copper sulphide containing particles have been included, at the 100% recovery axis. At roughing sizes from P_{80} 110–220 µm, there is a fair degree of variation in liberation level, which is only partially independent of the P_{80} variation from the different sample work indices. Hugo North composites HN1 and HN8 are softer, finer, but less well liberated, while HN18 and HN19 are harder, coarser, and also less well liberated.

The average Hugo North rougher flotation grade-recovery point (96%–12% Cu or 26% copper sulphides) is included for reference, at the intersection of the horizontal and vertical target lines. It is comfortably to the left of any of the 20 CLY curves, allowing room to include significant dilution resulting from the 10% mass yield to rougher concentrate that occurs naturally from gangue entrained in water in froth after 30 minutes of continuous froth removal.

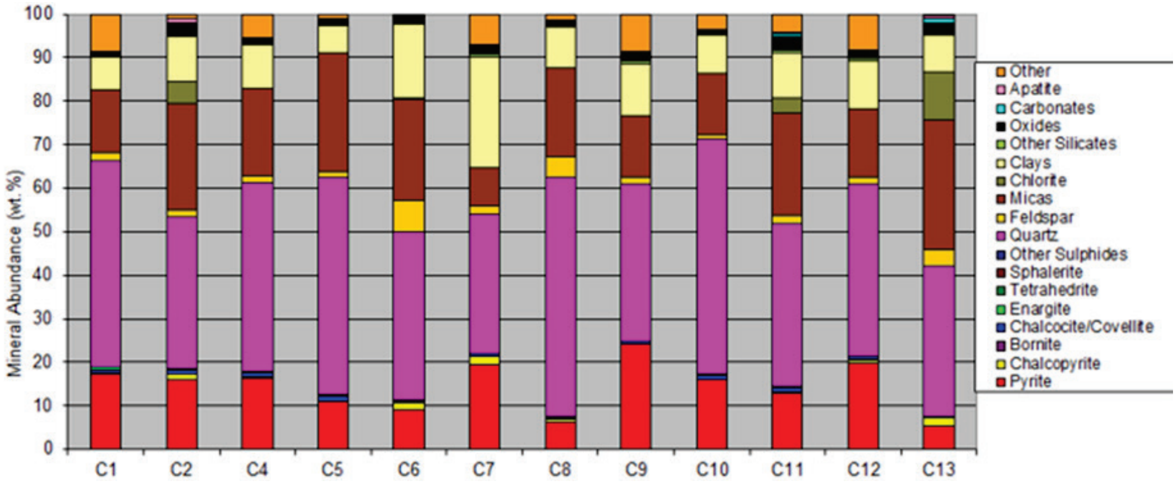
All but four of the 20 composites intersect the 100% recovery axis between 30%–45% copper sulphides, which is at the bottom of the normal range of liberation for porphyry copper processing. Lower plant recoveries are to be expected for the other four composites, with only 20%–25% copper sulphides when 100% of the copper distribution is included. The data also demonstrates the importance of regrinding, compared to other, better liberated porphyry copper deposits, where regrind circuits are sometimes considered an optional extra. If a 90% liberation level is considered necessary for the production of marketable concentrate, as is usual, then overall copper recovery in roughing would have to be restricted to 80%–85%, if the regrind circuit were shut down, compared to 93% overall with regrind. This assumes that the normal offset between theoretical CLY distribution and actual plant recovery performance applies.

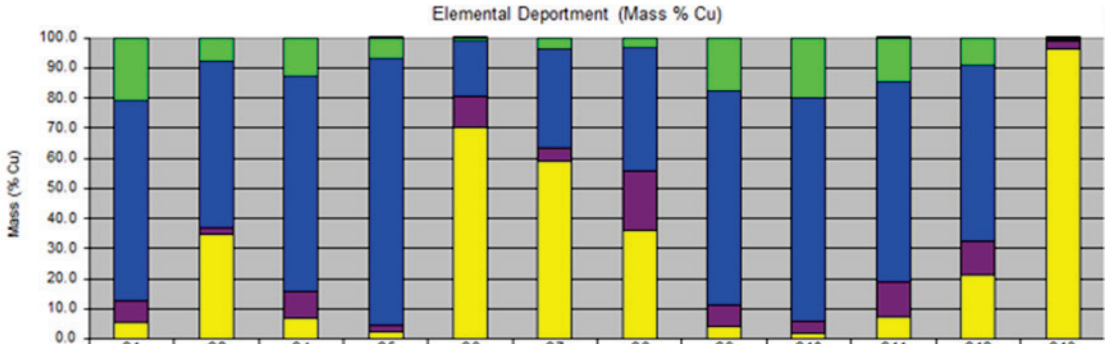
The right hand side line graph shows the same data for the cleaner feed size distribution, at a P_{80} of 45 µm. This is constructed from a weighted average of the data for separate –38 µm and –106 +38 µm fractions. The degree of liberation after regrinding to the target Hugo North size distribution is much higher than in roughing and the variability is much reduced. All but two of the 20 composites meet the 100% copper distribution axis at 65%–85% copper sulphides and the concentrate is 90%–96% liberated at the 97% cleaner recovery target. The two composites that have liberation challenges are HN1 and HN8, which also showed sub-normal liberation in roughing. Referring to Table 13.4, the copper assays for both composites are below 1.0%, so that not much copper distribution is at risk. They are unlikely to present more than 5.0% of the draw at any given time.

The mineralogy of the Central zone composites, Figure 13.4, shows more complex sulphide speciation, significant levels of copper present as arsenic-bearing enargite, much higher pyrite content (8.0%–24%) and much finer and more variable grain sizes at rougher and cleaner feed sizes. Bornite is minor in all zones and chalcopyrite is predominant in the Central chalcopyrite zone, represented by composite C13 and also by composites C6 and C7. In the other composites, most of the copper is present as covellite, followed by chalcocite, then by chalcopyrite, enargite and bornite.

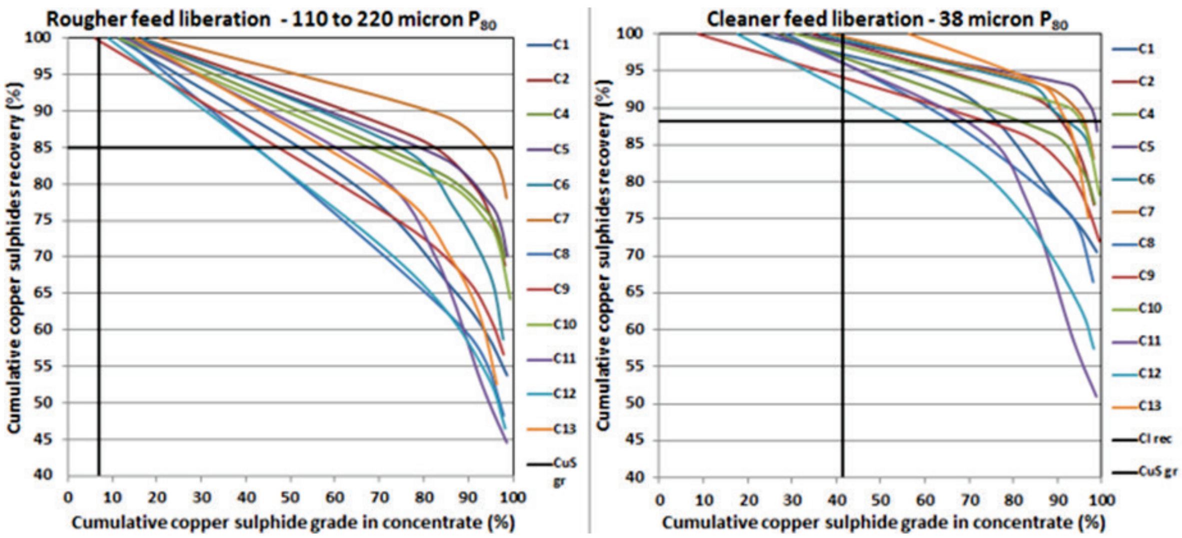
It is possible to produce Central zone concentrate of 25% grade and 75% recovery by use of very high pH in cleaning. These levels are shown in copper sulphide grade and cleaner stage recovery terms in the cleaner feed liberation graph. However, the use of lime to pH 12 at 25 µm to depress / liberate pyrite is very expensive and is untested in blends with majority Hugo North ore to reflect the conversion case, further high pH is expected to depress copper and final gold recoveries for Hugo North ores and so Central zone ores will be processed instead at Hugo North conditions.

Figure 13.4 Presentation of QEMSCAN Results – 12 Central Zone Composites





	C1	C2	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Tetrahedrite				0.0	0.0					0.0		0.0
Enargite	20.9	7.5	12.7	6.8	0.9	3.5	3.3	17.4	20.0	14.6	9.0	0.4
Chalcocite/Covellite	66.5	55.8	71.4	88.7	18.5	33.2	41.0	71.2	74.4	66.3	58.4	0.5
Bornite	7.1	2.3	9.0	2.3	10.3	4.5	19.5	7.2	4.0	12.0	11.4	2.9
Chalcopyrite	5.4	34.4	6.8	2.2	70.3	58.8	36.2	4.1	1.7	7.1	21.1	96.1



13.4.1 Availability and Volume of Test Work Conducted

The samples selected in the latest confirmatory programme of work on the northern area of Hugo North are shown in Table 13.4. The confirmatory work better investigated low pH conditions for Central zone ore flotation of composites that were both spatially and mineralogically discrete in terms of sulphide speciation. It also generated flotation results for Hugo North (including Hugo North Extension) composites, which displayed the full range of copper head grades, gangue mineralogy / alteration, and for which comminution characteristics had been defined in SPI / MBI / Ci terms.

Table 13.4 New Flotation Composite Selections for Hugo North (including Hugo North Extension)

Designator	Grade		Alteration
	Cu (%)	Au (g/t)	
HN1	0.99	0.07	Intermediate Argillitic (ARG)
HN2	1.85	0.43	Mainly sericitic (SER)
HN3	4.18	0.38	Mix of ARG, chloritic (CHL) and SER
HN4	2.34	0.38	ARG
HN5	3.16	0.75	Mainly SER
HN6	2.69	1.18	Mix of ARG, CHL, and SER
HN7	3.15	1.26	SER
HN8	0.81	0.15	SER
HN9	4.04	1.82	SER
HN10	1.30	0.24	Mainly ARG
HN11	2.68	1.05	Mainly CHL
HN12	0.79	0.11	Mix of SER and CHL
HN13	3.15	1.11	Mix of ARG, CHL, and SER
HN14	3.04	0.95	Mainly SER
HN15	3.09	0.50	Mainly SER
HN16	2.49	0.57	Mainly SER
HN17	2.57	0.37	SER
HN18	3.25	1.25	SER
HN19	1.43	0.37	SER
HN20	3.79	0.44	Mainly ARG

13.4.1.1 Variability of Test Work

The locations of the additional flotation samples are aligned with the Hugo North comminution samples. Spatial variability composites for flotation were generated from three to seven interleaved sub-samples of the core intervals selected for the comminution samples. These are designated by points of a common colour on Figure 13.2. The new Hugo North flotation samples are described in Table 13.4. Selection criteria for compositing were primarily spatial, with fairly tight groupings that could be tracked via similar height-of-draw. However, the process managed to differentiate a wide range of head grades for development of head grade recovery relationships and also managed to classify partly by alteration type.

13.4.1.2 Effect of Processing Variables on Flotation

Rougher Flotation Feed P_{80}

Flotation feed sizing in the block model outputs is established by the SAG mill / ball mill power split and the ratio between SPI and MBI for Southwest zone, Central zone, and Hugo North. As discussed previously, a correction is required for the addition of Ball Mill 5. The economic optimum flotation feed sizes are summarised in Table 13.5. These values have been approached quite closely by the grinding circuit design and production schedule predictions via the hardness parameters in the block model, which allows the continued use of the IDOP metallurgical predictions for Hugo North and Southwest zone with minor corrections of the latter for recent operating experience. The size-by-size Aminpro grind recovery optimisation approach is described in Section 13.4.1.3 on the flotation capacity modelling.

Table 13.5 Optimum Primary Grind Size for Each Ore Type (P_{80}, µm)

Deposit / Zone	IDP05	Aminpro 2007
Southwest Zone	180	180
Hugo South	150	–
Hugo North (including Hugo North Extension)	140	116
Central Zone(average)	138	179

Cleaner Flotation Feed P_{80}

In the absence of penalty element liberation problems, the coarsest regrind sizing that achieves 90% liberation of copper sulphides in cleaner feed is generally considered a good estimate of the optimal regrind level in plant operation. Hugo North ore has shown uniformly lower fluorine levels than Southwest zone ore in concentrate from locked-cycle test work. In test work, one third of the Hugo North concentrates would exceed the 300 ppm F penalty level. Penalties between the 300 ppm F penalty threshold and the 1,000 ppm F rejection level are insufficient to repay much investment.

Rougher and Cleaner Flotation Conditions

The Aminpro work also used Southwest, Hugo North, and EJV kinetic flotation work by Process Research Associates of Vancouver (PRA) to develop flotation simulation models in roughing and in cleaning that could be calibrated against the kinetic work and used to simulate the effects of ore type, copper head grade, primary grind level, rougher pH, regrind level, and cleaner pH.

In general, the following trends were observed:

- With sufficient collector adjustment, copper recovery is insensitive to pH within broad ranges (pH 7–11).
- Gold recovery is adversely affected by lime addition (both pH and Ca++ concentration above pH 9) and is not as responsive to additional collector. This has influenced a slower ramp-up of Central zone pit development in OTFS14 until high gold Hugo North ore has been processed (2022–2024). Gravity gold recovery is a possible contingency to recover slow-floating gold, while unit cell operation on regrind cyclone underflow is a possible means of preventing as much gold from becoming slow-floating by reducing over grinding.
- Additional collector and retention time is required at high copper head grades (feed forward strategy required to link collector addition to copper metal units in flotation feed).
- Better copper grade–recovery response and pyrite rejection are typically achieved with dithiophosphinate collector (3418A) than with any single xanthate (isopropyl, isobutyl, or amyl). However, xanthate storage and mixing facilities have been provided for potential synergistic addition with secondary gold collectors. Test work completed in 2012 by Blue Coast indicated a slight advantage in copper and gold recovery with potassium amyl xanthate. The results were not conclusive, however, against the comparative 3418A tests conducted at higher rougher concentrate grades.
- Additional cleaner collector is required at finer regrinds and higher pH values.
- There is a benefit from staged addition of collector.
- Rougher flotation kinetics might be slower at low pulp potential (eH). In recent confirmatory test work, rougher flotation response was delayed until the flotation pulp potential (absolute) was above 0 mV. This trend was exacerbated by even modest lime additions, because increasing pH reduces eH. It is possible that this observation is a reflection of batch test work and not representative of a continuous flow system. The cyclone overflow eH in almost all concentrators (except those treating ores with extremely high pyrite content, or an active pyrite or pyrrhotite content) is routinely in the range of 0–50 mV, with no specific chemical interventions or additional aeration in the grinding circuit. Even the most-pyritic Oyu Tolgoi ores have less than 15% pyrite content, which is not chemically active. If low eH is encountered, then additional aeration may be warranted. There is space to retrofit conditioners or aeration devices of a few minutes capacity on the ball mill floor below the cyclones. In this event, it might also be

necessary to retrofit an additional pumping stage, for which the grinding basement has sufficient space.

Water Quality

Test work to assess the effect of water quality on flotation has been conducted since IDOP. A bore water composite was collected from the Gunii Hooloi bore field as a simple average of samples from individual wells. Test work was conducted at SGS, with Vancouver tap water used as a control. The test work indicated that, for Southwest zone ore, recycle water was favourable to the copper grade vs. recovery curve at lower grades (possibly due to collector recycle), but unfavourable to copper recovery at higher grades. One year of experience at Oyu Tolgoi has shown no ill-effects from using process water.

13.4.1.3 Flotation Capacity Modelling

The selection of flotation design criteria for mechanical cells in the concentrator conversion has taken account of the following information:

- The laboratory bench kinetic test work at Ammtec in roughing and cleaning, while achieving the rougher and cleaner overall stage recoveries required by the mass balance.
- The review of flotation kinetics by Aminpro and the results of the Minemaster model for Hugo North and Central zone ores. Column cell and mechanical requirements were confirmed at both 30 µm and 40 µm grinds by Aminpro simulations around results from PRA kinetic flotation test programmes carried out in Vancouver.
- Comparison with cell capacity allocations for Lines 1–2 in Phase 1, before and after an additional rougher bank.

13.4.1.4 Thickening and Filtration Capacity

Test work has not focused on generating large volumes of concentrate and tailings for thickening and filtration test work, as was carried out for Southwest zone ore. To allow for a conservative design, the same unit thickener capacities have been used for concentrate thickening as in Phase 1, despite the coarser regrind targets.

The same is true in the final tailings area, where the dewatering duty for blended Southwest, Central, and Hugo North tailings is similar to Phase 1. Phase 1 thickener optimisation is still in its infancy, but significant reductions in flocculant addition (from 30–20 g/t) have recently been achieved, while improving underflow density.

Phase 1 adopted conservative design margins in thickener unit area, which can be further enhanced by higher flocculant addition. In a recent operating period in which one thickener was out of service, the remaining thickener was operated at rates to 75 ktpd. It is unlikely that the conversion will push the existing thickeners to capacity. As a contingency measure in detailed design, more thickener area is available at locations that the original Fluor design had reserved for two additional tailings thickeners. Such additions would be motivated by operating experience on Southwest zone ore.

Phase 1 filtration performance has performed to specification. Filtration has been trouble-free, allowing a very straightforward scale-up for the conversion, which includes the addition of two more identical filters. Industrial experience indicates that cake formation rates will increase by 14% due to the envisaged coarser Phase 2 regrind (45 µm vs. 35 µm). A location for a fifth pressure filter has been reserved in the layout as a contingency against a further 20% increase in peak filtration duty.

It is recommended that further Hugo North tailings thickening and concentrate pressure filtration test work at 0.1 m^2 scale be conducted before detailed design, but after underground development has progressed, to allow lower cost acquisition of larger diameter core samples from a greater number of access points. Phase 1 operating performance will continue to be monitored.

13.4.2 Metallurgical Predictions

13.4.2.1 Payable Metal Recoveries

The current models used for metallurgical performance and throughput estimation are presented in Table 13.6 to Table 13.10. The key changes from LHTR13 include:

- A change in the grade-recovery point for Southwest zone, with a 1.5% absolute decrease in copper assay in concentrate and a corresponding 1.8% absolute increase in copper recovery at mean copper and Cu to S ratio in feed.

- A reduction in gold recovery for Southwest zone. The relationship between gold and copper recovery was validated as shown below:

  - BDT29 (DIDOP / initial Phase 1): Au Recovery(%) = 0.8 x Cu Recovery(%) + 9.8
  - BDT31 (OTFS14 / revised Phase 1): Au Recovery(%) = 0.8 x Cu Recovery(%) + 4.8

- Similar relationships between gold and copper recovery being recommended for the Central zone. The relationships are similar in nature to that shown above for Southwest zone gold recovery. The 4.8 intercept is maintained, but the copper recovery multipliers (gradients) replace the 0.8 factor for Southwest zone. The new recommended gradients are chalcocite (0.70) and Central zone covellite (0.65) with chalcopyrite remaining the same as Southwest zone (0.8).

- Reductions in the 'a' constant multiplier term in copper recovery from Central zone chalcocite (–10%), covellite (–5.0%), and chalcopyrite (–10%) to account for blended feed operations at Hugo North optimised parameters.

- Reductions in concentrate grades from Central zone chalcocite (–5.0%), covellite (–5.0%), and chalcopyrite (–1.5%), which were also required to shift the overall grade vs. recovery curve for blended feed operations at parameters optimised for Hugo North ore (primary grind P_{80}, regrind P_{80}, and cleaner pH).

The parameters used for Hugo North were also applied to the Entrée ore, which is a continuation of the same Hugo Dummett orebody beyond the Oyu Tolgoi lease boundary. Additional test work conducted in 2012 on 20 Hugo North composites did not materially affect comminution or recovery estimates, given the greater volume of earlier work and the use of fresh core.

The Hugo North core for the Blue Coast test work at SGS was stored outside (at ambient conditions, but kept dry) for six years before selection, crushing, and freezer storage at SGS. Similarly, the Central zone core was stored outside for eight to ten years before testing. While local conditions are relatively non-conducive to oxidation, it is possible that flotation response suffered as a result. It is recommended that fresh core from the 23 drillholes from the 2013 infill drilling programme be preserved in frozen storage as a precaution.

The formulae in Table 13.6 to Table 13.10 have been incorporated in interim operating cost estimates for cut-off determination purposes. The throughput algorithms are used for production throughput scheduling. The higher ratio of ball mill power after the concentrator conversion is modelled by applying an additional stage of ball milling on the original flotation feed sizing predicted by the Minnovex model.

Table 13.6 Base Data Template 31 – Copper Recovery

All Ores				
A x [(b x Cu%) / (1+b x Cu%)] x [1–exp(–b x Cu%)]				
Southwest Zone a = 98 b = 14.5	**Hugo North** a = 95 b = 15	**Central Zone Covellite** a = 80 b = 15	**Central Zone Chalcocite** a = 72 b = 15	**Central Zone Chalcopyrite** a = 88 b = 12.2

Table 13.7 Base Data Template 31 – Gold Recovery

All Ores				
c x (d x Cu Recovery)				
Southwest Zone c = 4.8 d = 0.80	**Hugo North** c = 9.8 d = 0.80	**Central Zone Covellite** c = 4.8 d = 0.65	**Central Zone Chalcocite** c = 4.8 d = 0.70	**Central Zone Chalcopyrite** c = 4.8 d = 0.80

Table 13.8 Base Data Template 31 – Silver Recovery

All Ores
13 + 0.8 x (Cu Recovery)

Table 13.9 Base Data Template 31 – Copper Assay in Concentrate

Southwest Zone	Hugo North	Central Zone Covellite and Chalcocite	Central Zone Chalcopyrite
–3.6 x (Cu : S)^2 + (12.8 x Cu : S) + 22.5	2.9 x (Cu) + (11.4 x Cu : S) + 15.3	20	–3.6 x (Cu : S)^2 + (12.8 x Cu : S) + 21

Table 13.10 Plant Grinding Throughput Rates

All Ores
Flotation feed P_{80}=113 x $Ci^{0.26}$ x $SPI^{-0.60}$ x $BM^{0.88}$ Maximum P_{80} guideline = 220 µm
Throughput in tph (instantaneous = 29,320 x $Ci^{0.19}$ x SPI $^{-0.36}$ x BM $^{-0.24}$
Maximum throughput = 5.5 ktph (hydraulic limitation)

13.4.2.2 Penalty Element Mineralogy, Control and Economic Impact

Arsenic and fluorine are the only penalty elements that have been identified in the Reserve Case orebodies. Enargite is the primary arsenic carrier in all orebodies, although tennantite is locally important.

High flotation pH is the primary mineral processing control on arsenic recovery, but it is only partially effective because of the difficulty in depressing enargite and the related copper losses. In addition, high pH has an adverse impact on gold recovery and is therefore not expected to be used often.

Fluorine distribution in concentrates is more variable, being locally present as coarser grained fluorite or finely intergrown topaz in some high-fluorine areas, but with a background level distributed as 0.6%–2.0% fluorine in sericite, which itself represents 15%–30% of the weight of all orebodies. Regrind level and the degree of entrained gangue removal are the primary control mechanisms for fluorine.

As long as concentrator feed is managed such that rejection levels are avoided, the modest impact of fluorine and arsenic penalties averaging less than $5/t of concentrate. To handle production peaks while maintaining a base load for contract, a certain amount of the Oyu Tolgoi concentrate production has been considered for sale to traders for subsequent blending. This could be an avenue for disposal of high-penalty element concentrates.

For arsenic in copper concentrate, the production model assigns a rate of $2/t per 1,000 ppm As above a 3,000 ppm As threshold up to the rejection level of 5,000 ppm As.

For fluorine, the production model assigns a rate of $2/t per 100 ppm F above a 300 ppm F threshold up to the rejection level of 1,000 ppm F.

The penalties are in line with terms from custom smelters. However, it has been reported that no fluorine penalties have been applied under the contract terms in operation since sales commenced in late-2013, so some conservatism is inherent in the Net Sales Return (NSR) estimates.

13.5 Concentrate Production, Payables, Penalty and Minor Elements

Molybdenum content is insufficient in the Reserve Case orebodies to justify production of a separate concentrate. Copper assay varies with higher grade Hugo North production and increased bornite content early in the block cave. The peak grades from underground bornite are moderated by simultaneous treatment of large amounts of Central zone. High copper content, especially high Cu : S ratio, is attractive to most smelters as it provides high copper yield while not taxing acid recovery and handling systems. The peak anticipated grades in the schedules are near 35% Cu. The minimum annual production grades of 23%–24% Cu in the last few years are less attractive, but are on a par with Erdenet product and represent small volumes far in the future.

Gold assay is much more variable, with early peaks coinciding with extraction of the high gold core to the maximum depth for successive phases of the Southwest zone pit.

Silver represents a much lower percentage of value and is elevated when there is a higher Ag : Cu ratio in feed. The significant variability in precious metals content may require shifts in concentrate allocations to smelters. Some smelters are better set up for precious metals recovery than others, thus making better margins relative to the amount of gold paid for.

Arsenic and fluorine are penalty elements, but the terms have relatively little economic impact. At high levels in concentrate, smelters are unable to deal acceptably with arsenic and fluorine and, rather than a penalty, their presence becomes a basis for rejecting the concentrate. The Chinese State Inspection Agency also monitors quality and enforces national limits. Consequently, the primary concern is staying well clear of the rejection limits, and retaining the ability to respond to a potential decrease in the rejection limit if environmental standards become more stringent.

Both fluorine and arsenic are modelled in the mine plans and neither element is expected to present significant long-term marketing difficulties. However, the primary control over fluorine rejection is in the hands of the concentrator, while the primary control over arsenic is by long-term planning and short-term grade control at the open pit mine. In Phase 1 and Phase 2, sufficient blending capacity exists in the concentrate slurry storage tanks (5–10 kt) and in the load-out shed (25 kt) to mitigate most process upsets affecting fluorine in a 5.0 kt smelter shipment. Such upsets would include loss of regrind efficiency or capacity or loss of control over column cleaner operation. Longer term excursions in arsenic content in feed could be managed by maintaining a larger than usual inventory of higher arsenic as bagged product at the site and scheduling its release over a longer time.

Depression of arsenic by elevated pH in cleaning is not particularly effective and would affect gold recovery from Southwest zone and Hugo North ores. It would be a less expensive measure whenever Central zone chalcocite and covellite ores predominate, when gold grades are much lower. Optimised cleaning schemes for Southwest zone and Central zone ores are possible when processed sequentially, but this is not possible in a mine plan optimised around aligning the grinding and volumetric capacity limits.

For arsenic and flourine, the annual mean level and the maximum level expected in a 5.0 kt shipment is estimated. Due to the differing sources of variation and measures available to control it, maximum fluorine is assessed at 1.2 times the annual average level, while maximum arsenic is assessed at 1.3 times the annual average. The fluorine variation allowed is based on an analysis of variation in Southwest zone production to date.

Current shipments are not attracting a penalty and peak shipment levels still retain a minimum 10%–20% margin below the rejection level (1,000 ppm F). Average concentrate production will occasionally attract arsenic penalties when Central zone ores forms a significant fraction of feed.

In addition to conventional payable and penalty elements, smelters are also interested in non-payable elements from which they may derive by-product credits (rhenium, mercury, selenium). There are also components that may be penalised in certain cases depending on other sources of smelter feed and their levels (bismuth, thallium). Other critical, non-penalty elements not tracked by the Oyu Tolgoi production model are also of importance in assessing a smelter's productive capacity (sulphur via the acid plant) or its operating costs and slag chemistry (Al, Ca, Mg, SiO_2, and Fe). Such elements can be assayed directly in production year composites, or their overall variation inferred from other indicator assays or mineralogy. Finally, the particle size and the moisture of the concentrate are required to assess the dusting and bulk handling characteristics in the feed preparation and gas handling areas.

The expected means and ranges of these parameters are presented in Table 13.11. None of the parameters listed would appear to give smelters cause for concern. The ranges are necessarily wide to reflect the assay results from a variety of ore types treated over an extended mine life. They also vary due to the uncertainty in their recoveries to concentrate.

Table 13.11 Non-payable, Non-penalty Component Analyses Based on 5.0 kt Shipments

Component	Unit	Combined Long-term Typical Range (5.0 kt lots)
Al	ppm	4,000–15,000
Ba	ppm	20–100
Be	ppm	<0.1
Bi	ppm	<10
Ca	ppm	500–3,000
Cd	ppm	5–80
Cl	ppm	20–150
Co	ppm	50–200
Cr	ppm	15–100
Fe	%	22–36
Ge	ppm	0.5–3
Hg	ppm	0.2–5

Component	Unit	Combined Long-term Typical Range (5.0 kt lots)
K	ppm	1,500–3,500
Li	ppm	<5
Mg	ppm	500–4,000
Mn	ppm	50–400
Mo	ppm	500–4,000
Na	ppm	300–1,500
Ni	ppm	50–150
P	ppm	<100
Pb	ppm	100–1,000
Pd	ppm	0.05–0.3
Pt	ppm	0.02–0.15
Re	ppm	0.02–0.4
S	%	26–36
Sb	ppm	5–400
Se	ppm	150–500
SiO_2	%	3–10
Sn	ppm	1–8
Sr	ppm	15–300
Te	ppm	4–60
Ti	ppm	500–1,600
Tl	ppm	<0.5
V	ppm	20–100
Y	ppm	2–10
Zn	ppm	200–3,000
Zr	ppm	200–600
Moisture	%	7–9
D80	microns	25–50

13.5.1 Markets and Product Specification

The process decisions made in OTFS14 will affect the quality of the concentrates produced. The quality of concentrates that will result from the blended treatment of Central zone and Hugo North ores and, later, Central and Southwest zone ores can only be inferred from test work and orebody knowledge. The performances from unblended ore composites of each type are known.

Final concentrate locked cycle test concentrate assays were generated under conditions that follow those applied in Phase 1. Minor elements that were non-payable and non-penalty in nature were taken directly from the ranges observed in those tests. The assay trends of major payable metals (Cu and Au) and penalty elements (As and F) are best determined by applying the metallurgical prediction formulae for recoveries and final concentrate copper grade to the head grades predicted by the open pit and underground mining plans, block models, and dilution and mixing models.

The high levels of arsenic in early Central zone ore will need to be managed by blending with the low arsenic Hugo North ore, as has already been discussed.

Major constituent non-payable, non-penalty components such as iron, sulphur, silica, and alumina are important for smelter metal and mass balances and are predictable from the mineralogy of ore and concentrate. The balance of less significant components (minor elements) each form less than 1.0% of the total weight. Typical values and expected ranges are reported in Table 13.11 in Section 13.5. Ranges have been predicted from the full elemental assays for concentrate from each ore type, based on achieving a 100% mineral and / or metal balance in final concentrate with the predicted mineralogy and the average minor element assays.

Unlike the payable and penalty grades, major and minor non-penalty / non-payable components are stated as 'typical' values and are not expected to be a source of contract dispute, although moisture ranges should be respected, even with bagged product, to minimise freight costs either to seller's account (in Mongolia) or buyer's account (in China). Allowances have been made for the greater variation to be expected in a 5.0 kt shipment than in a monthly or annual average.

13.6 Future Work

Additional work is required in the following areas to advance the design of the process plant:

- Concentrator expansion studies.
- Prefeasibility level programme for additional resources.
- Smelter studies.
- Gravity or magnetic separation of gold from the regrind circuit.
- Other improvements to gold recovery.
- Magnetite recovery.
- Enhanced tailings treatment to reduce water retention.

13.7 Conclusions

The Hugo North Extension flotation results show that the plant feed is not unusual with respect to the other Hugo Dummett samples tested.

Preliminary process and metallurgical test work has been completed on Hugo North Extension and Hugo North within the Oyu Tolgoi project. Copper and gold recoveries for Hugo North Extension are reasonable and not unusual with respect to the other Hugo Dummett ores tested. According to OT LLC, elevated arsenic and fluorine values are evident, but trace element models for Hugo North indicate these elevated arsenic or fluorine zones would be mined over short periods and could be managed though blending. Since Hugo North and Hugo North Extension are part of the same continuous zone of mineralisation, it is inferred that there is reasonable expectation that the gold and copper mineralisation at Hugo North Extension can be treated to produce a saleable concentrate using the currently-proposed metallurgical process methods for the Oyu Tolgoi project.

Although there is only a limited set of variability samples on Hugo North Extension by the time the ore is processed there will have been significant Hugo North ore processed and this will provide sufficient data to either confirm or amend the predictive metallurgical parameters.

It is not known if the low grade composite 1 or the high arsenic composite 3 samples are typical or if they are isolated occurrences. A programme of variability testing comprising at least 15 Hugo North Extension samples should be conducted to establish typical performance.

14 MINERAL RESOURCE ESTIMATES

14.1 Mineral Resources Estimation

The following sub-sections describe the methods used for and results of the mineral resource estimation for the Hugo North Extension and Heruga deposits.

14.1.1 Databases

Database close-off dates for the Mineral Resource estimates are summarised in Table 14.1.

The database used for the estimation of Mineral Resources for the Hugo North Extension deposit consists of samples and geological information from 37 drillholes, including daughter holes, totalling approximately 54,546 m.

The database used to estimate the Mineral Resources for the Heruga deposit consists of samples and geological information from 43 drillholes, including daughter holes, totalling 58,276 m.

Table 14.1 Database Close-off Dates

Deposit	Data Close-off Date
Heruga	21 June 2009
Hugo North Extension	14 February 2014

14.1.2 Geological and Grade Shell Models

OT LLC produced 3D geological models of the major structures and lithological units based on the structural and geological information outlined in the geological discussion in this report. The geological shapes for the deposits are listed in Table 14.2 and Table 14.3.

For each deposit, appropriate copper and gold shells at various cut-off grades (Table 14.4) were also defined. These shapes were then edited on plan and section view to be consistent with the structural and lithological models and the drill assay data.

Checks on the structural, lithological, and grade shell models indicated that the shapes honoured the drillhole data and interpreted geology.

Table 14.2 Surfaces and Lithology Solids in Geological Models

Model Component	Comment
Surfaces – General	
Topography	Project-wide
Base of Quaternary cover	Project-wide
Base of Cretaceous clays and gravels	Project-wide
Solids / Surfaces – Lithology	
Quartz monzodiorite (Qmd) solid	Hugo North, Hugo North Extension, SOT,Heruga
Late Quartz Monzodiorite	Heruga
Augite basalt (Va) D1 solid	Hugo North
Ignimbrite (Ign) DA2 solid	Hugo North
Hanging Wall Sequence (HWS) DA3, solid	Hugo North
Base of ash flow tuff (DA2a – Ign)	Project-wide
Base of unmineralised volcanic and sedimentary units; DA2b or DA3 or DA4	Project-wide. Used as a hanging wall limit to grade interpolation
Biotite granodiorite (BiGd) dykes	Project-wide. Most important in Hugo deposits. Unmineralised unit, includes Heruga
Biotite granodiorite (BiGd) dykes solid	Hugo North. Unmineralised unit
Rhyolite (Rhy) dykes	Project-wide.
Rhyolite (Rhy) dykes, solid	Hugo North. Unmineralised unit
Hornblende–biotite granodiorite, solid	Hugo North, Unmineralised unit
Hornblende-Biotite Andesite dykes (Hb-Bi An)	Heruga

Table 14.3 Fault Surfaces in Geological Models

Model Component	Comment
Surfaces – Faults	
East Bat Fault	Hugo area: used to define Hugo North eastern limit
West Bat Fault	Hugo area: used to define Hugo North, Central and West zones western limits
Contact Fault	Hugo North: defines post-volcanic sequence, sub-parallel to lithological contacts
7100 Fault	Hugo North, north–west trending fault
Lower and Intermediate Faults	Hugo North, north trending faults sub-parallel to lithological contacts
Bogd Fault	Hugo North, east–west fault in Hugo North Extension
Khar Suult Fault	Hugo North, east–west fault in southern area
Kharaa and Eroo Faults	Hugo North, north-east trend fault in Northern area
Bumbat and Dugant Faults	Hugo North, east–west fault in Hugo North Extension
Burged, Noyon, Gobi, Javhlant Faults	Hugo North, north–west trending series of faults
160 Fault	Hugo North, north trending fault
110 Fault	Hugo area: forms boundary between Hugo South and Hugo North deposits
North Boundary Fault	Hugo North area: used to define north-western limit
West Bor Tolgoi Fault	Heruga
Central Bor Tolgoi Fault East Bor Tolgoi Fault	Heruga
South Sparrow Fault	Heruga

Table 14.4 Grade Shell Construction Parameters

Deposit / Zone	Grade Shell		
	Au (g/t)	Cu (%)	Mo (ppm)
Hugo North Extension	0.3; 1.0	0.6; qtz veining 15% by vol.	–
Heruga	0.3; 0.7	0.3	100

The lithological shapes and faults, together with copper and gold grade shells and deposit zones, constrain the grade analysis and interpolation. Typically the faults form the first order of hard boundaries constraining the lithological interpretation.

The solids and surfaces were used to code the drillhole data. Sets of plans and cross sections that displayed colour-coded drillholes were plotted and inspected to ensure the proper assignment of domains to drillholes.

Domains were established using the codes outlined in Table 14.5, where the domain variable used in grade estimation was a four-digit integer code composed from the following fields in the composite database: deposit (DPOSIT), grade shell (GS_CU or GS_AU), lithology (FLAG), and supergene (SUPERG).

A third digit in the code was originally intended to accommodate a greater number of lithology codes, but currently remains unused.

Table 14.5 Domain Codes

DPOSIT (1st digit)		GS_CU or GS_AU (2nd digit)		FLAG (4th digit)	
Value	**Code**	**Value**	**Code**	**Value**	**Code**
Default / None	0	Outside grade shells	1	VA	1
Southwest Zone	1	Inside 0.3 (% or g/t) grade shell	2	Ign	2
Central Zone	2	Inside 0.7 (g/t) Au grade shell	3	Qmd	3
South Zone	3	–	–	HWS	4
Far South	4	–	–	BiGd	5
Bridge	5	–	–	Ands	6
Wedge	6	–	–	Rhy	7
West	7	–	–	Clay	8
South of the Solongo fault	8	–	–	–	–
Supergene	9	–	–	–	–

14.1.3 Grade Capping and Evaluation of Outlier / Extreme Grades

Extreme (outlier) copper and gold grades were evaluated using histograms, probability, and cumulative distribution function plots.

14.1.3.1 Hugo North and Hugo North Extension

A combination of outlier restriction and grade capping was applied during grade estimation for the Hugo North area (Hugo North and Hugo North Extension). In most cases, an outlier restriction of 50 m was used to control the effects of high-grade samples within the domains, particularly in the background domains where unrestricted high-grade composites tended to result in over-representation of high-grade estimates owing to the disproportional numbers of high-grade to lower grade composites. In outlier-restricted kriging, outliers (i.e. values above the specified cut-off) are restricted to the specified threshold value if their distance to the interpolated block is greater than 50 m. If the distance to the interpolated block is less than 50 m outliers are used at their full value. The outlier thresholds applied at Hugo North and Hugo North Extension were defined at the 99th percentile of their respective population. The thresholds for restrictions are shown in Table 14.6 and Table 14.7.

Table 14.6 Grade Caps Applied to Cu, Au, and Ag Grade Domains – Hugo North and Hugo North Extension Area

Grade Domain	Cu (%)	Au (g/t)	Ag (g/t)
101	1.0	1.2	2.5
102	–	0.4	8
103	1.5	2.0	–
104	–	n/a	–
105	–	2.0	10.5
21+202+203+204	5.5	2.5	17
205	n/a	no cap	n/a
301+303	9.5	3.5	–
302	3.5	no cap	n/a
304	n/a	–	n/a
305	n/a	6.0	2.5

Table 14.7 Outlier Restrictions (High Yield Restrictions) Applied to Cu, Au, and Ag Grade Domains – Hugo North and Hugo North Extension Area

Grade Domain	Cu (%)	Au (g/t)	Ag (g/t)
102	2.5	–	–
103	–	–	10.5
104	–	–	1.5
105	3.0	–	–
301+303	–	–	21
101, 21+202+203+204, 205, 302, 304, 305	–	–	–

14.1.3.2 Heruga

As well as top-cutting of extreme grades, some outlier restriction was also applied for the Heruga deposit, particularly in the background domains. Top-cutting was generally applied at values close to or above the 99th percentile for gold and molybdenum. No cap was felt warranted for copper. The grade caps on outlier grades employed at Heruga are shown in Table 14.8.

Table 14.8 Outlier Restrictions / Grade Caps – Heruga

Domain	Metal	Domain	Cap	Distance	Outlier Cap
Background	Au	1,000–4,000	3.0 g/t	50 m	1.0 g/t
Background	Au	5,000	3.0 g/t	50 m	0.3 g/t
Background	Mo	All	1,000 ppm	100 m	500 ppm
0.3 g/t Au shell	Au	2,000	3.0 g/t	–	–
0.3 g/t Au shell	Au	4,000	5.0 g/t	–	–
0.7 g/t Au shell	Au	2,000	10 g/t	–	–
100 ppm Mo shell	Mo	All	3,000 ppm	–	–

14.1.4 Composites

The drillhole assays were composited into downhole composites of a fixed length that was considered appropriate when taking into account estimation block size, required lithological resolution, and probable mining method. This compositing honoured the domain zones by breaking the composites on the domain boundary for all deposits except in the Hugo North models. The domains used in compositing were derived from a combination of the grade shells and lithological domains. Composite fixed lengths of 5.0 m were used for the Hugo North Extension and Heruga deposits.

Intervals of less than the fixed length represented individual residual composites from end of hole or end of domain intervals. Composites that had a length of less than 1.5 m (Hugo North and Hugo North Extension) or 2.0 m (Heruga) were excluded from the dataset used in interpolation.

At Hugo North and Hugo North Extension, the composites included any post-mineralisation dyke intervals that were deemed too small to be part of a dyke geology model. Any unsampled dyke intervals included in the composites dataset for Hugo North and Hugo North Extension were set to:

- Cu 0.001%
- Au 0.01 g/t

For Heruga, any unsampled dyke intervals included in the composites dataset for Heruga were set to:

- Cu 0.001%

- Au 0.01 g/t
- Mo 10 ppm

14.1.5 Exploratory Data Analysis

The lithological, structural, and mineralised domains for Hugo North and Hugo North Extension were reviewed to determine appropriate estimation or grade interpolation parameters. Several different procedures were applied to the data to discover whether statistically distinct domains could be defined using the available geological objects.

The data analyses were conducted on composited assay data. Descriptive statistics, histograms and cumulative probability plots, box plots, contact plots, and X–Y scatter plots were completed for copper and gold in each deposit area.

Results obtained were used to guide the construction of the block model and the development of estimation plans.

14.1.5.1 Hugo North and Hugo North Extension

Copper grades in the mineralised units (Va, Ign, Qmd, and xenolithic biotite granodiorite (xBiGd)) show single lognormal to near-normal distributions inside each domain (0.6% and 2.0% Cu Shells). Coefficients of variation values are low at 0.3–0.6. There are small variations in grade as a result of lithological differences within the copper domains: generally, Qmd and Va have the highest values, followed by Ign. The lowest grades of all lithologies occur in xBiGd.

The cumulative distribution function patterns of copper data for all domains show evidence of three populations: a higher grade population (above a copper threshold value of 2.0%–2.5% Cu), a lower grade zone (threshold value of 0.4% Cu–0.5% Cu), and a background lowest grade domain. The pattern supports the construction of the quartz vein shell (2.0% Cu is approximately coincident) and the 0.6% Cu shell.

Gold grade distributions at Hugo North and Hugo North Extension show typical positively skewed trends. The distributions are slightly more skewed than those for copper, but the level of skewness can still be described as only mild to moderate within each domain. The Qmd shows higher average gold values than the Va unit, which in turn is higher than the Ign. Coefficients of variation values for the host lithologies are moderate, varying from 0.6–0.9. The cumulative distribution function pattern of gold data of all domains and the background domain shows evidence for three populations: a higher grade population (above a gold threshold value of 1.0 g/t Au), a lower grade zone (threshold value of 0.2– 0.3 g/t Au), and a background lowest grade domain. The pattern supports the construction of the 1.0 g/t Au and 0.3 g/t Au grade shells.

At Hugo North and Hugo North Extension the Au : Cu relationships that were identified in 2005 are poorer. Generally two trends may be present. The more common is a low gold trend that outlines an Au : Cu ratio of about 1 : 10 in the mineralised volcanic units. The Qmd unit also displays the 1 : 10 Au : Cu ratio trend but also shows a more gold enriched Au : Cu ratio at about 1 : 2.

14.1.5.2 Heruga

Copper grades within the 0.3% Cu shell generally displayed single distributions with some evidence for a lower grade population resulting from the presence of barren post-mineralisation dykes that had not been captured by wireframes. Coefficients of variation (CVs) were relatively low at 0.5–0.6. The cumulative distribution function plot for the entire population supported the construction of a grade shell in the 0.3%–0.4% Cu range.

Gold grades were observed to display a moderate positive skew and multiple populations with evidence of lower grade populations in the range of 0.2–0.3 g/t Au.

Molybdenum grades within the 100 ppm Mo shell display a low to moderate positive skew and a single population distribution.

14.1.6 Estimation Domains

A strategy of soft, firm, and hard (SFH) boundaries was implemented to account for domain boundary uncertainty (dilution) and to reproduce the input grade sample distribution in the block model. Soft boundaries allowed full sharing of composites between domains during grade estimation; firm boundaries allowed sharing of composites from within a certain distance of the boundary; and hard boundaries allowed no composite sharing between domains. Contact plots and visual inspection of grade distributions were also used in cases where results were unclear or were contrary to geological interpretations.

14.1.6.1 Estimation Domains – Hugo North and Hugo North Extension

Different boundary designations of soft, firm, or hard can be used for the different lithologies, depending on the grade shell. The intra-domain contact boundaries are summarised in the matrix in Table 14.9 for copper and in Table 14.10 for gold.

The various copper and gold grade shells used to constrain the selection of composites and blocks during the interpolation of block grades at Hugo North and Hugo North Extension are illustrated in Figure 14.1.

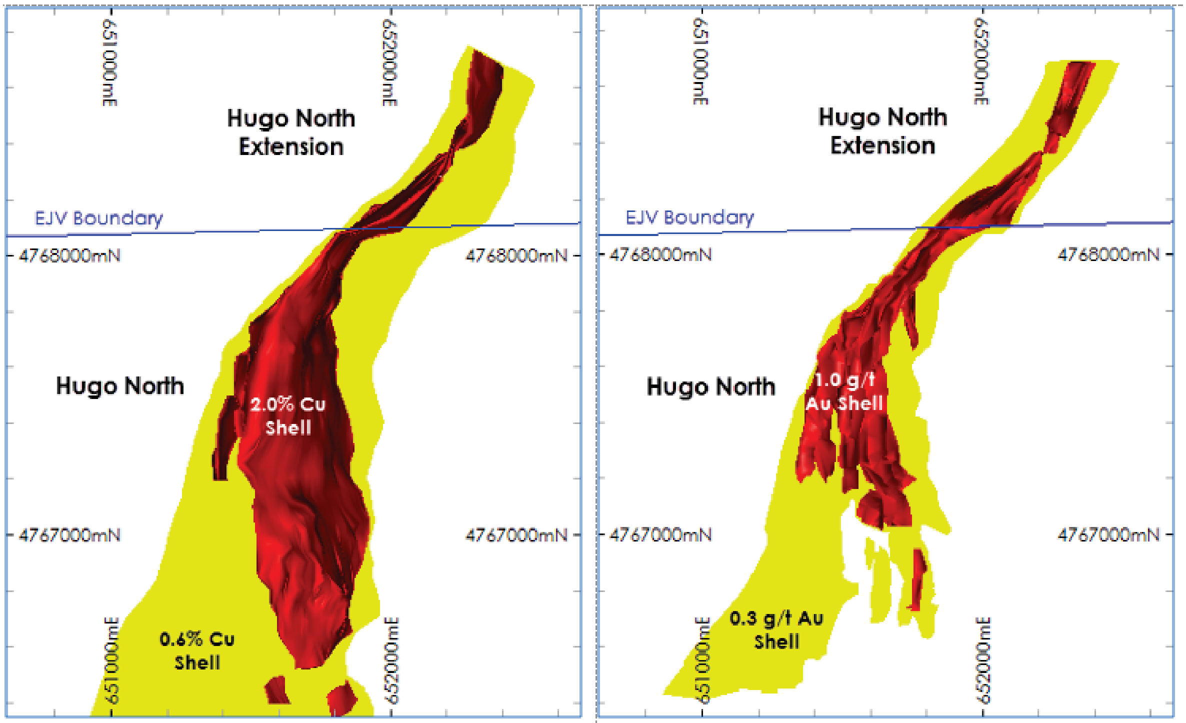
Table 14.9 Hugo North and Hugo North Extension Intra-Domain Boundary Contacts – Copper

Shell	Va	Qmd	Ign	xBiGd
Background				
Va	Soft	Hard	Firm	Firm
Qmd	Hard	Soft	Firm	Firm
Ign	Firm	Firm	Soft	Firm
HWS	Firm	Firm	Firm	Soft
0.6% Cu Shell				
Va	Soft	Firm	Firm	Firm
Qmd	Firm	Soft	Firm	Firm
Ign	Firm	Firm	Soft	Firm
HWS	Firm	Firm	Firm	Soft
xBiGd	Hard	Hard	Hard	Hard
Qtz Vein (2.0% Cu) Shell				
Va	Firm	Firm	Hard	Hard
Qmd	Firm	Soft	Hard	Hard
Ign	Firm	Hard	Soft	Hard
HWS	Hard	Hard	Hard	Soft
xBiGd	Hard	Hard	Hard	Hard

Table 14.10 Hugo North and Hugo North Extension Intra-Domain Boundary Contacts – Gold

Shell	Va	Qmd	Ign	xBiGd
Background				
Va	Soft	Firm	Soft	Firm
Qmd	Hard	Soft	Firm	Firm
Ign	Soft	Firm	Soft	Soft
xBiGd	Hard	Firm	Soft	Soft
HWS	–	–	–	–
0.3 g/t Au Shell				
Va	Soft	Firm	Firm	Hard
Qmd	Firm	Soft	Hard	Firm
Ign	Soft	Firm	Soft	Hard
xBiGd	Hard	Hard	Hard	Hard
HWS	Firm	Firm	Soft	Soft
1.0 g/t Au Shell				
Va	Soft	Firm	Hard	Hard
Qmd	Firm	Soft	Hard	Hard
Ign	Hard	Soft	Soft	Hard
xBiGd	Hard	Hard	Hard	–
HWS	–	–	–	–

Figure 14.1 Copper Grade Shells and Gold Grade Shells – Hugo North, and Hugo North Extension



14.1.6.2 Estimation Domains – Heruga

Data analysis showed no discernible difference between the two main host lithologies, Va and Qmd, at Heruga. Therefore, for estimation purposes the two lithologies were able to be grouped into a single lithology domain. The post-mineralisation lithologies (LQmd, BiGd, HbBiAn) were assigned zero grade.

Within each structural domain, the cells in the model were coded according to whether or not they were mineralised or unmineralised, and which grade shell they fell within.

14.1.7 Variography

14.1.7.1 Variography – Hugo North and Hugo North Extension

Data in some shells were sub-divided into north and south sectors for the variographic analysis to take into account the flexure in direction of the deposit that occurs near 4,767,600 mN.

The mineralisation controls observed were considered to be related to the intrusive history and structural geology (faults). The patterns of anisotropy demonstrated by the various correlograms tended to be consistent with geological interpretations, particularly to any bounding structural features (faults and lithological contacts) and quartz + sulphide vein orientation data.

The nugget variance tended to be low to moderate in all of the domains assessed. Copper variograms generally had nugget variances of between 15%–20% (relative) of the total variance, except in BiGd, where the nugget is 38% of total variance. The nugget variance for gold variograms varied from 5.0%–25%.

Both copper and gold displayed short ranges for the first variogram structure and moderate to long ranges for the second variogram structure (where modelled).

The model parameters for copper outside the 0.6% Cu grade shell are summarised in Table 14.11; for copper inside the 0.6% Cu grade shell and outside the 1.0% Cu grade shell in Table 14.12; for copper within the 1.0% Cu grade shell in Table 14.13; and for copper within the BiGd in Table 14.14.

The model correlogram parameters for gold outside the 0.3 g/t Au grade shell are summarised in Table 14.15; for gold inside the 0.3 g/t Au grade shell and outside the 1.0 g/t Au grade shell in Table 14.16; for gold within the 1.0 g/t Au grade shell in Table 14.17; and for gold within the BiGd in Table 14.18.

Table 14.11 Copper Correlogram Parameters, Outside 0.6% Cu Grade Shell, Hugo North

Estimation ID	Au Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
1011_1	Outside 0.6% Cu Grade Shell	1	Va	1	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1012_1				2	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1013_1				3	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1014_1				4	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1015_1				5	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1016_1				6	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1017_1				7	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1021_1		2	Ign	1	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1022_1				2	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1023_1				3	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1024_1				4	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1025_1				5	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1026_1				6	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1027_1				7	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1031_1		3	Qmd	1	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1032_1				2	0.1	2	Spherical	0.4	45	–15	–90	118	123	87	Spherical	0.5	45	–15	–90	675	382	99
1033_1				3	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1034_1				4	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1035_1				5	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1036_1				6	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110
1037_1				7	0.17	2	Spherical	0.39	270	60	0	88	16	69	Spherical	0.44	270	60	0	507	539	110

Table 14.12 Copper Correlogram Parameters, Inside 0.6% Cu Grade Shell and Outside 1.0% Cu Grade Shell, Hugo North

Estimation ID	Cu Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
2011_1	Inside 0.6% Cu Grade Shell and Outside 1.0% Cu Grade Shell	1	Va	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2012_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2013_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2014_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2015_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2016_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2017_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2021_1		2	Ign	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2022_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2023_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2024_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2025_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2026_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2027_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2031_1		3	Qmd	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2032_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2033_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2034_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2035_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2036_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2037_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2041_1		4	HWS	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2042_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20
2043_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2044_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2045_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2046_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103
2047_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103

Estimation ID	Structure 2							
	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
2011_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2012_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2013_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2014_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2015_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2016_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2017_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2021_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2022_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2023_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2024_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2025_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2026_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2027_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2031_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2032_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2033_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2034_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2035_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2036_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2037_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2041_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2042_1	Spherical	0.54	5.854	56.774	−61.813	224	356	40
2043_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2044_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2045_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2046_1	Spherical	0.3	181.102	25.659	56.31	654	192	104
2047_1	Spherical	0.3	181.102	25.659	56.31	654	192	104

Table 14.13 Copper Correlogram Parameters, Inside 1.0% Cu Grade Shell, Hugo North

Estimation ID	Cu Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
3011_1	Inside 1% Cu Grade Shell	1	Va	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3012_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3013_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3014_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3015_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3016_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3017_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3021_1		2	Ign	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3022_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3023_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3024_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3025_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3026_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3027_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3031_1		3	Qmd	1	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3032_1				2	0.06	2	Spherical	0.4	5.854	56.774	−61.813	47	104	20	Spherical	0.54	5.854	56.774	−61.813	224	356	40
3033_1				3	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3034_1				4	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3035_1				5	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3036_1				6	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104
3037_1				7	0.11	2	Spherical	0.59	181.102	25.659	56.31	175	140	103	Spherical	0.3	181.102	25.659	56.31	654	192	104

Table 14.14 Copper Correlogram Parameters, Inside BiGd, Hugo North

Estimation ID	Domain	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
1051_1	BiGd High grade Domain	5	BiGd	1	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1052_1				2	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1053_1				3	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1054_1				4	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1055_1				5	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1056_1				6	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1057_1				7	0.08	2	Spherical	0.1	345	0	–65	94	90	164	Spherical	0.82	345	0	–65	319	214	205
1051_I2	BiGd Outside of Grade Shell			1	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1052_I2				2	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1053_I2				3	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1054_I2				4	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1055_I2				5	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1056_I2				6	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58
1057_I2				7	0.38	2	Spherical	0.19	356.384	–19.683	79.372	42	25	12	Spherical	0.43	356.384	–19.683	79.372	133	129	58

Table 14.15 Gold Correlogram Parameters, Outside 0.3 g/t Au Grade Shell, Hugo North

Estimation ID	Au Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
1011_1	Outside of 0.3 g/t Au Grade Shell	1	Va	1	0.23	2	Spherical	0.32	45	–75	–90	179	174	98	Spherical	0.45	45	–75	–90	619	442	139
1012_1				2	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300
1013_1				3	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300
1021_1		2	Ign	1	0.23	2	Spherical	0.32	45	–75	–90	179	174	98	Spherical	0.45	45	–75	–90	619	442	139
1022_1				2	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300
1023_1				3	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300
1031_1		3	Qmd	1	0.23	2	Spherical	0.32	45	–75	–90	179	174	98	Spherical	0.45	45	–75	–90	619	442	139
1032_1				2	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300
1033_1				3	0.23	2	Spherical	0.36	355.729	–10.545	–44.007	150	125	200	Spherical	0.41	355.729	–10.545	–44.007	762	300	300

Table 14.16 Gold Correlogram Parameters, Inside 0.3 g/t Au Grade Shell and Outside 1.0 g/t Au Grade Shell, Hugo North

Estimation ID	Au Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
2011_1	Inside 0.3 g/t Au Grade Shell and Outside 1.0 g/t Au Grade Shell	1	Va	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
2012_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
2013_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0
2021_1		2	Ign	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
2022_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
2023_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0
2031_1		3	Qmd	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
2032_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
2033_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0
2041_1		4	HWS	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
2042_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
2043_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0

Table 14.17 Gold Correlogram Parameters, Inside 1.0 g/t Au Grade Shell, Hugo North

Estimation ID	Au Grade Shell	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
3011_1	Inside 1.0 g/t Au Grade Shell	1	Va	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
3012_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
3013_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0
3021_1		2	Ign	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
3022_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
3023_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0
3031_1		3	Qmd	1	0.18	2	Spherical	0.19	45	0	120	61	63	26	Spherical	0.63	45	0	120	170	104	52
3032_1				2	0.22	2	Spherical	0.35	345	0	90	94	32	57	Spherical	0.43	345	0	90	599	373	176
3033_1				3	0.15	1	Spherical	0.85	281.31	–25.659	–16.102	36	89	106	Spherical	0	0	0	0	0	0	0

Table 14.18 Gold Correlogram Parameters, Inside BiGd, Hugo North

Estimation ID	Domain	Nlith	Rock Type	Zone Code	Variance Nugget	Variogram Structure Count	Structure 1								Structure 2							
							Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	Model Type	Sill	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis
1051h1	BiGd High-grade Domain	5	BiGd	1	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241
1052h1				2	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241
1053h1				3	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241
1051_1	BiGd Outside of Grade Shell			1	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241
1052_1				2	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241
1053_1				3	0.05	2	Spherical	0.78	345	–45	0	44	69	237	Spherical	0.17	345	–45	0	298	235	241

Models are spherical (SPH) or exponential (EXP). Traditional ranges are used for the exponential variograms. Axis rotations are left-hand, right-hand, left-hand for the Z, X, and Y axis, respectively.

14.1.7.2 Variography – Heruga

Although Heruga data are less plentiful, an attempt was made to model directional variograms for gold, copper, and molybdenum. Copper and gold showed relatively low nuggets of 25%–35% (relative) of the total variance, whereas molybdenum was moderate to high at 40% of the sill. All three metals showed relatively short first variogram structures and long second variogram structures of 250–300 m.

14.1.8 Model Setup

For Hugo North and Hugo North Extension, the mining method of block cave mining does not allow for consideration of selectivity. A sub-celled model was used for resource estimation that has parent block dimensions equal to 15 m x 15 m x 15 m and minimum sub-cell dimensions down to 5.0 m x 5.0 m x 5.0 m. The actual sub-cell sizes in the Hugo North model are permitted to vary as necessary (into sub-cells) to fit the specified boundaries of the wireframes used to tag the block model.

Bulk density data were assigned to a unique assay database file. These data were composited into 5.0 m fixed length downhole values for the Heruga model.

Various domain coding was done on the block models in preparation for grade interpolation. The block models were coded according to zone, lithological domain, and grade shell. Post-mineralisation dykes were considered as potentially selectively mineable. For Hugo North and Hugo North Extension, sub-celling was used to honour lithology, grade, and structural contacts.

Blocks above topography were removed from the block model. Non-mineralised units were flagged using a lithology code and were excluded during the interpolation process.

Blocks in the Hugo North and Hugo North Extension model were assigned an estimation domain using a combination of grade shells or alteration and lithology.

14.1.8.1 Model Setup – Hugo North and Hugo North Extension

Interpolation was limited to the mineralised lithological units (Va, Ign, Qmd, and xBiGd). Only composites belonging to those units were used. Grades and metal values within blocks belonging to all other units (post-mineralisation dykes and sediments) were set to zero.

Modelling consisted of grade interpolation by Ordinary Kriging (OK), except for bulk density, which was interpolated using a combination of simple kriging (SK) and inverse distance weighting to the third power (ID3). Restricted and unrestricted grades were interpolated to allow calculation of the metal removed by outlier restriction. Grades were also interpolated using Nearest Neighbour (NN) methods for validation purposes. Blocks and composites were matched on estimation domain.

The search ellipsoids were oriented preferentially to the general orientation of each estimation domain. The search strategy employed concentric expanding search ellipsoids. The first search pass (Pass 1) used a relatively short search ellipse relative to the long axis of the correlogram ellipsoid. For the second pass (Pass 2), the search ellipse was increased by 50% (up to the full range of the correlogram) to allow interpolation of grade into those blocks not estimated by the first pass. A final, third pass (Pass 3) was performed using a larger search ellipsoid.

To ensure that at least three drillholes were used estimate blocks in Pass 1, the number of composites from a single drillhole that could be used was restricted to three. Similarly, Pass 2 required a minimum of two drillholes to generate an estimate. The number of composites allowed from a single hole was restricted to three.

The search parameters for copper outside the 0.6% Cu grade shell are shown in Table 14.19; for copper within the 0.6% Cu grade shell and outside the 1.0% Cu grade shell in Table 14.20; for copper within the 1.0% Cu grade shell in Table 14.21; and for copper within BiGd in Table 14.22.

The search parameters for gold outside the 0.3 g/t Au grade shell are shown in Table 14.23; for gold inside the 0.3 g/t Au grade shell and outside the 0.1 g/t Au grade shell in Table 14.24; for gold inside the 0.1% Au grade shell in Table 14.25; and for gold inside BiGd in Table 14.26.

These parameters were based on the geological interpretation, data analyses, and variogram analyses. The number of composites used in estimating grade into a model block followed a strategy that matched composite values and model blocks sharing the same feed code or domain. The minimum and maximum numbers of composites were adjusted to incorporate an appropriate amount of grade smoothing.

Estimation of sub-cells at the boundary of grade or lithology domains was based on assigning the parent cell grade to the sub-cells; the end result being that all like-flagged sub-cells within the larger parent cell contain the same grade.

For both copper and gold, a combination of outlier restriction and grade capping was used to control the effects of high-grade samples within the domains. This is discussed in Section 14.1.3.

Grade variables were regularised to the tonnage-weighted (volume x density) mean of the sub-cell source grade values enclosed in the parent blocks before they were provided for use in detailed engineering and tabulation of Mineral Resources.

Table 14.19 Copper Search Parameters, Outside 0.6% Cu Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
1011_1	Pass 1	Outside 0.6% Cu Grade Shell	1	Va	1	20	–20	–80	120	80	40	0	50	50	50	9	15	1	3
1012_1					2	45	–20	–90	120	80	40	0	50	50	50	9	15	1	3
1013_1					3	0	–15	–85	120	80	40	0	50	50	50	9	15	1	3
1014_1					4	–5	–20	–65	120	80	40	0	50	50	50	9	15	1	3
1015_1					5	15	–20	–75	120	80	40	0	50	50	50	9	15	1	3
1016_1					6	–15	–20	–65	120	80	40	0	50	50	50	9	15	1	3
1017_1					7	–30	–30	–50	120	80	40	0	50	50	50	9	15	1	3
1021_1			2	Ign	1	20	–20	–80	120	80	40	2.5	50	50	50	9	15	1	3
1022_1					2	45	–20	–90	120	80	40	2.5	50	50	50	9	15	1	3
1023_1					3	0	–15	–85	120	80	40	2.5	50	50	50	9	15	1	3
1024_1					4	–5	–20	–65	120	80	40	2.5	50	50	50	9	15	1	3
1025_1					5	15	–20	–75	120	80	40	2.5	50	50	50	9	15	1	3
1026_1					6	–15	–20	–65	120	80	40	2.5	50	50	50	9	15	1	3
1027_1					7	–30	–30	–50	120	80	40	2.5	50	50	50	9	15	1	3
1031_1			3	Qmd	1	20	–20	–80	120	80	40	2.5	100	50	100	9	15	1	3
1032_1					2	45	–20	–90	120	80	40	2.5	100	50	100	9	15	1	3
1033_1					3	0	–15	–85	120	80	40	2.5	100	50	100	9	15	1	3
1034_1					4	–5	–20	–65	120	80	40	2.5	100	50	100	9	15	1	3
1035_1					5	15	–20	–75	120	80	40	2.5	100	50	100	9	15	1	3
1036_1					6	–15	–20	–65	120	80	40	2.5	100	50	100	9	15	1	3
1037_1					7	–30	–30	–50	120	80	40	2.5	100	50	100	9	15	1	3
1011_2	Pass 2	Outside 0.6% Cu Grade shell	1	Va	1	20	–20	–80	180	120	60	0	50	50	15	6	12	1	3
1012_2					2	45	–20	–90	180	120	60	0	50	50	50	6	12	1	3
1013_2					3	0	–15	–85	180	120	60	0	50	50	50	6	12	1	3
1014_2					4	–5	–20	–65	180	120	60	0	50	50	50	6	12	1	3
1015_2					5	15	–20	–75	180	120	60	0	50	50	50	6	12	1	3
1016_2					6	–15	–20	–65	180	120	60	0	50	50	50	6	12	1	3
1017_2					7	–30	–30	–50	180	120	60	0	50	50	50	6	12	1	3
1021_2			2	Ign	1	20	–20	–80	180	120	60	2.5	50	50	50	6	12	1	3
1022_2					2	45	–20	–90	180	120	60	2.5	50	50	50	6	12	1	3
1023_2					3	0	–15	–85	180	120	60	2.5	50	50	50	6	12	1	3
1024_2					4	–5	–20	–65	180	120	60	2.5	50	50	50	6	12	1	3
1025_2					5	15	–20	–75	180	120	60	2.5	50	50	50	6	12	1	3
1026_2					6	–15	–20	–65	180	120	60	2.5	50	50	50	6	12	1	3
1027_2					7	–30	–30	–50	180	120	60	2.5	50	50	50	6	12	1	3
1031_2			3	Qmd	1	20	–20	–80	180	120	60	2.5	100	50	100	6	12	1	3
1032_2					2	45	–20	–90	180	120	60	2.5	100	50	100	6	12	1	3
1033_2					3	0	–15	–85	180	120	60	2.5	100	50	100	6	12	1	3
1034_2					4	–5	–20	–65	180	120	60	2.5	100	50	100	6	12	1	3

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
1035_2					5	15	–20	–75	180	120	60	2.5	100	50	100	6	12	1	3
1036_2					6	–15	–20	–65	180	120	60	2.5	100	50	100	6	12	1	3
1037_2					7	–30	–30	–50	180	120	60	2.5	100	50	100	6	12	1	3
1011_3	Pass 3	Outside 0.6% Cu Grade shell	1	Va	1	20	–20	–80	360	240	120	0	50	50	15	3	9	1	3
1012_3					2	45	–20	–90	360	240	120	0	50	50	50	3	9	1	3
1013_3					3	0	–15	–85	360	240	120	0	50	50	50	3	9	1	3
1014_3					4	–5	–20	–65	360	240	120	2.5	75	75	75	3	9	1	3
1015_3					5	15	–20	–75	360	240	120	0	50	50	50	3	9	1	3
1016_3					6	–15	–20	–65	360	240	120	0	50	50	50	3	9	1	3
1017_3					7	–30	–30	–50	360	240	120	0	50	50	50	3	9	1	3
1021_3			2	Ign	1	20	–20	–80	360	240	120	2.5	50	50	50	3	9	1	3
1022_3					2	45	–20	–90	360	240	120	2.5	50	50	50	3	9	1	3
1023_3					3	0	–15	–85	360	240	120	2.5	50	50	50	3	9	1	3
1024_3					4	–5	–20	–65	360	240	120	2.5	50	50	50	3	9	1	3
1025_3					5	15	–20	–75	360	240	120	2.5	50	50	50	3	9	1	3
1026_3					6	–15	–20	–65	360	240	120	2.5	50	50	50	3	9	1	3
1027_3					7	–30	–30	–50	360	240	120	2.5	50	50	50	3	9	1	3
1031_3			3	Qmd	1	20	–20	–80	360	240	120	2.5	100	50	100	3	9	1	3
1032_3					2	45	–20	–90	360	240	120	2.5	100	50	100	3	9	1	3
1033_3					3	0	–15	–85	360	240	120	2.5	100	50	100	3	9	1	3
1034_3					4	–5	–20	–65	360	240	120	2.5	100	50	100	3	9	1	3
1035_3					5	15	–20	–75	360	240	120	2.5	100	50	100	3	9	1	3
1036_3					6	–15	–20	–65	360	240	120	2.5	100	50	100	3	9	1	3
1037_3					7	–30	–30	–50	360	240	120	2.5	100	50	100	3	9	1	3

Table 14.20 Copper Search Parameters, Inside 0.6% Cu Grade Shell and Outside 1.0% Cu Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
2011_1	Pass 1	Inside 0.6% Cu Grade Shell	1	Va	1	20	–20	–80	120	80	40	1.1	50	50	50	9	15	1	3
2012_1					2	45	–20	–90	120	80	40	1.1	50	50	50	9	15	1	3
2013_1					3	0	–15	–85	120	80	40	1.1	50	50	50	9	15	1	3
2014_1					4	–5	–20	–65	120	80	40	1.1	50	50	50	9	15	1	3
2015_1					5	15	–20	–75	120	80	40	1.1	50	50	50	9	15	1	3
2016_1					6	–15	–20	–65	120	80	40	1.1	50	50	50	9	15	1	3
2017_1					7	–30	–30	–50	120	80	40	1.1	50	50	50	9	15	1	3
2021_1			2	Ign	1	20	–20	–80	120	80	40	1.1	50	50	50	9	15	1	3
2022_1					2	45	–20	–90	120	80	40	1.1	50	50	50	9	15	1	3
2023_1					3	0	–15	–85	120	80	40	1.1	50	50	50	9	15	1	3
2024_1					4	–5	–20	–65	120	80	40	1.1	50	50	50	9	15	1	3
2025_1					5	15	–20	–75	120	80	40	1.1	50	50	50	9	15	1	3
2026_1					6	–15	–20	–65	120	80	40	1.1	50	50	50	9	15	1	3
2027_1					7	–30	–30	–50	120	80	40	1.1	50	50	50	9	15	1	3
2031_1			3	Qmd	1	20	–20	–80	120	80	40	1.1	50	50	50	9	15	1	3
2032_1					2	45	–20	–90	120	80	40	1.1	50	50	50	9	15	1	3
2033_1					3	0	–15	–85	120	80	40	0.8	50	50	50	9	15	1	3
2034_1					4	–5	–20	–65	120	80	40	0.8	50	50	50	9	15	1	3
2035_1					5	15	–20	–75	120	80	40	0.8	50	50	50	9	15	1	3
2036_1					6	–15	–20	–65	120	80	40	0.8	50	50	50	9	15	1	3
2037_1					7	–30	–30	–50	120	80	40	0.8	50	50	50	9	15	1	3
2041_1			4	HWS	1	20	–20	–80	120	80	40	0.8	50	50	50	9	15	1	3
2042_1					2	45	–20	–90	120	80	40	1.2	50	50	50	9	15	1	3
2043_1					3	0	–15	–85	120	80	40	1.2	50	50	50	9	15	1	3
2044_1					4	–5	–20	–65	120	80	40	0	50	50	50	9	15	1	3
2045_1					5	15	–20	–75	120	80	40	1.2	50	50	50	9	15	1	3
2046_1					6	–15	–20	–65	120	80	40	1.2	50	50	50	9	15	1	3
2047_1					7	–30	–30	–50	120	80	40	0	50	50	50	9	15	1	3
2011_2	Pass 2	Inside 0.6% Cu Grade Shell	1	Va	1	20	–20	–80	180	120	60	1.1	50	50	50	6	12	1	3
2012_2					2	45	–20	–90	180	120	60	1.1	50	50	50	6	12	1	3
2013_2					3	0	–15	–85	180	120	60	1.1	50	50	50	6	12	1	3
2014_2					4	–5	–20	–65	180	120	60	1.1	50	50	50	6	12	1	3
2015_2					5	15	–20	–75	180	120	60	1.1	50	50	50	6	12	1	3
2016_2					6	–15	–20	–65	180	120	60	1.1	50	50	50	6	12	1	3
2017_2					7	–30	–30	–50	180	120	60	1.1	50	50	50	6	12	1	3
2021_2			2	Ign	1	20	–20	–80	180	120	60	1.1	50	50	50	6	12	1	3
2022_2					2	45	–20	–90	180	120	60	1.1	50	50	50	6	12	1	3
2023_2					3	0	–15	–85	180	120	60	1.1	50	50	50	6	12	1	3
2024_2					4	–5	–20	–65	180	120	60	1.1	50	50	50	6	12	1	3

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
2025_2					5	15	–20	–75	180	120	60	1.1	50	50	50	6	12	1	3
2026_2					6	–15	–20	–65	180	120	60	1.1	50	50	50	6	12	1	3
2027_2					7	–30	–30	–50	180	120	60	1.1	50	50	50	6	12	1	3
2031_2			3	Qmd	1	20	–20	–80	180	120	60	1.1	50	50	50	6	12	1	3
2032_2					2	45	–20	–90	180	120	60	1.1	50	50	50	6	12	1	3
2033_2					3	0	–15	–85	180	120	60	0.8	50	50	50	6	12	1	3
2034_2					4	–5	–20	–65	180	120	60	0.8	50	50	50	6	12	1	3
2035_2					5	15	–20	–75	180	120	60	0.8	50	50	50	6	12	1	3
2036_2					6	–15	–20	–65	180	120	60	0.8	50	50	50	6	12	1	3
2037_2					7	–30	–30	–50	180	120	60	0.8	50	50	50	6	12	1	3
2041_2			4	HWS	1	20	–20	–80	180	120	60	0.8	50	50	50	6	12	1	3
2042_2					2	45	–20	–90	180	120	60	1.2	50	50	50	6	12	1	3
2043_2					3	0	–15	–85	180	120	60	1.2	50	50	50	6	12	1	3
2044_2					4	–5	–20	–65	180	120	60	0	50	50	50	6	12	1	3
2045_2					5	15	–20	–75	180	120	60	1.2	50	50	50	6	12	1	3
2046_2					6	–15	–20	–65	180	120	60	1.2	50	50	50	6	12	1	3
2047_2					7	–30	–30	–50	180	120	60	0	50	50	50	6	12	1	3
2011_3	Pass 3	Inside 0.6% Cu Grade Shell	1	Va	1	20	–20	–80	360	240	120	1.1	50	50	50	3	9	1	3
2012_3					2	45	–20	–90	360	240	120	1.1	50	50	50	3	9	1	3
2013_3					3	0	–15	–85	360	240	120	1.1	50	50	50	3	9	1	3
2014_3					4	–5	–20	–65	360	240	120	4	75	75	75	3	9	1	3
2015_3					5	15	–20	–75	360	240	120	1.1	50	50	50	3	9	1	3
2016_3					6	–15	–20	–65	360	240	120	4	75	75	75	3	9	1	3
2017_3					7	–30	–30	–50	360	240	120	1.1	50	50	50	3	9	1	3
2021_3			2	Ign	1	20	–20	–80	360	240	120	1.1	50	50	50	3	9	1	3
2022_3					2	45	–20	–90	360	240	120	1.1	50	50	50	3	9	1	3
2023_3					3	0	–15	–85	360	240	120	1.1	50	50	50	3	9	1	3
2024_3					4	–5	–20	–65	360	240	120	1.1	50	50	50	3	9	1	3
2025_3					5	15	–20	–75	360	240	120	1.1	50	50	50	3	9	1	3
2026_3					6	–15	–20	–65	360	240	120	1.1	50	50	50	3	9	1	3
2027_3					7	–30	–30	–50	360	240	120	1.1	50	50	50	3	9	1	3
2031_3			3	Qmd	1	20	–20	–80	360	240	120	1.1	50	50	50	3	9	1	3
2032_3					2	45	–20	–90	360	240	120	1.1	50	50	50	3	9	1	3
2033_3					3	0	–15	–85	360	240	120	0.8	50	50	50	3	9	1	3
2034_3					4	–5	–20	–65	360	240	120	0.8	50	50	50	3	9	1	3
2035_3					5	15	–20	–75	360	240	120	0.8	50	50	50	3	9	1	3
2036_3					6	–15	–20	–65	360	240	120	0.8	50	50	50	3	9	1	3
2037_3					7	–30	–30	–50	360	240	120	0.8	50	50	50	3	9	1	3
2041_3			4	HWS	1	20	–20	–80	360	240	120	0.8	50	50	50	3	9	1	3
2042_3					2	45	–20	–90	360	240	120	1.2	50	50	50	3	9	1	3

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
2043_3					3	0	–15	–85	360	240	120	1.2	50	50	50	3	9	1	3
2044_3					4	–5	–20	–65	360	240	120	0	50	50	50	3	9	1	3
2045_3					5	15	–20	–75	360	240	120	1.2	50	50	50	3	9	1	3
2046_3					6	–15	–20	–65	360	240	120	1.2	50	50	50	3	9	1	3
2047_3					7	–30	–30	–50	360	240	120	0	50	50	50	3	9	1	3

Table 14.21 Copper Search Parameters, Inside 1.0% Cu Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
3011_1	Pass 1	Inside 1.0% Cu Grade Shell	1	Va	1	20	–20	–80	120	80	40	0	50	50	50	9	15	1	3
3012_1					2	45	–20	–90	120	80	40	0	50	50	50	9	15	1	3
3013_1					3	0	–15	–85	120	80	40	1.2	50	50	50	9	15	1	3
3014_1					4	–5	–20	–65	120	80	40	0.5	50	50	50	9	15	1	3
3015_1					5	15	–20	–75	120	80	40	0.5	50	50	50	9	15	1	3
3016_1					6	–15	–20	–65	120	80	40	0.5	50	50	50	9	15	1	3
3017_1					7	–30	–30	–50	120	80	40	0.5	50	50	50	9	15	1	3
3021_1			2	Ign	1	20	–20	–80	120	80	40	0.5	50	50	50	9	15	1	3
3022_1					2	45	–20	–90	120	80	40	0.5	50	50	50	9	15	1	3
3023_1					3	0	–15	–85	120	80	40	0.5	50	50	50	9	15	1	3
3024_1					4	–5	–20	–65	120	80	40	0.5	50	50	50	9	15	1	3
3025_1					5	15	–20	–75	120	80	40	0.5	50	50	50	9	15	1	3
3026_1					6	–15	–20	–65	120	80	40	0.5	50	50	50	9	15	1	3
3027_1					7	–30	–30	–50	120	80	40	0.5	50	50	50	9	15	1	3
3031_1			3	Qmd	1	20	–20	–80	120	80	40	0	50	50	50	9	15	1	3
3032_1					2	45	–20	–90	120	80	40	0	50	50	50	9	15	1	3
3033_1					3	0	–15	–85	120	80	40	0	50	50	50	9	15	1	3
3034_1					4	–5	–20	–65	120	80	40	0	50	50	50	9	15	1	3
3035_1					5	15	–20	–75	120	80	40	0	50	50	50	9	15	1	3
3036_1					6	–15	–20	–65	120	80	40	0	50	50	50	9	15	1	3
3037_1					7	–30	–30	–50	120	80	40	0	50	50	50	9	15	1	3
3011_2	Pass 2	Inside 1.0% Cu Grade Shell	1	Va	1	20	–20	–80	180	120	60	0	50	50	50	6	12	1	3
3012_2					2	45	–20	–90	180	120	60	0	50	50	50	6	12	1	3
3013_2					3	0	–15	–85	180	120	60	1.2	50	50	50	6	12	1	3
3014_2					4	–5	–20	–65	180	120	60	0.5	50	50	50	6	12	1	3
3015_2					5	15	–20	–75	180	120	60	0.5	50	50	50	6	12	1	3
3016_2					6	–15	–20	–65	180	120	60	0.5	50	50	50	6	12	1	3
3017_2					7	–30	–30	–50	180	120	60	0.5	50	50	50	6	12	1	3
3021_2			2	Ign	1	20	–20	–80	180	120	60	0.5	50	50	50	6	12	1	3
3022_2					2	45	–20	–90	180	120	60	0.5	50	50	50	6	12	1	3

Estimation ID	Estimation Pass	Copper Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
3023_2					3	0	–15	–85	180	120	60	0.5	50	50	50	6	12	1	3
3024_2					4	–5	–20	–65	180	120	60	0.5	50	50	50	6	12	1	3
3025_2					5	15	–20	–75	180	120	60	0.5	50	50	50	6	12	1	3
3026_2					6	–15	–20	–65	180	120	60	0.5	50	50	50	6	12	1	3
3027_2					7	–30	–30	–50	180	120	60	0.5	50	50	50	6	12	1	3
3031_2			3	Qmd	1	20	–20	–80	180	120	60	0	50	50	50	6	12	1	3
3032_2					2	45	–20	–90	180	120	60	0	50	50	50	6	12	1	3
3033_2					3	0	–15	–85	180	120	60	0	50	50	50	6	12	1	3
3034_2					4	–5	–20	–65	180	120	60	0	50	50	50	6	12	1	3
3035_2					5	15	–20	–75	180	120	60	0	50	50	50	6	12	1	3
3036_2					6	–15	–20	–65	180	120	60	0	50	50	50	6	12	1	3
3037_2					7	–30	–30	–50	180	120	60	0	50	50	50	6	12	1	3
3011_3	Pass 3	Inside 1.0% Cu Grade Shell	1	Va	1	20	–20	–80	360	240	120	0	50	50	50	3	9	1	3
3012_3					2	45	–20	–90	360	240	120	0	50	50	50	3	9	1	3
3013_3					3	0	–15	–85	360	240	120	1.2	50	50	50	3	9	1	3
3014_3					4	–5	–20	–65	360	240	120	5	75	75	75	3	9	1	3
3015_3					5	15	–20	–75	360	240	120	0.5	50	50	50	3	9	1	3
3016_3					6	–15	–20	–65	360	240	120	0.5	50	50	50	3	9	1	3
3017_3					7	–30	–30	–50	360	240	120	5	75	75	75	3	9	1	3
3021_3			2	Ign	1	20	–20	–80	360	240	120	0.5	50	50	50	3	9	1	3
3022_3					2	45	–20	–90	360	240	120	0.5	50	50	50	3	9	1	3
3023_3					3	0	–15	–85	360	240	120	0.5	50	50	50	3	9	1	3
3024_3					4	–5	–20	–65	360	240	120	0.5	50	50	50	3	9	1	3
3025_3					5	15	–20	–75	360	240	120	0.5	50	50	50	3	9	1	3
3026_3					6	–15	–20	–65	360	240	120	0.5	50	50	50	3	9	1	3
3027_3					7	–30	–30	–50	360	240	120	0.5	50	50	50	3	9	1	3
3031_3			3	Qmd	1	20	–20	–80	360	240	120	0	50	50	50	3	9	1	3
3032_3					2	45	–20	–90	360	240	120	0	50	50	50	3	9	1	3
3033_3					3	0	–15	–85	360	240	120	0	50	50	50	3	9	1	3
3034_3					4	–5	–20	–65	360	240	120	0	50	50	50	3	9	1	3
3035_3					5	15	–20	–75	360	240	120	0	50	50	50	3	9	1	3
3036_3					6	–15	–20	–65	360	240	120	0	50	50	50	3	9	1	3
3037_3					7	–30	–30	–50	360	240	120	0	50	50	50	3	9	1	3

Table 14.22 Copper Search Parameters, Inside BiGd, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Domain	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY –- Semi-Major Radius	HY – Minor Radius	Minor Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
1051_1	Pass 1	BiGd High grade Domain	5	BiGd	1	20	–20	–80	120	80	40	3	50	50	15	9	15	1	3
1052_1					2	45	–20	–90	120	80	40	3	50	50	15	9	15	1	3
1053_1					3	0	–15	–85	120	80	40	3	50	50	15	9	15	1	3
1054_1					4	–5	–20	–65	120	80	40	3	50	50	15	9	15	1	3
1055_1					5	15	–20	–75	120	80	40	3	50	50	15	9	15	1	3
1056_1					6	–15	–20	–65	120	80	40	3	50	50	15	9	15	1	3
1057_1					7	–30	–30	–50	120	80	40	3	50	50	15	9	15	1	3
1051_h2	Pass 2				1	20	–20	–80	180	120	60	3	50	50	15	6	12	1	3
1052_h2					2	45	–20	–90	180	120	60	3	50	50	15	6	12	1	3
1053_h2					3	0	–15	–85	180	120	60	3	50	50	15	6	12	1	3
1054_h2					4	–5	–20	–65	180	120	60	3	50	50	15	6	12	1	3
1055_h2					5	15	–20	–75	180	120	60	3	50	50	15	6	12	1	3
1056_h2					6	–15	–20	–65	180	120	60	3	50	50	15	6	12	1	3
1057_h2					7	–30	–30	–50	180	120	60	3	50	50	15	6	12	1	3
1051_h3	Pass 3				1	20	–20	–80	360	240	120	3	50	50	15	3	9	1	3
1052_h3					2	45	–20	–90	360	240	120	3	50	50	15	3	9	1	3
1053_h3					3	0	–15	–85	360	240	120	3	50	50	15	3	9	1	3
1054_h3					4	–5	–20	–65	360	240	120	3	50	50	15	3	9	1	3
1055_h3					5	15	–20	–75	360	240	120	3	50	50	15	3	9	1	3
1056_h3					6	–15	–20	–65	360	240	120	3	50	50	15	3	9	1	3
1057_h3					7	–30	–30	–50	360	240	120	3	50	50	15	3	9	1	3
1051_l2	Pass 1	BiGd Outside of Grade Shell	5	BiGd	1	20	–20	–80	180	120	60	3	50	50	15	6	12	1	3
1052_l2					2	45	–20	–90	180	120	60	3	50	50	15	6	12	1	3
1053_l2					3	0	–15	–85	180	120	60	3	50	50	15	6	12	1	3
1054_l2					4	–5	–20	–65	180	120	60	3	50	50	15	6	12	1	3
1055_l2					5	15	–20	–75	180	120	60	3	50	50	15	6	12	1	3
1056_l2					6	–15	–20	–65	180	120	60	3	50	50	15	6	12	1	3
1057_l2					7	–30	–30	–50	180	120	60	3	50	50	15	6	12	1	3
1051_l3	Pass 2				1	20	–20	–80	360	240	120	3	50	50	15	3	9	1	3
1052_l3					2	45	–20	–90	360	240	120	3	50	50	15	3	9	1	3
1053_l3					3	0	–15	–85	360	240	120	3	50	50	15	3	9	1	3
1054_l3					4	–5	–20	–65	360	240	120	3	50	50	15	3	9	1	3
1055_l3					5	15	–20	–75	360	240	120	3	50	50	15	3	9	1	3
1056_l3					6	–15	–20	–65	360	240	120	3	50	50	15	3	9	1	3
1057_l3					7	–30	–30	–50	360	240	120	3	50	50	15	3	9	1	3

Table 14.23 Gold Search Parameters, Outside 0.3 g/t Au Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Au Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY – Semi-Major Radius	HY – Minor Radius	Minimum Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
1011_1	Pass 1	Outside 0.3 g/t Au Grade shell	1	Va	1	55	–70	20	120	40	80	0	50	50	15	9	15	1	3
1012_1					2	–15	15	20	120	40	80	0	50	50	50	9	15	1	3
1013_1					3	15	–15	90	120	80	40	0	50	50	50	9	15	1	3
1021_1			2	Ign	1	55	–70	20	120	40	80	1.5	50	50	50	9	15	1	3
1022_1					2	–15	15	20	120	40	80	1.5	50	50	50	9	15	1	3
1023_1					3	15	–15	90	120	80	40	1.5	50	50	50	9	15	1	3
1031_1			3	Qmd	1	55	–70	20	120	40	80	1	100	50	100	9	15	1	3
1032_1					2	–15	15	20	120	40	80	1	100	50	100	9	15	1	3
1033_1					3	15	–15	90	120	80	40	1	100	50	100	9	15	1	3
1011_2	Pass 2	Outside 0.3 g/t Au Grade shell	1	Va	1	55	–70	20	180	60	120	0	50	50	15	6	12	1	3
1012_2					2	–15	15	20	180	60	120	0	50	50	50	6	12	1	3
1013_2					3	15	–15	90	180	120	60	0	50	50	50	6	12	1	3
1021_2			2	Ign	1	55	–70	20	180	60	120	1.5	50	50	50	6	12	1	3
1022_2					2	–15	15	20	180	60	120	1.5	50	50	50	6	12	1	3
1023_2					3	15	–15	90	180	120	60	1.5	50	50	50	6	12	1	3
1031_2			3	Qmd	1	55	–70	20	180	60	120	1	100	50	100	6	12	1	3
1032_2					2	–15	15	20	180	60	120	1	100	50	100	6	12	1	3
1033_2					3	15	–15	90	180	120	60	1	100	50	100	6	12	1	3
1011_3	Pass 3	Outside 0.3 g/t Au Grade shell	1	Va	1	55	–70	20	360	120	240	0	50	50	15	3	9	1	3
1012_3					2	–15	15	20	360	120	240	0	50	50	50	3	9	1	3
1013_3					3	15	–15	90	360	240	120	0	50	50	50	3	9	1	3
1021_3			2	Ign	1	55	–70	20	360	120	240	1.5	50	50	50	3	9	1	3
1022_3					2	–15	15	20	360	120	240	1.5	50	50	50	3	9	1	3
1023_3					3	15	–15	90	360	240	120	1.5	50	50	50	3	9	1	3
1031_3			3	Qmd	1	55	–70	20	360	120	240	1	100	50	100	3	9	1	3
1032_3					2	–15	15	20	360	120	240	1	100	50	100	3	9	1	3
1033_3					3	15	–15	90	360	240	120	1	100	50	100	3	9	1	3

Table 14.24 Gold Search Parameters, Inside 0.3 g/t Au Grade Shell and Outside 1.0 g/t Au Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Au Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY – Semi-Major Radius	HY – Minor Radius	Minimum Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
2011_1	Pass 1	0.3 g/t Au Grade Shell	1	Va	1	55	–70	20	120	40	80	1.1	50	50	50	9	15	1	3
2012_1					2	–15	15	20	120	40	80	1.1	50	50	50	9	15	1	3
2013_1					3	15	–15	90	120	80	40	1.1	50	50	50	9	15	1	3
2021_1			2	Ign	1	55	–70	20	120	40	80	1.1	50	50	50	9	15	1	3
2022_1					2	–15	15	20	120	40	80	1.1	50	50	50	9	15	1	3
2023_1					3	15	–15	90	120	80	40	1.1	50	50	50	9	15	1	3
2031_1			3	Qmd	1	55	–70	20	120	40	80	1.1	50	50	50	9	15	1	3
2032_1					2	–15	15	20	120	40	80	1.1	50	50	50	9	15	1	3
2033_1					3	15	–15	90	120	80	40	0.8	50	50	50	9	15	1	3
2041_1			4	HWS	1	55	–70	20	120	40	80	0.8	50	50	50	9	15	1	3
2042_1					2	–15	15	20	120	40	80	1.2	50	50	50	9	15	1	3
2043_1					3	15	–15	90	120	80	40	1.2	50	50	50	9	15	1	3
2011_2	Pass 2	0.3 g/t Au Grade Shell	1	Va	1	55	–70	20	180	60	120	1.1	50	50	50	6	12	1	3
2012_2					2	–15	15	20	180	60	120	1.1	50	50	50	6	12	1	3
2013_2					3	15	–15	90	180	120	60	1.1	50	50	50	6	12	1	3
2021_2			2	Ign	1	55	–70	20	180	60	120	1.1	50	50	50	6	12	1	3
2022_2					2	–15	15	20	180	60	120	1.1	50	50	50	6	12	1	3
2023_2					3	15	–15	90	180	120	60	1.1	50	50	50	6	12	1	3
2031_2			3	Qmd	1	55	–70	20	180	60	120	1.1	50	50	50	6	12	1	3
2032_2					2	–15	15	20	180	60	120	1.1	50	50	50	6	12	1	3
2033_2					3	15	–15	90	180	120	60	0.8	50	50	50	6	12	1	3
2041_2			4	HWS	1	55	–70	20	180	60	120	0.8	50	50	50	6	12	1	3
2042_2					2	–15	15	20	180	60	120	1.2	50	50	50	6	12	1	3
2043_2					3	15	–15	90	180	120	60	1.2	50	50	50	6	12	1	3
2011_3	Pass 3	0.3 g/t Au Grade Shell	1	Va	1	55	–70	20	360	120	240	1.1	50	50	50	3	9	1	3
2012_3					2	–15	15	20	360	120	240	1.1	50	50	50	3	9	1	3
2013_3					3	15	–15	90	360	240	120	1.1	50	50	50	3	9	1	3
2021_3			2	Ign	1	55	–70	20	360	120	240	1.1	50	50	50	3	9	1	3
2022_3					2	–15	15	20	360	120	240	1.1	50	50	50	3	9	1	3
2023_3					3	15	–15	90	360	240	120	1.1	50	50	50	3	9	1	3
2031_3			3	Qmd	1	55	–70	20	360	120	240	1.1	50	50	50	3	9	1	3
2032_3					2	–15	15	20	360	120	240	1.1	50	50	50	3	9	1	3
2033_3					3	15	–15	90	360	240	120	0.8	50	50	50	3	9	1	3
2041_3			4	HWS	1	55	–70	20	360	120	240	0.8	50	50	50	3	9	1	3
2042_3					2	–15	15	20	360	120	240	1.2	50	50	50	3	9	1	3
2043_3					3	15	–15	90	360	240	120	1.2	50	50	50	3	9	1	3

Table 14.25 Gold Search Parameters, Inside 1.0 g/t Au Grade Shell, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Au Grade Shell	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY – Semi-Major Radius	HY – Minor Radius	Minimum Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
3011_1	Pass 1	1.0 g/t Au Grade Shell	1	Va	1	55	–70	20	120	40	80	0	50	50	50	9	15	1	3
3012_1					2	–15	15	20	120	40	80	0	50	50	50	9	15	1	3
3013_1					3	15	–15	90	120	80	40	1.2	50	50	50	9	15	1	3
3021_1			2	Ign	1	55	–70	20	120	40	80	0.5	50	50	50	9	15	1	3
3022_1					2	–15	15	20	120	40	80	0.5	50	50	50	9	15	1	3
3023_1					3	15	–15	90	120	80	40	0.5	50	50	50	9	15	1	3
3031_1			3	Qmd	1	55	–70	20	120	40	80	0	50	50	50	9	15	1	3
3032_1					2	–15	15	20	120	40	80	0	50	50	50	9	15	1	3
3033_1					3	15	–15	90	120	80	40	0	50	50	50	9	15	1	3
3011_2	Pass 2	1.0 g/t Au Grade Shell	1	Va	1	55	–70	20	180	60	120	0	50	50	50	6	12	1	3
3012_2					2	–15	15	20	180	60	120	0	50	50	50	6	12	1	3
3013_2					3	15	–15	90	180	120	60	1.2	50	50	50	6	12	1	3
3021_2			2	Ign	1	55	–70	20	180	60	120	0.5	50	50	50	6	12	1	3
3022_2					2	–15	15	20	180	60	120	0.5	50	50	50	6	12	1	3
3023_2					3	15	–15	90	180	120	60	0.5	50	50	50	6	12	1	3
3031_2			3	Qmd	1	55	–70	20	180	60	120	0	50	50	50	6	12	1	3
3032_2					2	–15	15	20	180	60	120	0	50	50	50	6	12	1	3
3033_2					3	15	–15	90	180	120	60	0	50	50	50	6	12	1	3
3011_3	Pass 3	1.0 g/t Au Grade Shell	1	Va	1	55	–70	20	360	120	240	0	50	50	50	3	9	1	3
3012_3					2	–15	15	20	360	120	240	0	50	50	50	3	9	1	3
3013_3					3	15	–15	90	360	240	120	1.2	50	50	50	3	9	1	3
3021_3			2	Ign	1	55	–70	20	360	120	240	0.5	50	50	50	3	9	1	3
3022_3					2	–15	15	20	360	120	240	0.5	50	50	50	3	9	1	3
3023_3					3	15	–15	90	360	240	120	0.5	50	50	50	3	9	1	3
3031_3			3	Qmd	1	55	–70	20	360	120	240	0	50	50	50	3	9	1	3
3032_3					2	–15	15	20	360	120	240	0	50	50	50	3	9	1	3
3033_3					3	15	–15	90	360	240	120	0	50	50	50	3	9	1	3

Table 14.26 Gold Search Parameters, Inside BiGd, Hugo North and Hugo North Extension

Estimation ID	Estimation Pass	Domain	Nlith	Rock Type	Zone Code	Bearing (Z)	Plunge (Y)	Dip (X)	Major Axis	Semi-Major Axis	Minor Axis	HY Threshold	HY – Major Radius	HY – Semi-Major Radius	HY – Minor Radius	Minimum Samples Per Est	Maximum Samples Per Est	Limit Samples Per Hole	Maximum Samples Per Hole
1051h1	Pass 1	BiGd High Grade Domain	5	BiGd	1	55	–70	20	120	40	80	0	50	50	50	9	15	1	3
1052h1					2	–15	15	20	120	40	80	0	50	50	50	9	15	1	3
1053h1					3	15	–15	90	120	40	80	0	50	50	50	9	15	1	3
1051h2	Pass 2				1	55	–70	20	180	60	120	0	50	50	50	6	12	1	3
1052h2					2	–15	15	20	180	60	120	0	50	50	50	6	12	1	3
1053h2					3	15	–15	90	180	60	120	0	50	50	50	6	12	1	3
1051h3	Pass 3				1	55	–70	20	360	120	240	0	50	50	50	3	9	1	3
1052h3					2	–15	15	20	360	120	240	0	50	50	50	3	9	1	3
1053h3					3	15	–15	90	360	120	240	0	50	50	50	3	9	1	3
1051_1	Pass 1	BiGd Outside of Au Grade shell	5	BiGd	1	55	–70	20	120	40	80	0	50	50	50	9	15	1	3
1052_1					2	–15	15	20	120	40	80	0	50	50	50	9	15	1	3
1053_1					3	15	–15	90	120	40	80	0	50	50	50	9	15	1	3
1051_2	Pass 2				3	55	–70	20	180	60	120	0	50	50	50	6	12	1	3
1052_2					3	–15	15	20	180	60	120	0	50	50	50	6	12	1	3
1053_2					3	15	–15	90	180	60	120	0	50	50	50	6	12	1	3
1051_3	Pass 3				1	55	–70	20	360	120	240	0	50	50	50	3	9	1	3
1052_3					2	–15	15	20	360	120	240	0	50	50	50	3	9	1	3
1053_3					3	15	–15	90	360	120	240	0	50	50	50	3	9	1	3

14.1.8.2 Model Setup – Heruga

The selected block size was 20 m east x 20 m north x 15 m high for consistency with previous modelling at the Oyu Tolgoi deposits. It was also considered to be a suitable block size for mining studies using the block cave approach, which is the assumed mining method for Heruga. The parent blocks were divided into sub-cells when flagging the model with dyke wireframes. The block model was coded according to zone, lithological domain, and grade shell. Post-mineralisation dykes and the late Qmd were assumed to represent waste (i.e. zero grade) cutting the mineralised lithologies.

Only the mineralised lithologies were estimated, i.e. Qmd and Va. All other units in the model were set to zero grade. Modelling consisted of grade interpolation by OK. As part of the model validation, grades were also interpolated using NN and ID3, as well as OK of uncapped composites. Density was interpolated by ID3.

The search ellipsoids were oriented preferentially to the general trend of the grade shells. A staged search strategy was applied, with the Pass 1 at 200 m and Pass 2 at 400 m. A minimum two-hole rule was applied to both passes. Any blocks not interpolated by the first two passes were populated in a third pass that removed the two-hole constraint. Outlier restriction was applied as a second cap whereby grades over a particular threshold were only used in blocks within a specified distance from a drillhole (50–100 m). Outside of this distance the lower capped value was used.

The sub-cells in the final model were regularised to parent cell size after estimation was complete.

14.1.9 Results of Estimation

The results of the Mineral Resource estimates are presented below as grade and tonnage tables at variable copper equivalent cut-off grades for different resource classifications, and as copper and gold grade-tonnage curves. The information is arranged as follows:

- Hugo North Extension: Table 14.27 and Figure 14.2.
- Heruga: Table 14.28 and Figure 14.3.

Table 14.27 Grade and Tonnage Calculations at Variable Copper Equivalent Cut-off Grades – Hugo North Extension

CLASS	CuEq Cut-off (%)	Tonnage (Mt)	Grade					Contained Metal			
			Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)
Measured	0.1	1.2	1.35	0.12	2.71	37.5	1.44	36	5	105	0.1
	0.22	1.2	1.36	0.12	2.72	37.5	1.45	36	5	105	0.1
	0.3	1.2	1.37	0.12	2.74	37.8	1.46	36	5	105	0.1
	0.37	1.2	1.38	0.12	2.77	38.4	1.47	36	4	104	0.1
	0.5	1.1	1.43	0.12	2.86	39.4	1.52	35	4	103	0.1
	0.6	1.1	1.47	0.12	2.93	40.6	1.56	35	4	101	0.1
	0.7	1.0	1.52	0.13	3.04	41.1	1.62	34	4	99	0.1
	0.8	0.9	1.61	0.14	3.20	41.6	1.72	32	4	94	0.1
	0.9	0.9	1.63	0.14	3.25	42.0	1.74	32	4	93	0.1
	1	0.9	1.66	0.14	3.29	42.2	1.77	31	4	90	0.1
	1.25	0.7	1.84	0.17	3.72	45.6	1.97	26	4	78	0.1
	1.5	0.5	2.04	0.20	4.27	52.1	2.19	21	3	66	0.1
	2	0.2	2.56	0.18	4.53	31.0	2.71	12	1	31	0.02
	2.5	0.1	2.98	0.23	5.22	28.3	3.16	7	1	18	0.01
	3	0.1	3.35	0.37	6.32	27.8	3.62	4	1	12	0.004
	3.5	0.03	3.55	0.67	6.46	30.3	3.98	2	1	6	0.002
Indicated	0.1	151	1.43	0.47	3.61	31.7	1.73	4,764	2,291	17,520	11
	0.22	139	1.54	0.51	3.86	33.0	1.86	4,728	2,282	17,296	10
	0.3	133	1.60	0.53	4.02	33.4	1.94	4,694	2,276	17,127	10
	0.37	128	1.65	0.55	4.12	33.6	1.99	4,663	2,271	16,988	10
	0.5	121	1.73	0.58	4.31	33.6	2.09	4,597	2,261	16,720	9
	0.6	112	1.82	0.62	4.53	33.0	2.20	4,504	2,247	16,372	8
	0.7	103	1.93	0.67	4.82	32.2	2.35	4,377	2,228	15,942	7
	0.8	92	2.07	0.74	5.18	31.5	2.53	4,219	2,200	15,416	6
	0.9	85	2.18	0.79	5.46	31.3	2.67	4,101	2,172	14,995	6
	1	80	2.26	0.83	5.67	31.2	2.77	4,008	2,142	14,642	6
	1.25	70	2.45	0.92	6.11	31.6	3.02	3,790	2,065	13,763	5
	1.5	63	2.61	0.98	6.44	32.1	3.21	3,605	1,981	12,976	4
	2	52	2.86	1.09	6.94	32.9	3.52	3,263	1,809	11,553	4
	2.5	44	3.04	1.16	7.27	33.4	3.75	2,944	1,640	10,274	3
	3	33	3.30	1.27	7.72	33.8	4.07	2,403	1,349	8,199	2
	3.5	22	3.65	1.41	8.43	34.3	4.51	1,739	982	5,862	2
Measured + Indicated	0.1	152	1.43	0.47	3.60	31.7	1.72	4,800	2,295	17,626	11
	0.22	140	1.54	0.51	3.85	33.0	1.85	4,764	2,286	17,401	10
	0.3	134	1.60	0.53	4.00	33.5	1.93	4,730	2,281	17,232	10
	0.37	129	1.65	0.55	4.11	33.7	1.99	4,699	2,276	17,093	10
	0.5	122	1.72	0.58	4.30	33.6	2.08	4,632	2,265	16,823	9
	0.6	114	1.81	0.62	4.51	33.1	2.20	4,539	2,251	16,473	8
	0.7	104	1.93	0.67	4.80	32.2	2.34	4,411	2,232	16,040	7
	0.8	93	2.06	0.73	5.17	31.6	2.52	4,251	2,204	15,510	7
	0.9	86	2.17	0.78	5.44	31.4	2.66	4,133	2,176	15,088	6
	1	81	2.26	0.82	5.64	31.4	2.76	4,039	2,146	14,733	6
	1.25	71	2.45	0.91	6.09	31.8	3.01	3,816	2,069	13,841	5
	1.5	63	2.60	0.98	6.42	32.2	3.20	3,626	1,984	13,041	4
	2	52	2.86	1.08	6.93	32.9	3.52	3,275	1,811	11,584	4
	2.5	44	3.04	1.16	7.27	33.4	3.75	2,951	1,640	10,291	3
	3	33	3.30	1.27	7.72	33.8	4.07	2,407	1,350	8,210	2
	3.5	22	3.65	1.41	8.43	34.3	4.51	1,741	983	5,868	2
Inferred	0.1	205	0.88	0.31	2.46	25.1	1.08	3,992	2,062	16,200	11
	0.22	196	0.92	0.32	2.53	25.4	1.12	3,972	2,034	15,958	11
	0.3	190	0.94	0.33	2.59	25.5	1.15	3,947	2,010	15,775	11

CLASS	CuEq Cut-off (%)	Tonnage (Mt)	Grade					Contained Metal			
			Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)
	0.37	179	0.99	0.34	2.68	25.4	1.20	3,887	1,963	15,418	10
	0.5	158	1.07	0.37	2.87	24.8	1.30	3,721	1,877	14,572	9
	0.6	141	1.14	0.40	3.06	24.6	1.39	3,549	1,803	13,866	8
	0.7	126	1.21	0.43	3.24	24.5	1.48	3,363	1,731	13,105	7
	0.8	110	1.30	0.47	3.50	24.7	1.59	3,129	1,656	12,340	6
	0.9	96	1.38	0.51	3.73	25.0	1.69	2,919	1,573	11,558	5
	1	88	1.43	0.53	3.87	25.1	1.76	2,772	1,495	10,909	5
	1.25	68	1.58	0.59	4.22	25.6	1.95	2,375	1,297	9,231	4
	1.5	50	1.75	0.68	4.56	27.1	2.16	1,908	1,080	7,258	3
	2	22	2.19	0.88	5.27	30.1	2.73	1,064	621	3,728	1
	2.5	12	2.56	0.99	5.84	34.5	3.16	678	382	2,258	0.9
	3	6	2.96	1.11	6.27	39.9	3.63	375	204	1,159	0.5
	3.5	3	3.24	1.28	6.70	39.0	4.01	208	119	627	0.3

Figure 14.2 Grade-Tonnage Curves at Various Copper Equivalent Cut-off Grades – Hugo North Extension

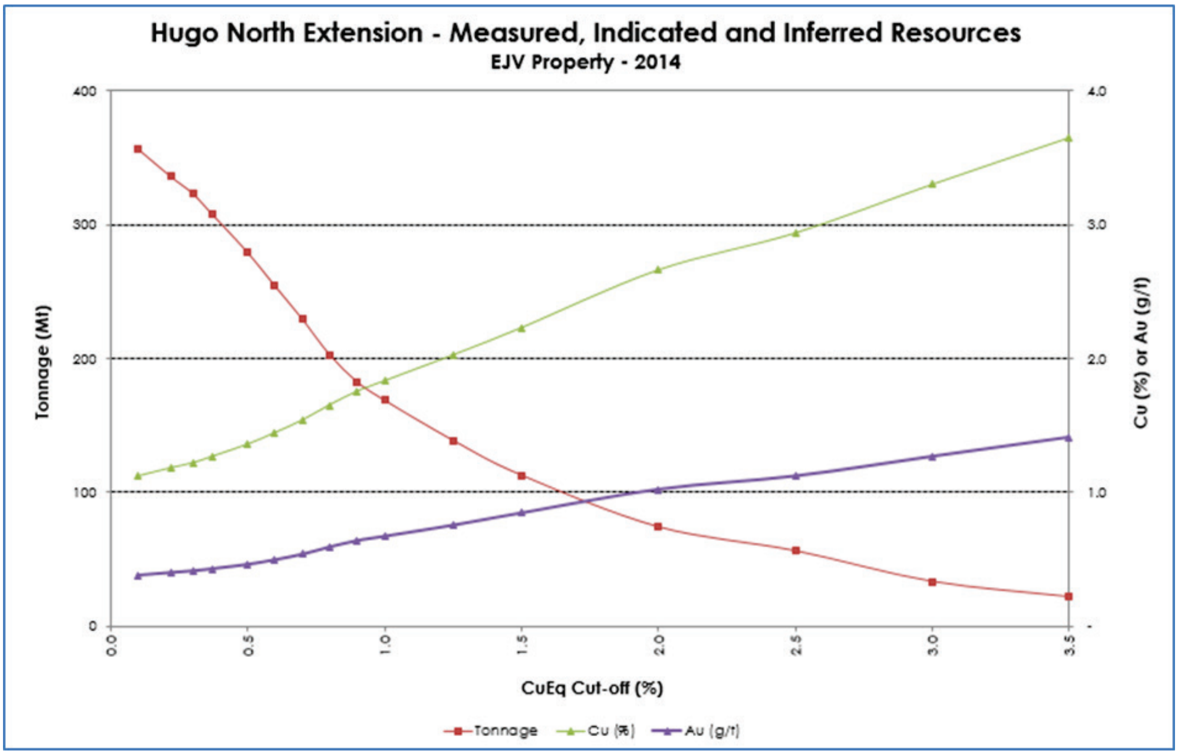
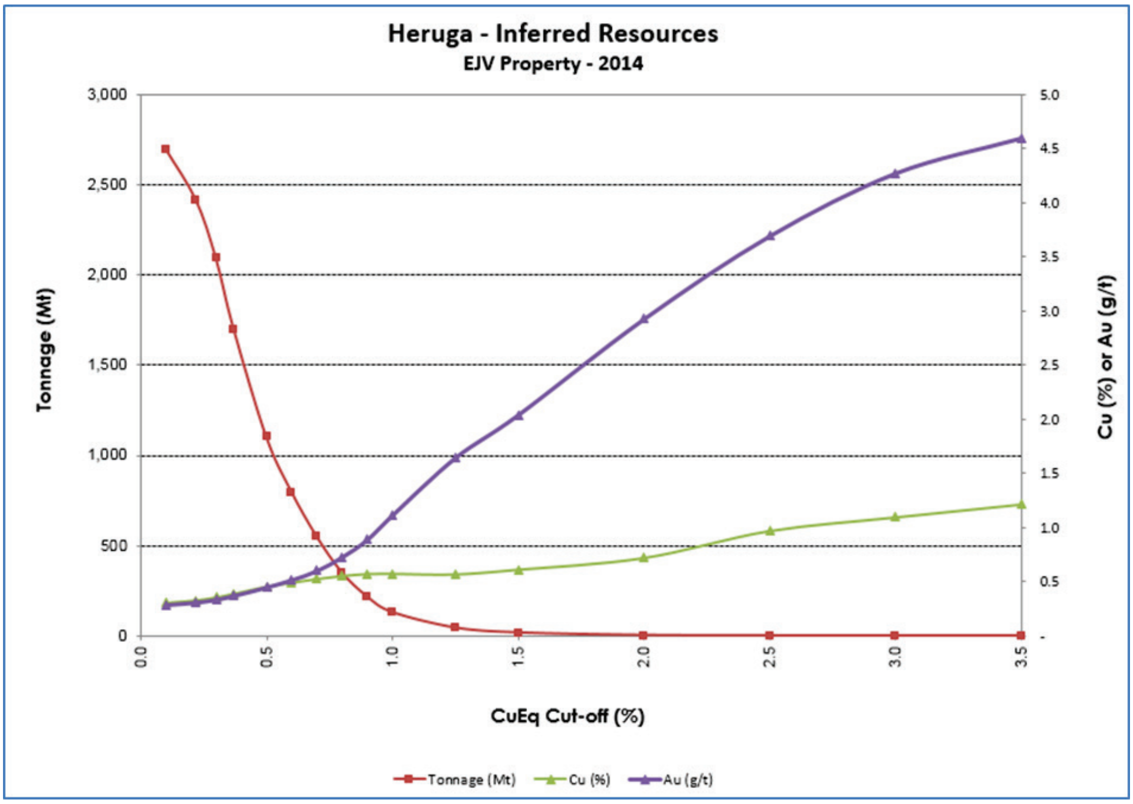


Table 14.28 Grade and Tonnage Calculations at Variable Copper Equivalent Cut-off Grades – Heruga

CLASS	CuEq Cut-off (%)	Tonnage (Mt)	Grade					Contained Metal			
			Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)
Inferred	0.10	2,696	0.31	0.29	1.16	89.1	0.50	18,185	25,090	100,148	530
	0.22	2,415	0.33	0.31	1.23	96.1	0.54	17,560	24,224	95,607	511
	0.30	2,091	0.36	0.34	1.30	103.3	0.58	16,407	22,720	87,477	476
	0.37	1,700	0.39	0.37	1.39	113.2	0.64	14,610	20,428	75,955	424
	0.50	1,102	0.46	0.45	1.56	133.2	0.76	11,054	16,007	55,351	324
	0.60	797	0.49	0.52	1.70	143.8	0.84	8,671	13,309	43,455	253
	0.70	550	0.53	0.60	1.82	153.4	0.92	6,398	10,684	32,135	186
	0.80	351	0.56	0.73	1.93	157.2	1.02	4,298	8,231	21,753	122
	0.90	218	0.57	0.89	2.01	153.9	1.13	2,754	6,235	14,082	74
	1.00	131	0.58	1.12	2.09	135.7	1.25	1,661	4,696	8,784	39
	1.25	45	0.57	1.65	2.40	113.4	1.53	561	2,360	3,441	11
	1.50	18	0.61	2.04	2.99	137.1	1.81	238	1,153	1,688	5
	2.00	3.1	0.72	2.93	3.89	99.7	2.40	49	292	389	0.7
	2.50	0.7	0.97	3.69	4.02	71.5	3.07	16	89	97	0.12
	3.00	0.3	1.10	4.27	4.03	73.0	3.52	8	47	44	0.06
	3.50	0.2	1.22	4.60	4.42	74.8	3.82	4	22	22	0.03

Figure 14.3 Grade-Tonnage Curves at Various Copper Equivalent Cut-off Grades – Heruga



14.1.10 Model Validation

14.1.10.1 Model Validation – Hugo North and Hugo North Extension

Detailed visual validation of the Hugo North and Hugo North Extension block models was performed in plan and section, comparing resource block grades to original drillhole data. The checks showed good agreement between drillhole composite values and model cell values. The addition of the outlier restriction values succeeded in minimising grade smearing.

Block model estimates were checked for global bias by comparing the average metal grades (with no cut-off) from the model (OK) with means from NN estimates. Results showed a good relationship (Table 14.29).

Models were also checked for local trends in the grade estimates (swath plot). This was undertaken by plotting the mean values from the NN estimate versus the OK results for benches in 30 m swaths and for northings and eastings in 40 m swaths.

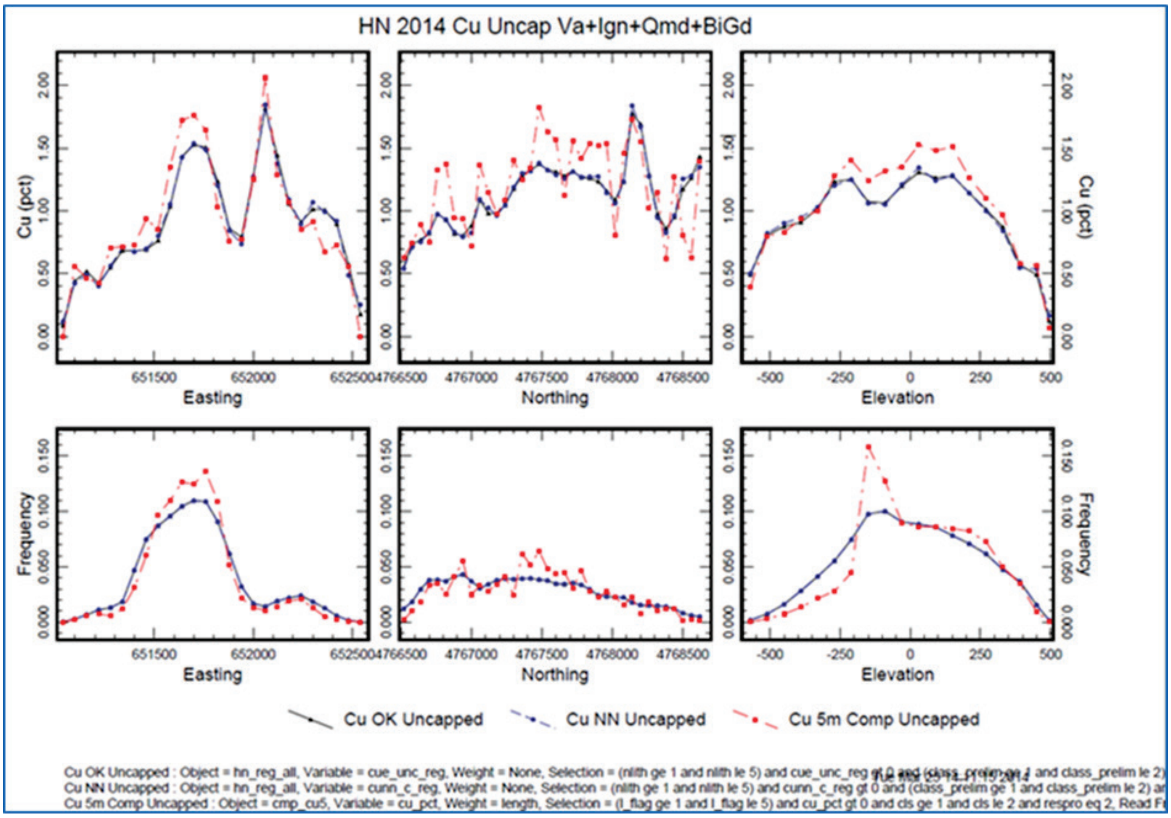
The OK estimate would be expected to be smoother than the NN estimate, thus the NN estimate should fluctuate around the OK estimate on the plots. The two trends behaved as predicted and showed no significant trends of copper or gold in the estimates.

Swath plots of uncapped copper estimations along easting, northing, and elevation are shown in Figure 14.4. The same information for gold estimation is shown in Figure 14.5.

Table 14.29 Global Model Mean Grade Values by Domain in Each Zone (Nearest Neighbour vs. Ordinary Kriging Estimates)

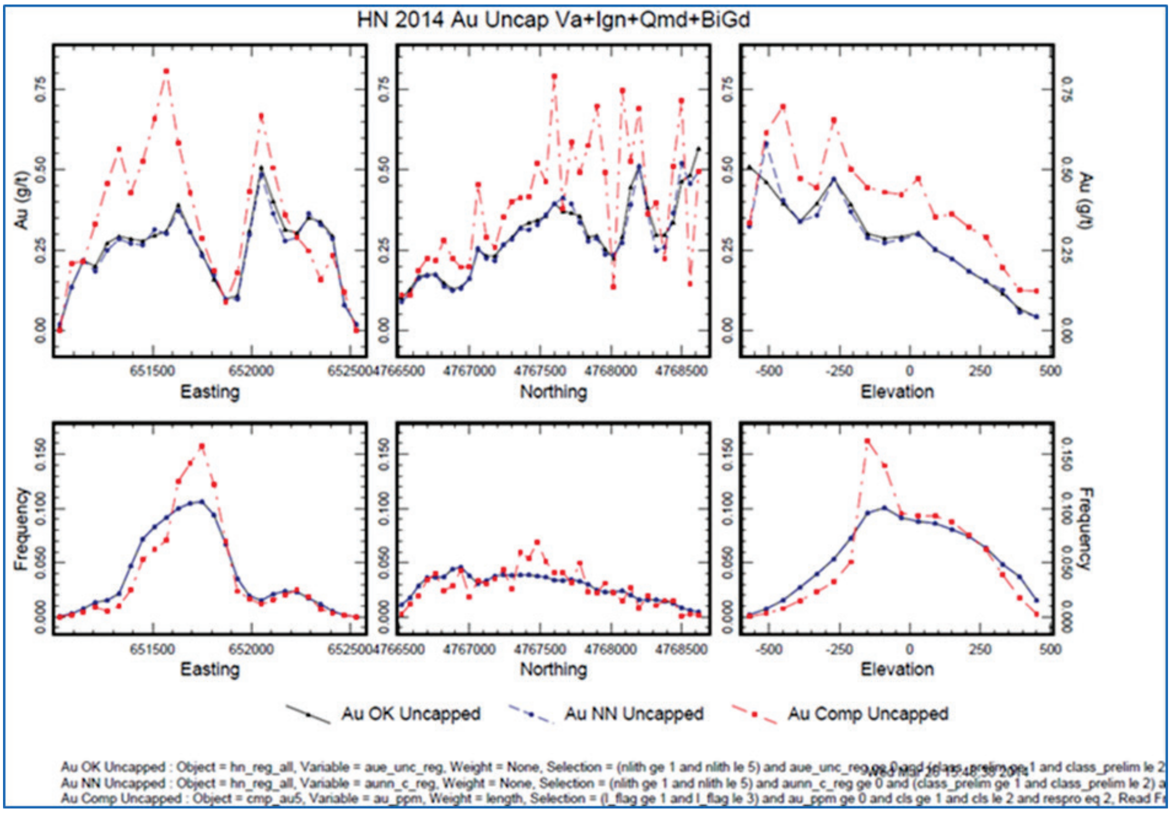
Domain / Zone	NN Estimate	OK Estimates	% Difference
Cu (%) – Hugo North			
All Zones	0.896	0.901	–1.0
Qtz-vein Domain	2.712	2.697	–0.5
0.6% Cu Domain	0.938	0.915	0.8
Cu background (outside 0.6%)	0.289	0.289	0.0
Au (g/t) – Hugo North			
All Zones	0.255	0.252	–2.6
1.0 g/t Au Zone	1.291	1.243	–2.1
0.3 g/t Au Zone	0.504	0.530	–3.7
Au background	0.127	0.117	–7.8

Figure 14.4 Comparison of Hugo North Ordinary Kriged and Nearest Neighbour Cu Estimates (uncapped) and 5.0 m Cu Composites with Depth (Va+Ign+Qmd+BiGd)



Includes Hugo North Extension

Figure 14.5 Comparison of Hugo North Ordinary Kriged and Nearest Neighbour Au Estimates (uncapped) and 5.0 m Au Composites with Depth (Va+Ign+Qmd+BiGd)



Includes Hugo North Extension

14.1.10.2 Model Validation – Heruga

A detailed visual validation of the Heruga resource model was undertaken and it was found that flagging of the drill data file and the block model had been performed as intended and reflected the drillhole data well. The block model estimates were checked for global bias by comparing the average metal grades from the model with means from unrestricted NN estimates. No bias was identified.

The distribution of the grades in the model was compared to the distribution of the original drillhole data, the composites used to build the model, and the declustered NN model. In all cases, although smoothed due to the kriging interpolation method, the model was found to reflect the underlying data used to build it. The degree of smoothing occurring within the model was considered reasonable for the type of deposit and the likely block cave mining method.

The resource model was also checked for trends and local bias using 50 m swath plots that compared the restricted OK estimates to NN estimates. The trends behaved as predicted and showed no significant bias in the estimates.

14.1.11 Mineral Resource Confidence Classification

An initial classification was assigned using a set of rules based on estimation (OK) passes, distances to nearest composites, and numbers of holes used to inform the block estimates.

At Hugo North and Hugo North Extension, block classification confidence is based on the copper grade variable. A three pass inverse distance squared (ID2) estimation of Cu composites was used to capture the distance from a block centroid to the nearest composites; the closest anisotropic distance was captured from search pass 1 and search pass 2, and the closest Cartesian distance was captured from search pass 3. For the ID2 estimation the principal mineralised rock types Va, Ign, and Qmd were treated as one group, and unmineralised rock types BiGd and Rhy were treated as another group. Contacts between these two groups were treated as hard. The HWS rocks were not classified. The seven search anisotropy zones used for 2012 copper grade estimation were used for the ID2 estimation.

At Hugo North and Hugo North Extension, block confidence classification is based on three processes: preliminary block classification using a script based on distance to a drillhole and number of drillholes used to estimate a block, generation of probability model for the three confidence categories, and manual 'cleaning' using polygons generated in sectional view.

A series of probability models were generated using the preliminary classification code of '1' for Measured, '2' for Indicated, and '3' for Inferred. Using a threshold value of 50%, the probability shells were compared to the preliminary classification block code. Boundary polygons reflecting the three categories were then manually digitised to eliminate the inclusion of isolated blocks and incorporate geologic and grade continuity. The probability shells were used as a guide for confidence.

The polygons were then connected to create a 3D solid. Blocks were then recoded as Measured, Indicated, or Inferred based on these solids.

Mineral Resources were classified based on the criteria outlined in Section 14.3.1.

14.2 Assessment of Reasonable Prospects for Economic Extraction

14.2.1 Copper Equivalence Formula

In order to assess the value of the total suite of minerals of economic interest in the mineral inventory, formulae have been developed to calculate copper equivalency (CuEq) based on given prices and recoveries.

The initial formula used to calculate the copper equivalent (CuEq) grade was developed in 2003 for Hugo North Extension and Heruga. There have been numerous variants on the formula used since.

14.2.1.1 Formula Derivation

The base 2014 copper equivalent formula incorporates copper, gold, silver, and molybdenum. The assumed metal prices are \$3.01/lb for copper, \$1,250/oz for gold, \$20.37/oz for silver, and \$11.90/lb for molybdenum. Copper is expressed in block grade in the form of percentages (%). Gold and silver are expressed in block grades in the form of grams per tonne (g/t). Molybdenum is expressed in block grades in the form of parts per million (ppm). Metallurgical recovery for gold, silver, and molybdenum are expressed as percentage relative to copper recovery.

The unit conversions used in the calculation are:

g/t to oz/t = 31.103477

lb/kg = 2.20462

tonne to lb = 2,204.62

g/t to tonne = 1×10^{-6}

This leads to a base formula of:

CuEq14 = Cu + ((Au x AuRev) + (Ag x AgRev) + (Mo x MoRev)†) / CuRev

† Mo and MoRev are only incorporated into CuEq calculations for Heruga

Where:

CuRev = (3.01 x 22.0462)

AuRev = (1,250 / 31.103477 x RecAu)

AgRev = (20.37 / 31.103477 x RecAg)

MoRev = (11.90 x 0.00220462 x RecMo)

RecAu = Au recovery / Cu Recovery

RecAg = Ag recovery / Cu Recovery

RecMo = Mo recovery / Cu Recovery

Different metallurgical recovery assumptions lead to slightly different copper equivalent formulas for each of the deposits; these are outlined in the following tables for Hugo North Extension and Heruga. In all cases, the metallurgical recovery assumptions are based on metallurgical test work. Recoveries are relative to copper because copper contributes the most to the equivalent calculation.

All elements included in the copper equivalent calculation have a reasonable potential to be recovered and sold, except for molybdenum. Molybdenum grades are only considered high enough to support construction of a molybdenum recovery circuit at Heruga, and hence the recoveries of molybdenum are zeroed out for the other deposits.

Table 14.30 Copper Equivalence Assumptions and Calculation based on Average Grades – Hugo North Extension

	Cu	Au	Ag	Mo
Metal Price	$3.01/lb	$1,250/oz	$20.37/oz	$11.90/lb
Recovery	0.92	0.84	0.86	0.00
Recovery Relative to Cu	1.00	0.913	0.942	0
Conversion Factor	22.0462	0.0321507	0.0321507	0.0022046

		% Cu	g/t Au	g/t Ag	ppm Mo	CuEq	$/t
Assumed Grade	**Cu Credit**	1	–	–	–	1	66.36
	Au Credit	–	1	–	–	0.553	36.69
	Ag Credit	–	–	1	–	0.009	0.62
	Mo Credit	–	–	–	1	0	0.03
Average Grade of Deposit	**Cu Grade**	1.59	–	–	–	1.59	105.51
	Au Grade	–	0.55	–	–	0.304	20.18
	Ag Grade	–	–	3.72	–	0.035	2.29
	Mo Grade	–	–	–	25.65	0	–
	CuEq Grade & Revenue	1.59	0.55	3.72	25.65	**1.929**	**127.98**

From Table 14.30 above, the base formula is adjusted as follows:

$CuEq14_{(Hugo\ North\ Extension)}$ =

Cu + ((Au x 1,250 x 0.0321507 x 0.913) + (Ag x 20.37 x 0.0321507 x 0.942)) / (3.01 x 22.0462)

Table 14.31 Copper Equivalence Assumptions and Calculation based on Average Grades – Heruga

	Cu	Au	Ag	Mo
Metal Price	$3.01/lb	$1,250/oz	$20.37/oz	$11.90/lb
Recovery	0.86	0.79	0.82	0.635
Recovery Relative to Cu	1	0.911	0.949	0.736
Conversion Factor	22.0462	0.0321507	0.0321507	0.0022046

		% Cu	g/t Au	g/t Ag	ppm Mo	CuEq	$/t
Assumed Grade	**Cu Credit**	1	–	–	–	1	66.36
	Au Credit	–	1	–	–	0.552	36.61
	Ag Credit	–	–	1		0.009	0.62
	Mo Credit	–	–	–	1	0	0.03
Average Grade of Deposit	**Cu Grade**	0.42	–	–	–	0.42	27.87
	Au Grade	–	0.41	–	–	0.226	15.01
	Ag Grade	–	–	1.47	–	0.014	0.91
	Mo Grade	–	–	–	138.47	0.055	2.67
	CuEq Grade & Revenue	0.42	0.41	1.47	138.47	**0.70**	**46.47**

From Table 14.31 above, the base formula is adjusted as follows:

CuEq14(HERUGA) =

Cu + ((Au x 1,250 x 0.0321507 x 0.911) + (Ag x 20.37 x 0.0321507 x 0.949) + (Mo x 11.9 x 0.0022046 x 0.736) / (3.01 x 22.0462).

14.2.2 Derivation of Cut-off Grades

Cut-off grades were determined using Base Data Template 31 (BDT31) assumptions. The Net Sales Return (NSR) per tonne of ore needs to equal or exceed the production cost of a tonne of ore for the mine to break even or make money.

For the underground mine, the break-even cut-off grade needs to cover the costs of mining, processing, and general and administrative (G&A). A NSR of $15.34/t would be required to cover costs of $8.00 for mining, $5.53 for processing, and $1.81 for G&A. This translates to a CuEq break-even underground cut-off grade of approximately 0.37% CuEq for Hugo North Extension. This cut-off grade has been used for tabulating underground Mineral Resources in this report.

14.2.3 CIM Definition of Reasonable Prospects for Eventual Economic Extraction

2014 Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards require reported Mineral Resources to have reasonable prospects for eventual economic extraction (RPEE). The following sub-sections address the RPEE together with commentary on conceptual mining considerations and other constraints used in tabulating the Mineral Resources.

Constraining 3D shapes were generated by ascribing positive values that defray mining, processing, and G&A costs to blocks that have been assigned to Measured, Indicated, and Inferred Mineral Resource categories.

14.2.3.1 Hugo North Extension and Heruga Resource Constraints

To assess reasonable prospects for eventual economic extraction and to declare underground resources at Hugo North and Hugo North Extension, an underground resource-constraining shape (the RPEE shell) was prepared on vertical sections using economic criteria that would pay for development, block cave mining, ventilation, haulage, hoisting, processing, and G&A costs.

A primary and secondary development cost of $8.00/t and a mining, process, and G&A cost of $12.45/t were used to delineate the RPEE shape cut-off. Using OT LLC's Base Data Template 29 (BDT29) gold price of $970/oz and a revised copper price of $3.00/lb, it was estimated that a 0.50% copper cut-off would return $21.74/t, which would cover the RPEE shape cut-off costs stated above. The RPEE shell was developed in 2012 and has not been updated in 2014. The infrastructure built for Hugo North Lift 1 would provide synergies for lower capital intensity underground development at subsequent Hugo North panels. Mineral resources within the RPEE shell at Hugo North are reported at a break-even CuEq cut-off grade of 0.37%.

Inferred Mineral Resources at Heruga have been constrained only by using a CuEq cut-off of 0.37%.

14.3 Tabulating Mineral Resources

Once the underground constraining shapes were generated, resources were stated for those model cells within the constraining underground stope block shapes that met a given CuEq cut-off grade.

14.3.1 Mineral Resource Confidence Classification

Classification was undertaken using a set of rules based on estimation (OK) passes, distances to nearest composites, and numbers of holes used to inform the cell estimates to establish an initial classification. The initial classification was then assessed and modified with an algorithm designed to eliminate isolated cells of a particular classification by switching them to majority classification of the surrounding cells.

Confidence categories, contained in the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves, were applied to the resource block models.

Mineral Resources were classified based on the criteria outlined in the following sections.

14.3.1.1 Mineral Resource Confidence Classification – Hugo North Extension

Measured Mineral Resources

Recent underground drilling has resulted in sufficient confidence in geological and grade continuity to support Measured Mineral Resources in proximity to underground drillholes. Blocks classified as Measured Mineral Resources have satisfied the following criteria:

- A three-hole rule was used for OK-estimated Cu blocks with three or more composites from three different holes, from three different search octants, all within 50 m and at least one composite within 35 m of the block centroid, all distances from ID2 Pass 1. The distance used is the closest anisotropic distance.

- Blocks were constrained by the Measured classification solid generated using sectional interpretation and block probabilities.

Indicated Mineral Resources

The drillhole spacing over much of the Hugo North and Hugo North Extension area is approximately 125 m x 75 m. The minimum nominal drillhole spacing of 75 m (horizontal) between drillholes and 150 m between drill lines for Indicated Mineral Resources was determined in the course of a study on drillhole spacing conducted in 2004. The following conditions need to be met to classify blocks as Indicated Mineral Resources:

- A three-hole rule was used for OK-estimated Cu blocks not classified as Measured and with three or more composites from three different holes, all within 50 m distance from ID2 Pass 1. The distance used is the closest anisotropic distance.

- A three-hole rule was used for OK-estimated Cu blocks with three or more composites from three different holes, all within 150 m and at least one composite within 105 m of the block centroid, all distances from ID2 Pass 2. The distance used is the closest anisotropic distance.

- A two-hole rule was used for OK-estimated Cu blocks with two or more composites from two different holes, all within 150 m with at least one hole within 75 m of the block centroid, all distances from ID2 Pass 2. The distance used is the closest anisotropic distance.

- Blocks were constrained by the Indicated classification solid generated using sectional interpretation and block probabilities.

Inferred Mineral Resources

All blocks in the Hugo North (including Hugo North Extension) model with an OK-estimated Cu grade that did not meet the classification criteria for Measured or Indicated Mineral Resources were assigned to Inferred Mineral Resources if the block centroid was within 150 m of a composite. The distance used is the closest Cartesian distance captured from Pass 3 of the ID2 estimation.

- Blocks were constrained by the inferred classification solid generated using sectional interpretation and block probabilities.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

14.3.1.2 Mineral Resource Confidence Classification – Heruga

There are no Measured or Indicated Mineral Resources at Heruga.

Inferred Mineral Resources

Interpolated cells were classified as Inferred Mineral Resources if they fell within 150 m of a drillhole composite. All Mineral Resources at Heruga are currently classified as Inferred.

14.4 Mineral Resource Statement

The summary of the EJV Property Mineral Resources is presented in Table 14.32.

Mineral Resources are classified in accordance with the 2014 CIM Definition Standards for Mineral Resources and Mineral Reserves.

The Mineral Resources have various effective dates:

- Hugo North Extension 28 March 2014
- Heruga 30 March 2010

The contained copper, gold, silver, and molybdenum estimates in the Mineral Resource tables have not been adjusted for metallurgical recoveries. However, the differential recoveries were taken into account when calculating the copper equivalency formula explained in Section 14.2.1. The various recovery relationships at Oyu Tolgoi, including the EJV Property, are complex and relate both to grade and Cu : S ratios.

Mineral Resources were also estimated for trace and impurity elements, including arsenic, fluorine, and sulphur, as well as the copper, gold, silver, and molybdenum estimates reported in these tables.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 14.32 EJV Mineral Resources (>0.37% CuEq Cut-off)

Classification	Ownership	Tonnage (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Contained Metal				
								Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)	CuEq (Mlb)
Hugo North Extension (0.37% CuEq Cut-off)												
Measured	EJV	1.2	1.38	0.12	2.77	38.4	1.47	36	4.4	105	0.1	38
Indicated	EJV	128	1.65	0.55	4.12	33.6	1.99	4,663	2,271	16,988	9.5	5,633
Inferred	EJV	179	0.99	0.34	2.68	25.4	1.20	3,887	1,963	15,418	10.0	4,730
Heruga (0.37% CuEq Cut-off)												
Inferred	EJV	1,700	0.39	0.37	1.39	113.2	0.64	14,610	20,428	75,955	424	24,061

1. CuEq is copper-equivalent grade, expressed in percent. Effective date for the Mineral Resources for Hugo North Extension is 28 March 2014.
2. Effective date for the Mineral Resources for Heruga is 30 March 2010.
3. The 0.37% CuEq cut-off is equivalent to the underground Mineral Reserve cut-off as determined by OT LLC.
4. CuEq has been calculated using assumed metal prices ($3.01/lb for copper, $1,250/oz for gold, $20.37/oz for silver, and $11.90/lb for molybdenum).
   a) Hugo North Extension CuEq% = Cu% + ((Au (g/t) x 1,250 x 0.0321507 x 0.913) + (Ag (g/t) x 20.37 x 0.0321507 x 0. 942)) / (3.01 x 22.0462)
   b) Heruga CuEq% = Cu% + ((Au (g/t) x 1,250 x 0.0321507 x 0.911) + (Ag (g/t) x 20.37 x 0.0321507 x 0. 949) + (Mo (ppm) x 11.9 x 0.0022046 x 0.736)) / (3.01 x 22.0462)
5. The contained copper, gold, copper, silver, and molybdenum in the tables have not been adjusted for metallurgical recovery.
6. Totals may not match due to rounding.
7. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
8. The EJV includes a portion of the Shivee Tolgoi licence and the all of Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi licence are held for the EJV by Entrée. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in mineralisation extracted from the EJV Property and OT LLC has an 80% interest.

14.5 Factors That Could Affect the Mineral Resource Estimates

Areas of uncertainty that could materially affect the Mineral Resource estimates include the following:

- Commodity pricing.
- Interpretations of fault geometries.
- Effect of alteration as a control on mineralisation.
- Lithological interpretations on a local scale, including dyke modelling and discrimination of different Qmd phases.
- Geotechnical assumptions related to the proposed block cave design and material behaviour.
- Metal recovery assumptions.
- Dilution considerations.
- Contaminants such as arsenic and fluorine.
- Estimates of operating costs used to support reasonable prospects assessment.
- Changes to drill spacings and number of drillhole composites used to support classification categories.

14.6 Reconciliation with 2013 Mineral Resources

Mineral Resources were last publically reported in the March 2013 Technical Report (LHTR13). A comparison of the LHTR13 and current Mineral Resources is shown in Table 14.33 and Table 14.34.

The Hugo North Extension Measured and Indicated Mineral Resources have decreased by approximately 3.0 Mt, with slight (<0.5%) relative decreases in Cu and Au grades, and an 0.5% relative increase in Au grade, which, in combination, results in a 2% decrease in contained copper, gold, and silver. Relative to the previously reported resources, this represents a decrease of 2.0% CuEq metal in the Measured and Indicated categories.

The Inferred Hugo North Extension Mineral Resource has increased by 45 Mt, with relative increases in Cu, Au, and Ag grade of 6%, 36%, and 10% respectively, resulting in an increase of approximately 47% CuEq metal in the Inferred category.

The Heruga Inferred Mineral Resources have decreased by approximately 124 Mt with a 3.0%–4.0% relative increase in Cu, Au, Ag, and Mo grades, which, in combination, results in a 4% relative decrease in contained copper, gold, silver, and molybdenum. Relative to the previously reported resources, this represents a relative decrease of 10% CuEq metal in the Inferred category.

Table 14.33 EJV Property Mineral Resource Reconciliation, LHTR16 and LHTR13 – Hugo North Extension

Classification	Tonnage (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Contained Metal				
							Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)	CuEq (Mlb)
LHTR16											
Measured	1.2	1.38	0.12	2.77	38.4	1.47	36	4	105	0.1	38
Indicated	128	1.65	0.55	4.12	33.6	1.99	4,663	2,271	16,988	9.5	5,633
Measured + Indicated	*129*	*1.65*	*0.55*	*4.11*	*33.7*	*1.99*	*4,698*	*2,276*	*17,091*	*9.6*	*5,670*
Inferred	179	0.99	0.34	2.68	25.4	1.20	3,887	1,963	15,418	10	4,730
LHTR13											
Measured	–	–	–	–	–	–	–	–	–	–	–
Indicated	132	1.65	0.55	4.09	35.7	2.00	4,800	2,320	17,400	10	5,810
Measured + Indicated	*132*	*1.65*	*0.55*	*4.09*	*35.7*	*2.00*	*4,800*	*2,320*	*17,400*	*10*	*5,810*
Inferred	134	0.93	0.25	2.44	23.6	1.09	2,760	1,080	10,500	7.0	3,230
Absolute Difference (LHTR16 – LHTR13)											
Measured	–	–	–	–	–	–	–	–	–	–	–
Indicated	–4	0.00	0.00	0.03	–2.1	–0.01	–137	–49	–412	–0.9	–177
Measured + Indicated	*–3*	*0.01*	*0.00*	*0.06*	*–1.7*	*0.01*	*–102*	*–44*	*–309*	*–0.8*	*–140*
Inferred	45	0.06	0.09	0.24	1.8	0.11	1,127	883	4,918	3.0	1,500
Percentage Difference (LHTR16/LHTR13)											
Measured	–	–	–	–	–	–	–	–	–	–	–
Indicated	–3%	0%	0%	1%	–6%	0%	–3%	–2%	–2%	–9%	–3%
Measured + Indicated	*–2%*	*1%*	*0%*	*1%*	*–5%*	*0%*	*–2%*	*–2%*	*–2%*	*–8%*	*–2%*
Inferred	34%	6%	36%	10%	8%	10%	41%	82%	47%	43%	46%

Table 14.34 EJV Property Mineral Resource Reconciliation, LHTR16 and LHTR13 – Heruga

Classification	Tonnage (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Mo (ppm)	CuEq (%)	Contained Metal				
							Cu (Mlb)	Au (koz)	Ag (koz)	Mo (Mlb)	CuEq (Mlb)
LHTR16											
Inferred	1,700	0.39	0.37	1.39	113.2	0.64	14,610	20,428	75,955	424	24,061
LHTR13											
Inferred	1,824	0.38	0.36	1.35	110.4	0.67	15,190	21,200	79,400	444	26,850
Absolute Difference (LHTR16 – LHTR13)											
Inferred	–124	0.01	0.01	0.04	2.8	–0.03	–580	–772	–3,445	–19	–2,789
Percentage Difference (LHTR16/LHTR13)											
Inferred	–7%	3%	4%	3%	3%	–4%	–4%	–4%	–4%	–4%	–10%

15 MINERAL RESERVE ESTIMATES

The EJV Property Mineral Reserve is contained within the Hugo North Extension Block Cave Lift 1. The mine design work on Hugo North Lift 1 was prepared by OT LLC and was used as the basis for the 2014 Hugo North Underground Mineral Reserve. OreWin has agreed with this conclusion and has reported the results for the 2014 Hugo North Extension Mineral Reserve estimatein LHTR16.

Mineral Reserves were last publically reported in the LHTR13 Technical Report March 2013. The EJV Mineral Reserve is shown in Table 15.1. A reconciliation of the LHTR13 and LHTR16 Mineral Reserve is shown in Table 15.2.

The LHTR16 Mineral Reserve only considers Mineral Resources in the Indicated category, and engineering that has been carried out to a feasibility level or better to state the underground Mineral Reserve. There is no Measured Resource in the Hugo North Mineral Resource. Copper and gold grades on Inferred Resources within the block cave shell were set to zero and such material was assumed to be dilution. The block cave shell was defined by a $15/t NSR. Further mine planning will examine lower shut-offs. The Hugo North Mineral Reserve is on both the OT LLC Oyu Tolgoi licence and the EJV Shivee Tolgoi licence (Hugo North Extension).

Table 15.1 EJV Mineral Reserve, 20 September 2014

Classification	Ore (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Copper (Mlb)	Gold (koz)	Silver (koz)
Proven	–	–	–	–	–	–	–
Probable	35	1.59	0.55	3.72	1,121	519	3,591
Total EJV	**35**	**1.59**	**0.55**	**3.72**	**1,121**	**519**	**3,591**

1. Metal prices used for calculating the Hugo North underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work. The analysis indicates that the mineral reserve is still valid at these metal prices.
2. The NSR has been calculated with assumptions for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
3. The block cave shell was defined using a NSR cut-off of $15/t NSR.
4. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
5. Only Measured mineral resources were used to report Proven mineral reserves and only Indicated mineral resources were used to report Probable mineral reserves.
6. EJV is the Entrée–OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant license and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
7. The base case financial analysis has been prepared using the following current long term metal price estimates: copper at $2.87/lb; gold at $1,350/oz; and silver at $23.50/oz. Metal prices are assumed to fall from current prices to the long term average over five years.
8. The mineral reserves reported above are not additive to the mineral resources.

Table 15.2 LHTR16 and LHTR13 Probable Mineral Reserve Comparison

Estimate	Ore (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Copper (Mlb)	Gold (koz)	Silver (koz)
LHTR16	35	1.59	0.55	3.72	1,121	519	3,591
LHTR13	31	1.73	0.62	3.74	1,090	521	3,229
Difference	**4**	**–0.14**	**–0.07**	**–0.02**	**31**	**–2**	**361**
Difference (%)	**11.7%**	**–8.1%**	**–11.3%**	**–0.6%**	**2.8%**	**–0.4%**	**11.2%**

1. LHTR13 Mineral Reserves have the effective date 25 March 2013.
2. LHTR16 Mineral Reserves have the effective date 20 September 2014.
3. Metal prices used for calculating the LHTR16 Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work.
4. Metal prices used for calculating the LHTR13 Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $2.81/lb; gold at $970/oz; and silver at $15.50/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work.
5. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
6. For both the LHTR13 and LHTR16 the block cave shell was defined using a NSR cut-off of $15/t NSR.
7. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
8. Only Indicated mineral resources were used to report Probable mineral reserves.
9. EJV is the Entrée–OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
10. The mineral reserves reported above are not additive to the mineral resources.

The Hugo Dummett underground deposit (including Hugo North Extension) will be mined by block caving, a safe, highly productive, cost-effective method. The deposit is comparable in dimension and tonnage to other deposits currently operating by block cave mining elsewhere in the world. The mine planning work has been prepared using industry standard mining software, assumed metal prices as described above and smelter terms as set forth in the 2014 OTTR.

To ensure that Inferred Resources do not become included in the Mineral Reserve estimate, copper and gold grades on Inferred Resources within the block cave shell were set to zero and such material was assumed to be dilution. The block cave shell was defined by a $15/t NSR, further mine planning will examine lower cut-offs. The Hugo North Mineral Reserve is on both the OT LLC Oyu Tolgoi licence and the EJV Shivee Tolgoi licence (Hugo North Extension).

15.1 Key Mining Assumptions

The Mineral Reserves were estimated by OreWin. Key assumptions are summarised below and other assumptions are documented in LHTR16:

- Metal prices used for calculating the Hugo North Underground NSR are copper $3.01/lb, gold $1,250/oz, and silver $20.37/oz based on long term metal price forecasts at the beginning of the Mineral Reserve work. The analysis indicates that the Mineral Reserve is still valid at these metal prices.
- The NSR has been calculated with assumptions for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
- For the underground a footprint cut-off of $15/t NSR and column height shut-off of $15/t NSR to maintain grade and productive capacity.
- For the underground block cave, all Mineral Resource within the shell has been converted to Mineral Reserve. This includes low grade Indicated Mineral Resource and Inferred Mineral Resource assigned zero grade treated as dilution.
- The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant license and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
- The Mineral Reserves are not additive to the Mineral Resources.
- The underground Mineral Resource block models used for reporting the Mineral Reserves are the models reported in the Mineral Resource section of the 2014 OTTR.
- Only Indicated Mineral Resources have been converted to Mineral Reserves.
- The processing schedule philosophy adopted for the mine planning work assumes feeding the open pit ore into the plant at an elevated cut-off grade and stockpiling low grade material for later treatment. This philosophy provides some insulation against metal price cycles and reduces the risk that the Mineral Reserve size is overestimated.

15.1.1 US SEC Industry Guide 7

The Mineral Reserve reported for NI 43-101 is also applicable for reporting the Ore Reserve under the US SEC Industry Guide 7. OreWin estimated the Oyu Tolgoi Mineral Reserves for the NI 43-101 compliant LHTR16 which is based on feasibility level work. The definitions of the Mineral Reserve classifications under NI 43-101 are the 2014 Canadian Institute of Mining (CIM) Definition Standards – For Mineral Resources and Mineral Reserves, Prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council on 10 May 2014.

After consideration of guidelines and other information regarding the declaration of Reserves for the United States Securities and Exchange Commission (US SEC) reporting, OreWin considers that the LHTR16 is suitable for declaring a Reserve as defined in US Industry Guide 7.

Documentation underlying Mineral Reserves determined in accordance with Industry Guide 7 generally includes the following:

- A "final" feasibility study.
- Utilisation of the historic 3 year average price for the commodity that expected to be mined in determining economic viability.
- Primary environmental analysis has been submitted to government authorities.

15.1.2 Bankable Study

OT LLC is in an advanced stage of project financing with a core lending group of financiers approving a $4.4 billion project-finance facility. In December 2015, the companies announced that Oyu Tolgoi had an identified debt capacity of $6 billion and that terms for a project finance facility of $4.4 billion to develop the underground mine had been agreed between the companies and lenders. The syndicate of lenders included a number of Government supported international financial institutions (International Finance Corporation, European Bank for Reconstruction and Development, Export Development Canada) and 15 commercial banks with political risk insurance provided by the Multilateral Investment Guarantee Agency (MIGA). The financing was disclosed with an all-in finance cost of LIBOR plus 6%.

Terms for the project financing have been approved by the OT LLC Board of Directors which includes representatives from the GOM and drawdown is subject only to the issue of a final Notice to Proceed from the boards of OT LLC, Turquoise Hill Resources Ltd and Rio Tinto PLC. OreWin therefore considered it reasonable to conclude that the bankable study test in US SEC Industry Guide 7 has been met.

15.1.3 Test Price for Commodities

The base case financial analysis has been prepared using current long term metal price estimates of:

- Copper $3.08/lb
- Gold $1,304/oz
- Silver $21.46/oz

The SME Guide Section 53 describes how the Test Price for commodities should be applied.

> "If a Mineral Reserve is reported using a price lower than the test price, the forward-looking discounted cash flow must be positive, and the Reserve Sensitivity Test (based on an undiscounted cash flow) need not be performed. When applicable, a statement should be made that a Reserves Sensitivity Test was completed, or that such a test was not applicable."

The metal prices for the previous three years, the average and the metal prices used for the Mineral Reserve estimates are shown in Table 15.3. The sensitivity analysis using the 3-year averages shows the Entrée after-tax NPV8 of $100 M compared to the base case $106 M. The results are reduced compared to the base case financial analysis, as the average prices are lower than the LHTR16 base case prices. This indicates that the Mineral Reserve is still valid at the 3-year average prices.

Table 15.3 Metal Price Summary

Year Ended	Cu ($/lb)	Au ($/oz)	Ag ($/oz)
2013	3.34	1,411	23.79
2014	3.10	1,266	19.08
2015	2.49	1,160	15.66
Average	2.98	1,279	19.51
Reserve NSR	3.01	1,250	20.37
Base Case Financial Analysis	3.08	1,304	21.46

15.1.4 Primary Environmental Analysis Submission

The 2007 SME Guide Section 56 describes how the permitting and legal requirements of US SEC Industry Guideline 7 should be applied. It indicates that:

> "To demonstrate reasonable expectation that all permits, ancillary rights and authorisations can be obtained, the reporting entity must show understanding of the procedures to be followed to obtain such permits, ancillary rights and authorisations. Demonstrating earlier success in getting the necessary permits can be used to document the likelihood of success."

Based on the understanding of the procedures and the history of permitting, it is considered reasonable to assume that the final environmental permitting will be granted without resulting in a change to the Reserve.

OT LLC has completed a comprehensive Environmental and Social Impact Assessment (ESIA) for the Oyu Tolgoi project (including the EJV Property). The culmination of nearly 10 years of independent work and research carried out by both international and Mongolian experts, the ESIA identifies and assesses the potential environmental and social impacts of the project, including cumulative impacts, focusing on key areas such as biodiversity, water resources, cultural heritage, and resettlement.

The ESIA also sets out measures through all project phases to avoid, minimize, mitigate, and manage potential adverse impacts to acceptable levels established by Mongolian regulatory requirements and good international industry practice, as defined by the requirements of the Equator Principles, and the standards and policies of the International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), and other financing institutions.

Corporate commitment to sound environmental and social planning for the project is based on two important policies: TRQ's Statement of Values and Responsibilities (March 2010), which declares its support for human rights, social justice, and sound environmental management, including the United Nations Universal Declaration of Human Rights (1948); and The Way We Work 2009, Rio Tinto's Global Code of Business Conduct that defines the way Rio Tinto manages the economic, social, and environmental challenges of its global operations.

OT LLC has commenced the development and implementation of an environmental management system (EMS) that conforms to the requirements of ISO 14001:2004. Implementation of the EMS during the construction phases will focus on the environmental policy; significant environmental aspects and impacts and their risk prioritisation; legal and other requirements; environmental performance objectives and targets; environmental management programs; and environmental incident reporting. The EMS for operations will consist of detailed plans to control the environmental and social management aspects of all project activities following the commencement of commercial production in 2013. The Oyu Tolgoi ESIA builds upon an extensive body of studies and reports, and Detailed Environmental Impact Assessments (DEIAs) that have been prepared for project design and development purposes, and for Mongolian approvals under the following laws:

- The Environmental Protection Law (1995)
- The Law on Environmental Impact Assessment (1998, amended in 2001)
- The Minerals Law (2006)

These initial studies, reports and DEIAs were prepared over a six-year period between 2002 and 2008, primarily by the Mongolian firm Eco-Trade LLC, with input from RPS Aquaterra on water issues.

The original DEIAs provided baseline information for both social and environmental issues. These DEIAs covered impact assessments for different project areas, and were prepared as separate components to facilitate technical review as requested by the GOM.

The original DEIAs were in accordance with Mongolian standards and while they incorporated World Bank and IFC guidelines, they were not intended to comprehensively address overarching IFC policies such as the IFC Policy on Social and Environmental Sustainability, or the EBRD Environmental and Social Policy.

Following submission and approval of the initial DEIAs, the Mongolian Government requested that OT LLC prepare an updated, comprehensive ESIA whereby the discussion of impacts and mitigation measures was project-wide and based on the latest project design. The ESIA was also to address social issues, meet Mongolian government (legal) requirements, and comply with current IFC good practice.

For the ESIA the baseline information from the original DEIAs was updated with recent monitoring and survey data. In addition, a social analysis was completed through the commissioning of a Socio-Economic Baseline Study and the preparation of a Social Impact Assessment (SIA) for the project. The requested ESIA, completed in 2012, combines the DEIAs, the project SIA, and other studies and activities that have been prepared and undertaken by and for OT LLC.

16 MINING METHODS

16.1 Mining - Overview

The LHTR16 Reserve Case assumes processing of 1.5 billion tonnes of ore, mined from OT LLC's SOT Open Pit and Lift 1 in Hugo North (including Hugo North Extension) underground block cave. The mining areas included in the LHTR16 Reserve Case are shown schematically in Figure 16.1.

Figure 16.1 LHTR16 Reserve Case Mining Areas

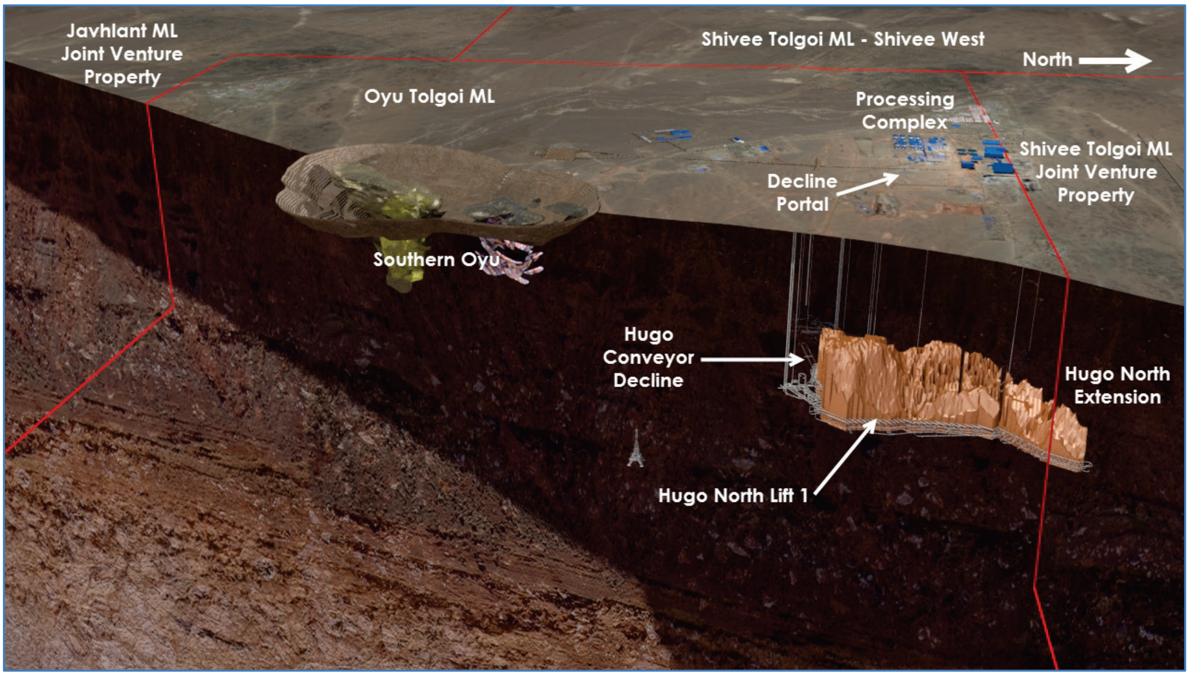


Figure by OreWin 2014

OT LLC prepared the open pit study work used for the 2014 OTTR. The open pit is on the Southern Oyu deposit on the Oyu Tolgoi licence and supports the open pit Mineral Reserve.

16.2 Mine Designs Summary

Oyu Tolgoi, including the EJV Property, hosts four main semi-contiguous, surface and underground porphyry copper–gold deposits (Hugo North, Hugo South, SOT, and Heruga – from north to south) along a 12 km north–north-east trending belt. Mineral reserves and resources estimated on these deposits form the basis of future project development. The deposits are located both on the Oyu Tolgoi ML and on the adjacent EJV Property, but the EJV deposits will be developed, operated and processed by OT LLC under the terms of the Entrée–OT LLC Joint Venture. This provides the operator with flexibility in studying alternative paths for mine development to match future economic conditions and actual mine performance.

Underground mining at Oyu Tolgoi, including the EJV Property, is planned to be by panel caving which is a variation of block caving. The weak, massive nature of the Hugo North and Hugo North Extension deposits and their location between 700 m and 1,400 m below surface make them well suited both geotechnically and economically to the large-scale caving method of underground mining. Caving requires a large early capital investment but is highly productive and has low operating costs. The long operating life of the mine supports this initial capital investment.

The mine design consists of 203 km of lateral development, five shafts, and two decline tunnels from surface. Five shafts are required to provide access for mining personnel and equipment, for production, and for intake and exhaust ventilation-ways. The primary life-of-mine material handling system will transport material to surface by a series of conveyors to surface. The underground mine will operate at a nominal 95 ktpd. An overview of Lift 1 is shown in Figure 16.2. Table 16.1 show the approximate dimensions of Lift 1. Table 16.2 outlines the development quantities.

Hugo North (including Hugo North Extension) Lift 1 will use the panel caving method to extract ore, which will be transported through a shaft hoist and conveyor to a surface material handling system. The Hugo North Lift 1 mining levels are approximately 1,300 m below surface. The entire Hugo North Lift 1 cave has average dimensions of 2,000 m long, 280 m wide and 600 m hgh.

Figure 16.2 Hugo North (including Hugo North Extension) Lift 1 Mine Design

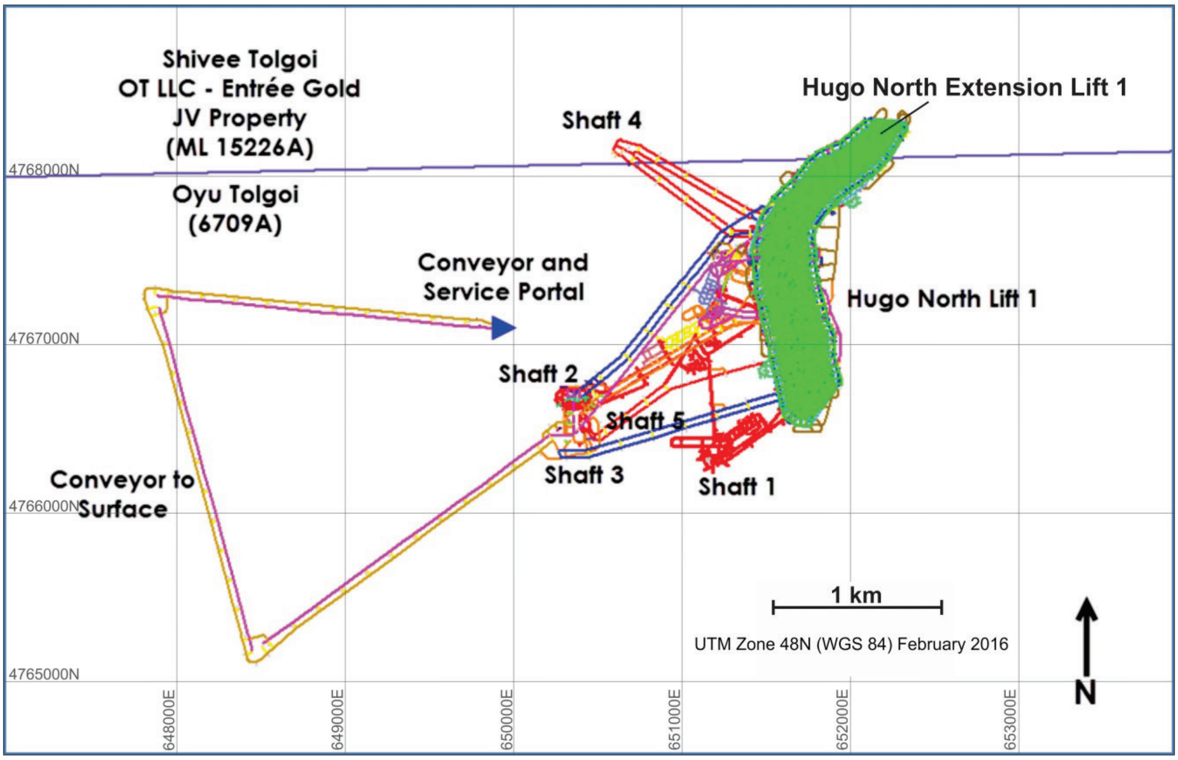


Figure by OT LLC modified by Entrée 2014

Table 16.1 Hugo North (including Hugo North Extension) Cave Dimensions

Cave	Extraction Level		Length (m)	Width (m)	Height (m)
	Above Sea Level (m)	Below Surface (m)			
Lift 1	-100	1,270	2,000	280	600

Table 16.2 Hugo North (including Hugo North Extension) Lift 1 Development

Lateral Development		Vertical Development and Mass Excavation		
Area	**Metres**	**Area**	**Unit**	**Value**
Complete Development (as-built)	15,747	Shaft Development	m	6,144
General Access & Facilities	7,104	–	–	–
Apex and Undercut Level	52,530	Raises 2.0–6.0 m diameter	m	6,807
Extraction Level	59,542	Bins 10.8 m diameter	m	93
Haulage Level	15,998	Mass Excavation for Facilities	m^3	60,077
Intake Drives	17,018	Handling Excavations	m^3	76,760
Exhaust Drives	16,168	–	–	–
Conveyor	18,916	–	–	–
Total Lateral Development	**203,023**	–	–	–

The caving design has the following key development features:

- Access Development
- Apex and Undercut Level
- Extraction Level
- Haulage Level
- Intake Ventilation Level
- Exhaust Ventilation Level
- Crusher and Conveying Levels
- Passes and Ventilation Raises

The levels to be developed to support Hugo North (including Hugo North Extension) Lift 1 are shown in Figure 16.3. A cross section through the production footprint is shown in Figure 16.4. The mine footprints are to be divided into mining panels. The panel division allows the apex, undercut and extraction drives to be oriented to optimise the undercut face length. It also allows alignment to major fault structures and principle stress as the deposit dimension changes along strike.

Figure 16.3. Summary of Mine Design Elements – Hugo North Lift 1

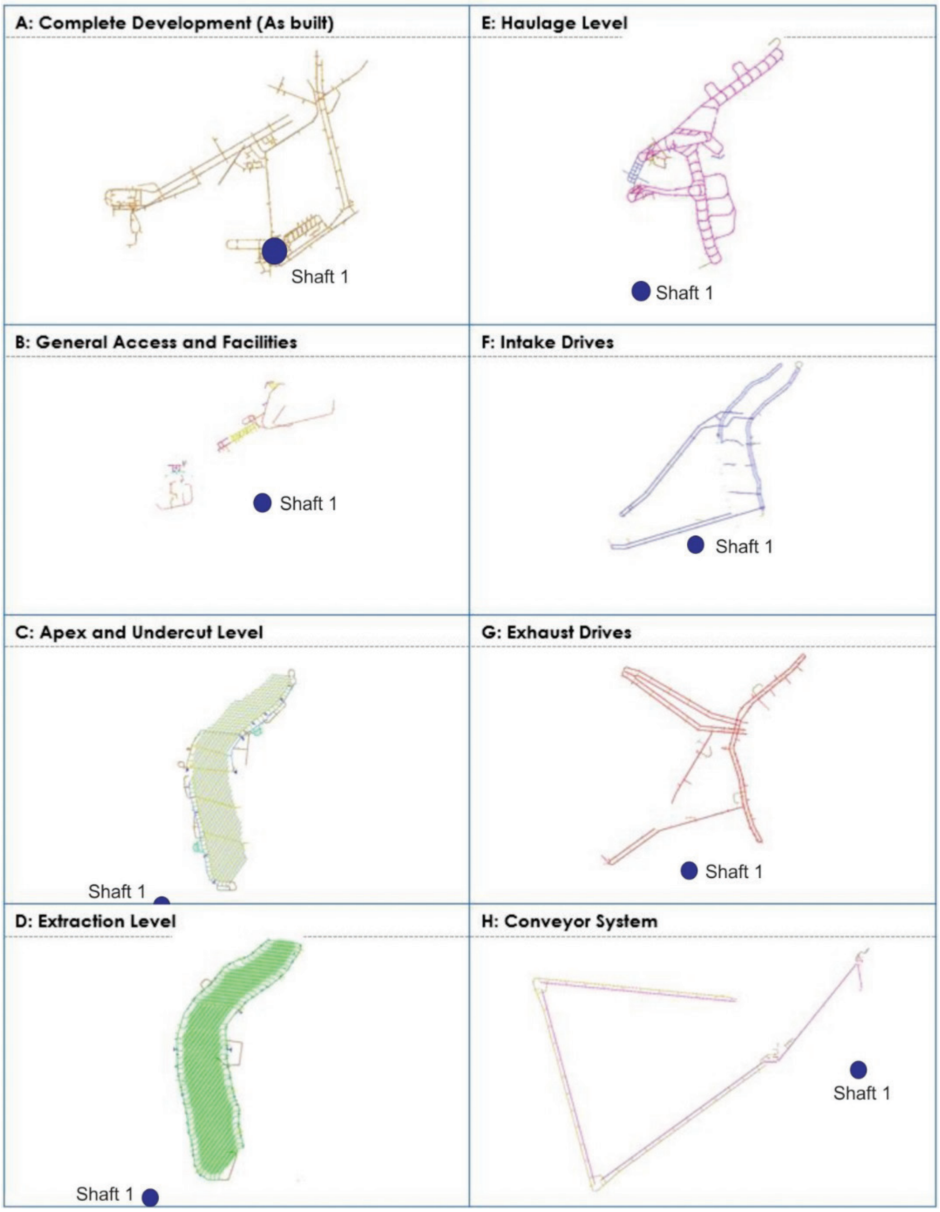


Figure by OT LLC modified by Entrée 2014

Figure 16.4 Cross Section through Production Levels

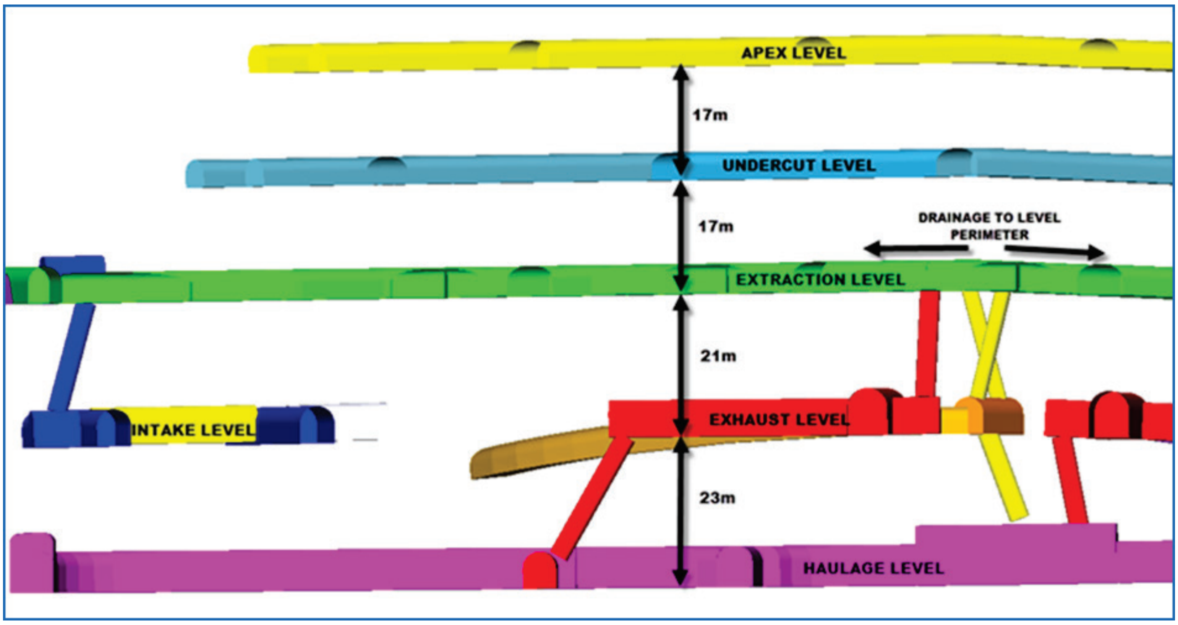


Figure by OT LLC 2014

16.3 Underground Geotechnical

Hugo North (including Hugo North Extension) is considered to be highly suitable for the caving method of mining. Three caveability assessments were undertaken for OTFS14 using the Laubscher Modified Rock Mass Rating (MRMR) rock mass classification system, the Mathews extended stability chart, and Flac 3D numerical modelling. The risks associated with caveability and propagation are considered to be low. High stress conditions, a highly fractured rock mass, and a large caving footprint are key factors. Surface subsidence analysis does not raise any concern for surface infrastructure in place or planned.

Fragmentation analysis illustrates fine fragmentation with all geotechnical domains. Secondary breaking requirements are not expected to pose a risk to production schedule ramp-up or full production rates.

Predicted abutment stresses are considered to be high, and focus has been placed on optimising mine design and ground support to manage excavation stability.

16.3.1 Subsidence

Predicted abutment stresses are considered to be high, and OT LLC plans to focus on optimising the mine design and ground support to manage excavation stability. The predicted fracture limits (determined as the point of having a notable impact on key infrastructure such as hoisting shafts) by the end of mining Hugo North (including Hugo North Extension) Lift 1 are shown by the red outline in Figure 16.5. A fence will be constructed 100 m outside this red outline to restrict access. The subsidence angles are predicted to be nearly vertical at the northern and southern limits of the cave, where confinement is highest, and are approximately 55° in the east and west, where confinement is lowest. All shafts and permanent infrastructure are planned to be situated outside the predicted fracture limits.

Figure 16.5 Cave Subsidence Predictions

Original figure by OT LLC modified by Entree. Fracture limits = thick red line

Shaft 1, at the south end of the subsidence zone, is closest to the fracture limits. Shaft 1 will be used as a hoisting shaft until the Shaft 2 loadout and primary crusher are commissioned by early-2019. Thereafter the primary function of Shaft 1 is for intake ventilation. This provides additional contingency against an unexpectedly larger cave subsidence damage area, as a bald concrete lined shaft can withstand higher ground movement than a shaft reliant on the close tolerances of operating hoisting infrastructure.

16.3.2 Rock Mechanics

The OTFS14 drilling programme, which concentrated on the cave initiation area and the first four years of production ramp-up, provided critical characterisation data and confirmed that the Hugo North orebody is highly faulted and sheared. In situ stress measurements estimated at the extraction horizon are high: $\sigma1$ = 58 MPa (sub-horizontal with a dip direction of 055°), $\sigma2$ = 33 MPa (sub-horizontal with a dip direction of 145°), and $\sigma3$ = 27 MPa (sub-vertical). An analysis of geotechnical domain data confirmed that a lithology basis for domain assignment remains valid. Laubscher rock mass rating (RMR) values for the different lithologies vary between 43 and 53.

Stress orientations have been calculated, with the sub-horizontal major principal stress bearing towards 055°. The in situ stress regime, summarised in Table 16.3, represents the latest version from the geotechnical assessment in the study.

The rock mass strengths of the orebody units were divided by a range of mining stress levels as predicted from the cave-scale modelling: isolated drifts under in situ stresses (60 MPa), average abutment stresses (80 MPa), and high abutment stresses (100 MPa). Results indicated that closure strains up to 5.0% were possible from high abutment stress loading on the extraction and undercut levels.

Table 16.3 In Situ Stress Regime

	Depth Range (m)	σ_1 (MPa)	σ_2 (MPa)	σ_3 (MPa)
Linear	0-1,330	0.049z	0.028z	0.022z
Domain 1	0-600	0.047z	0.031z	0.024z
Domain 2	600-800	0.071z – 13.95	0.012z + 11.08	0.027z – 1.59
Domain 3	>800	0.031z + 17.50	0.026z – 0.33	0.015z + 7.66

Note: z = depth below surface.

16.3.3 Caveability and Fragmentation

The Hugo North orebody is a highly jointed rock mass classed as fair to poor. The rock mass of MRMR 40–45 is caveable at HR >20–23, or at approximate dimensions of 80 m x 80 m to 100 m x 100 m. Other key points from the analysis include:

- Major faulting will significantly influence caving and should promote cave propagation.
- Stress caving is likely to dominate the cave propagation.

The rock mass is caveable, with a predicted critical hydraulic radius of approximately 20–23 m to sustain continuous caving for median rock mass conditions.

16.3.4 Ground Control and Support Regimes

Different support regimes are proposed as a function of the anticipated ground conditions and induced stress regimes that may be encountered during the development and operation of the Hugo North (including Hugo North Extension) Lift 1 cave.

Two main support categories are specified for heading profiles, relating to 'Good' ground (Rock Mass Rating) and 'Poor' ground. For on-footprint development, 80% of the ground is classified as Good and 20% as Poor. For off-footprint development, 90% of the ground is classified as Good and 10% as Poor. A review of geotechnical conditions for on-footprint development carried out late in the OTFS14 programme indicated that a split of 60% Good ground and 40% Poor ground may be more representative. The costing of the underground has used the 60% Good ground and 40% Poor ground assumption.

The following ground support elements are included in all ground support designs:

- Fibre-reinforced shotcrete between 50–100 mm thickness, having a minimum UCS of 20 Mpa in 72 hours; 30 Mpa in seven days; and 40 Mpa in 28 days.

- Rock bolts 25 mm diameter, threaded, fully encapsulated resin-grouted thread bars with a minimum yield strength of 200 kN. All rock bolts will have a standard bearing and domed face plates. The minimum bolt length is 2.4 m.

- Cable bolts installed at all intersections will be 18 mm and 22 mm single-strand cables with a minimum yield strength of 331 kN and 510 kN, respectively, installed with a high-tensile domed face plate. For zones of high deformations such as on footprint or strainburst-prone rock masses, cables are to be installed with a two metre debonded section at the collar and pre-tensioned to 10 t. Cable bolts are also installed in any drive profile greater than 6.0 m wide.

- The ground support for all major excavations (namely the crusher chambers, bins, etc.) have been designed to minimise the deformations predicted by the modelling and to avoid any later rehabilitation, which will be extremely difficult to undertake due to either construction or production activities.

The ground support recommendations proposed are based on the anticipated average ground conditions and stress regime; hence, these are minimum support requirements and additional ground support may be required where the conditions demand. Additional ground support elements include:

- An additional shotcrete layer from floor to floor will be applied for poor ground classification and for extraction-level and haulage-level drives for added support and to embed mesh layer.

- Debonded cable bolts will be installed in high-stress areas such as extraction drives and haulage drives.

- A yielding rock bolt, diamond / chain mesh, and debonded cable bolt installation is proposed for the strain prone zones.

- Strapping on the extraction level, installed around pillar ribs including bullnoses and camel backs, will be the OSRO / Cable strap design.

- Steel will be installed in each drawpoint on the extraction level to support drawpoint drive and brow area.

- Underground development support recommendations have been standardised for all heading types and ground conditions.

The proposed cave monitoring system includes a micro-seismic system, Time Domain Reflectometers (TDR), extensometers, and open drillholes. Cave flow monitoring systems comprise markers and trackers installed primarily down surface drillholes. These systems are safeguards against potential hazards and increase the understanding of cave flow for adjusting draw strategy to optimise recovery.

Three caveability assessments were undertaken for OTFS14 using the Laubscher Modified Rock Mass Rating (MRMR) rock mass classification system, the Mathews extended stability chart, and Flac 3D numerical modelling. OT LLC concluded that the risks associated with caveability and propagation are low; high stress conditions, a highly fractured rock mass, and a large caving footprint are key factors that will require management attention, and that surface subsidence analysis does not raise any concern for surface infrastructure in place or planned.

The OTFS14 fragmentation analysis indicated fine fragmentation within geotechnical domains such that secondary breaking requirements are not expected to pose a risk to production schedule ramp-up or full production rates.

16.4 Mining Layout

To manage the risk of drive and pillar damage from high abutment stresses and the highly fractured orebody, the footprint design has been divided into three production panels (Panels 0, 1 and 2). Hugo North Extension is located within Panel 1. The footprint layout is shown in Figure 16.6.

Figure 16.6 Hugo North Lift 1 Footprint Layout

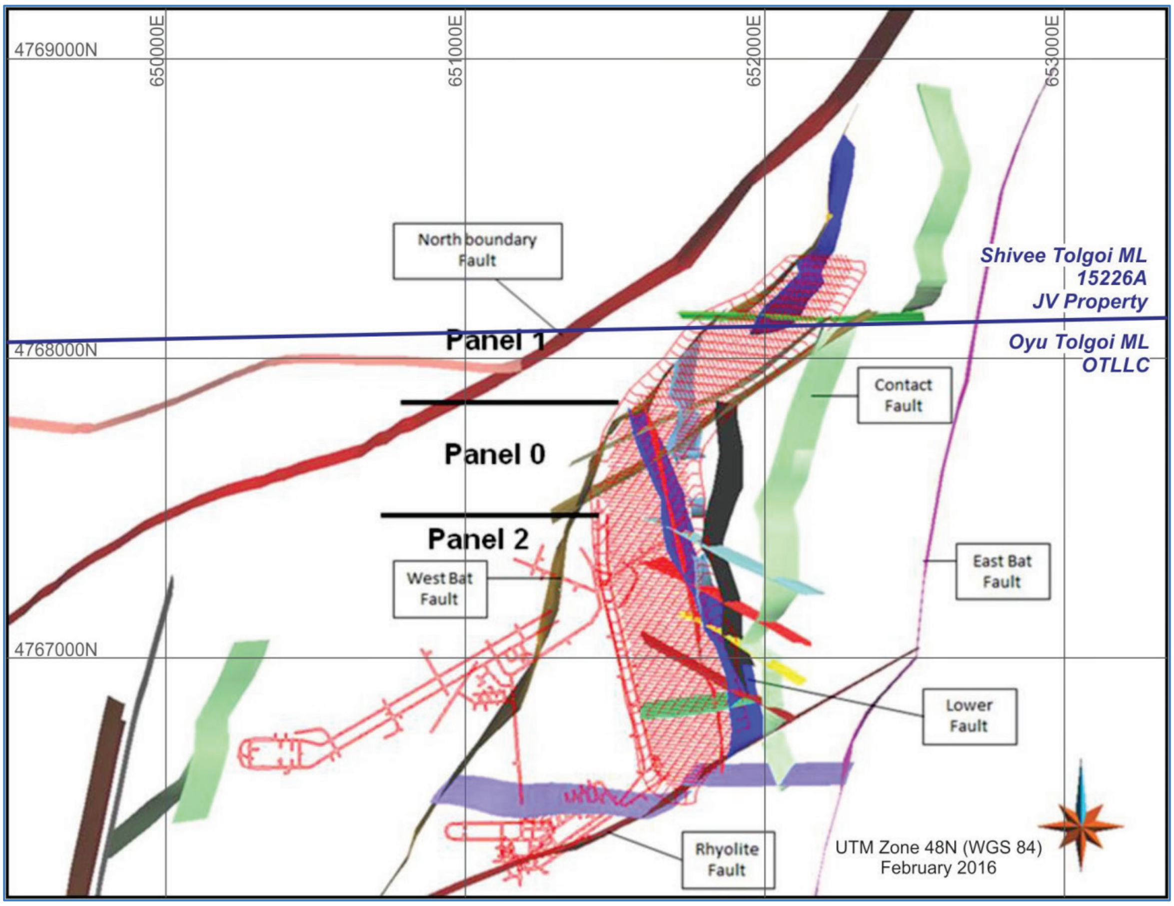


Figure by OT LLC

The Hugo North Lift 1 design was influenced by the following key geotechnical criteria:

<u>Principal Stress</u>:

- Undercut face perpendicular or sub-perpendicular to principal stress direction of 055° strike: This provides lower stress conditions immediately in front of the undercut face, and, coupled with drive pillars parallel to principal stress as mentioned above, provides highest stability.

- Extraction drives parallel or sub-parallel (±20°) to principal stress direction of 055° strike: This provides best use of the clamping forces from the high horizontal stress on the major apex to improve pillar stability. It also improves the development quality and advance rate of extraction panel drives, undercut drill drives, and apex inspection drives.

Structure:

- Undercut face intersecting major structure at an angle, not parallel, to structure: A key structure in the central and southern areas of the footprint is the north–south trending Lower Fault. Key structures in the northern area of the footprint are the H Fault, trending north-east–south-west, and other similar faults parallel to the West Bat and Contact faults, which are major deposit bounding faults.

- Extraction drives intersecting major structure at an angle, not parallel, to major structure. This provides best conditions for development quality and advance rate, along with long-term stability of key development openings.

Undercut Stability:

- Undercut length under 350 m: Longer undercut faces increase the number of active undercut drives that are required to operate in series, increasing the risk of one undercut drive delaying the retreat of the undercut face. Additional active undercut drives add complexity and congestion. Long undercut faces are considered to aid in concentration of undercut stresses near the centre of the undercut face.

- Undercut rate of retreat greater than 80 mpa, or 7.0 m per month, as measured along the undercut drill drive: Slower undercut retreat rates increase the time dependent stress deterioration along the zone in front of the undercut face, in particular the half blasted pillar area that establishes the undercut lead-lag.

- Undercut lead-lag of 10 m (±1) undercut blast (2.5 m): Larger lead-lags increase the half-blasted pillar area in front of the undercut face, increasing the risk of ground damage and collapse.

- Implementation of the Wide W undercut design with apex level: The Wide W design increases the volume of undercut pillar and major apex pillar, improving pillar and drive stability. The apex level, elevated above the undercut level with drives located along the peak of the major apex pillar, provides several benefits, including improved ability to inspect undercut blasts, swell void for the toe area of undercut blast rings, a platform for monitoring the undercut amount of swell mucking, and an additional platform for remedial drilling of unblasted stubs. These operational benefits decrease the risk of undercut delay causing stress loading and potential damage and collapse.

To implement the design criteria over the Hugo North Lift 1 footprint, a three-panel approach was adopted. This approach includes two panel boundaries. The northern panel boundary between Panel 0 and Panel 1 changes in undercut orientation and development drive orientation, as illustrated in Figure 16.7. The panel interfaces are not ideal, but are considered manageable and have often been used at several operations in the past. These boundaries are in isolated areas and are a lesser problem than ongoing issues with long undercut faces and slow-moving caves.

Figure 16.7 Illustration of Panel 0 and Panel 1 Boundary

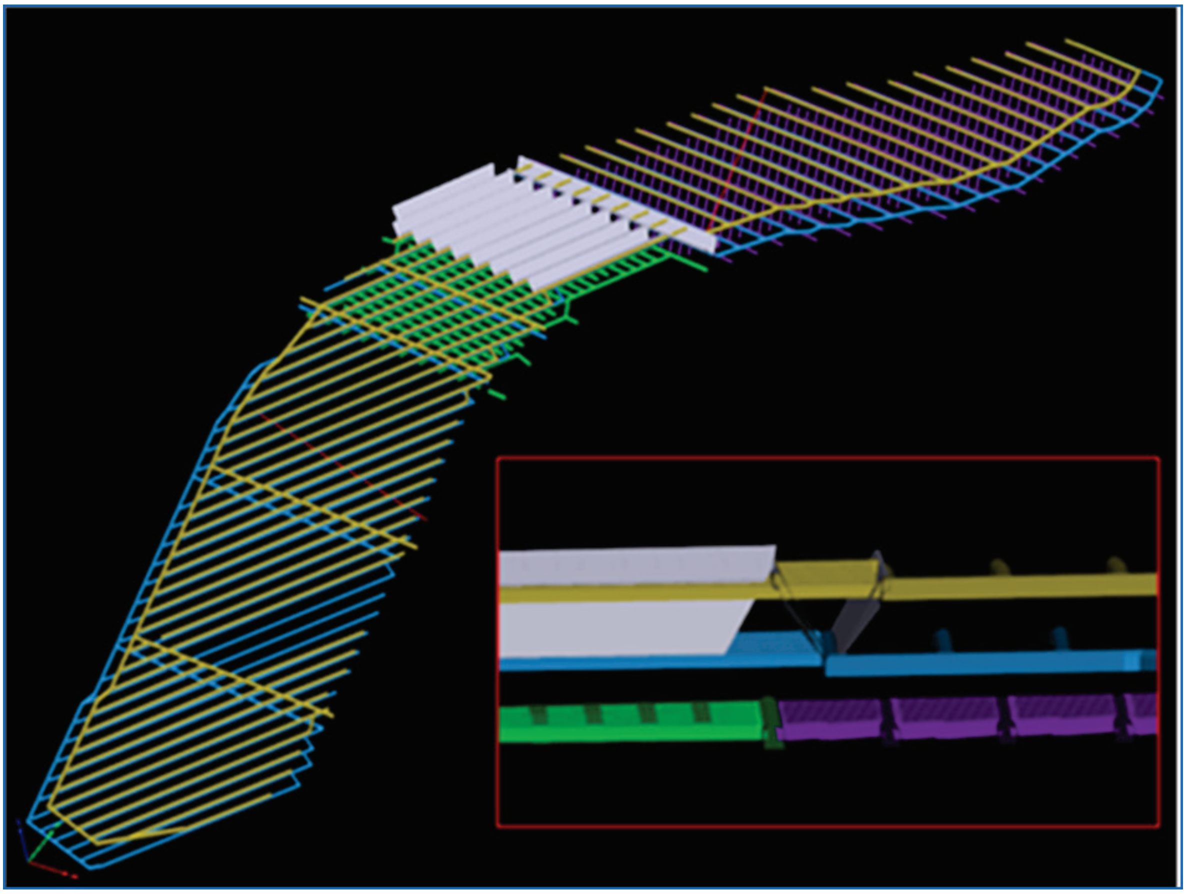


Figure by OT LLC.

Undercut pillars next to the advancing cave front are likely to experience vertical stresses on the order of 45 Mpa. Sigma 1 comes into the undercut face in a horizontal direction from a bearing of 055° (normal to the cave front) and angles down through the undercut pillars at up to 110 Mpa, then reduced to in situ levels two or three pillars (30–45 m) behind the undercut front. These stresses result in high modelled closure strains (up to 5.0%) immediately at the undercut front and lower strains (2.0%–5.0%) behind the undercut face.

Figure 16.8 and Figure 16.9 illustrate the undercut blasting area and cave front. The 10 m lead-lag shown between adjacent undercut drives to manage stress build-up near the undercut face results in an undercut face orientated at 70° to the undercut and extraction drive. The minimum undercut retreat rate (along an undercut drive) will be 7.0 m per month to prevent stress build-up and management of time-dependent ground deterioration.

The 4.0 m wide x 4.2 m high undercut drives spaced every 28 m are considered to be supportable and adequate. Apex inspection drives, located 17 m above the undercut level and spaced every 28 m, are situated along the peak of the major apex pillars and are considered important in managing successful undercutting activities.

Figure 16.8 Cave Section along Extraction Drift

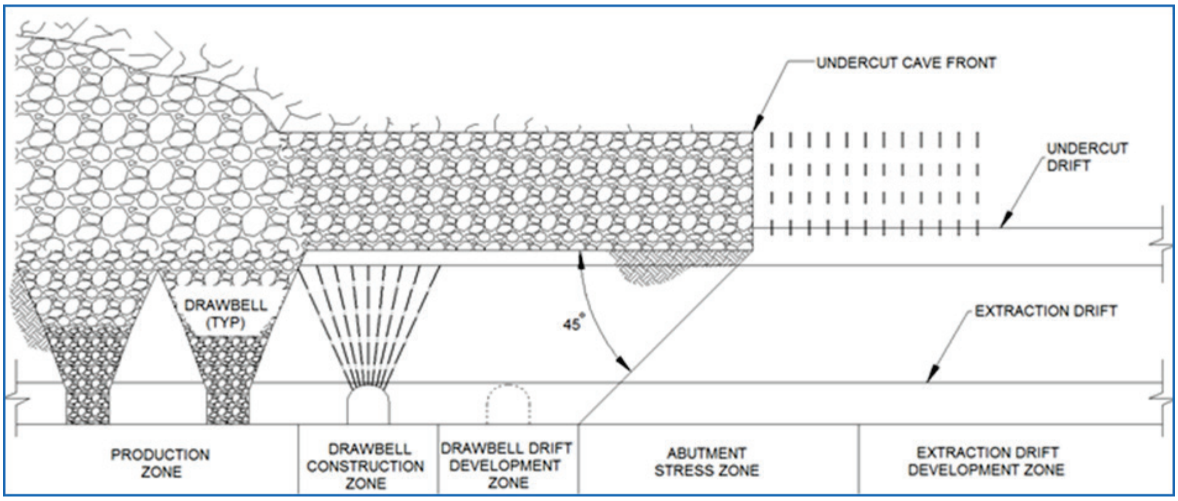


Figure by OT LLC. 2014

Figure 16.9 Undercut and Cave Front

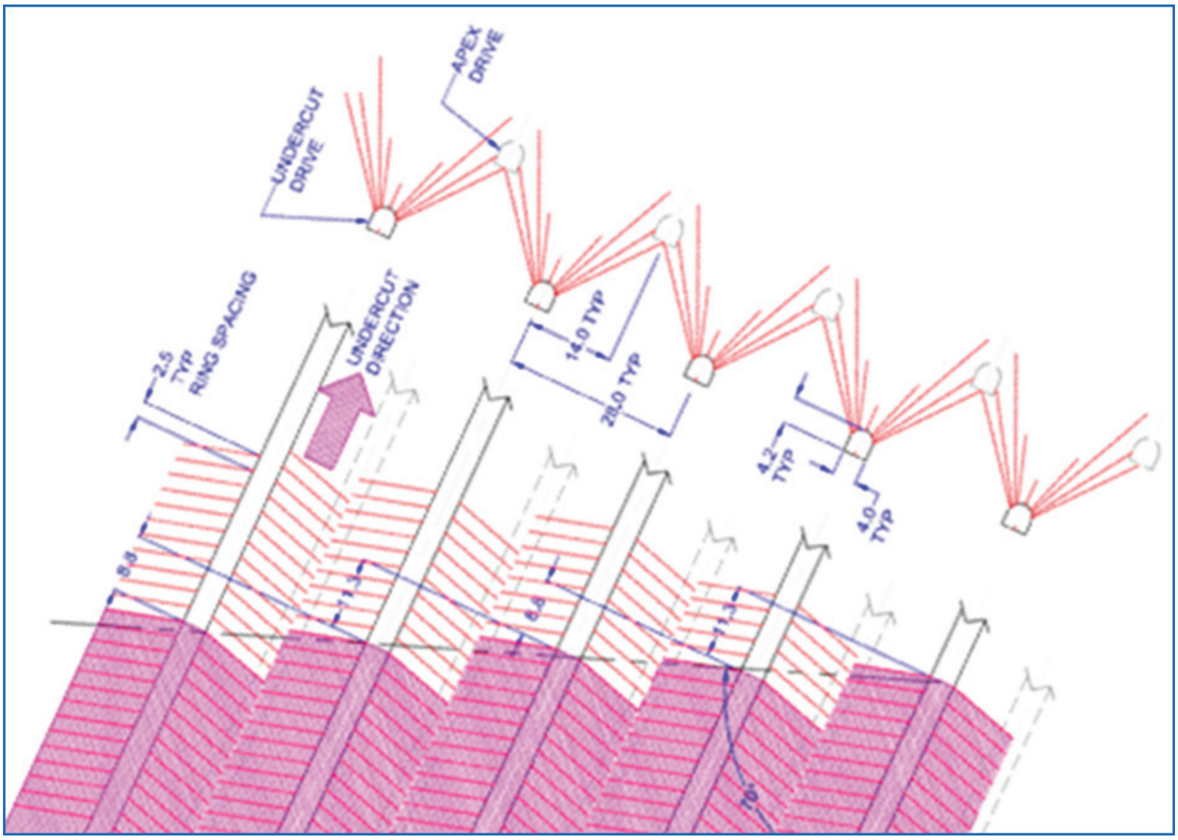


Figure by OT LLC 2014

The Hugo North (including Hugo North Extension) Lift 1 drawbell spacing layout of 28 m x 15 m is based on geotechnical and cave flow models. Pillar stability and recovery were major factors in selecting the drawpoint spacing. To promote interactive draw, drawcone centroids within a drawbell are spaced 10 m apart. Layout parameters are illustrated in Figure 16.10.

The advanced undercut sequence allows the extraction level panel drives to be mined ahead of the undercut face. A safety zone running the length of the undercut face will be established on the extraction level underneath the advancing undercut face. This zone will be 34 m wide, starting 17 m, or 45°, in front of the undercut, and ending 17 m, or 45°, behind the undercut face. The development of the drawpoint drives will begin 17 m behind the undercut face, and full drawbell excavation will begin at least 60° behind the undercut face. This is shown in Figure 16.8.

The 4.5 m wide x 4.5 m high extraction panel drives spaced every 28 m, and the 4.5 m wide x 4.2 m high drawpoint drives, are considered to be supportable and adequate.

Figure 16.10 Extraction Level Layout Parameters

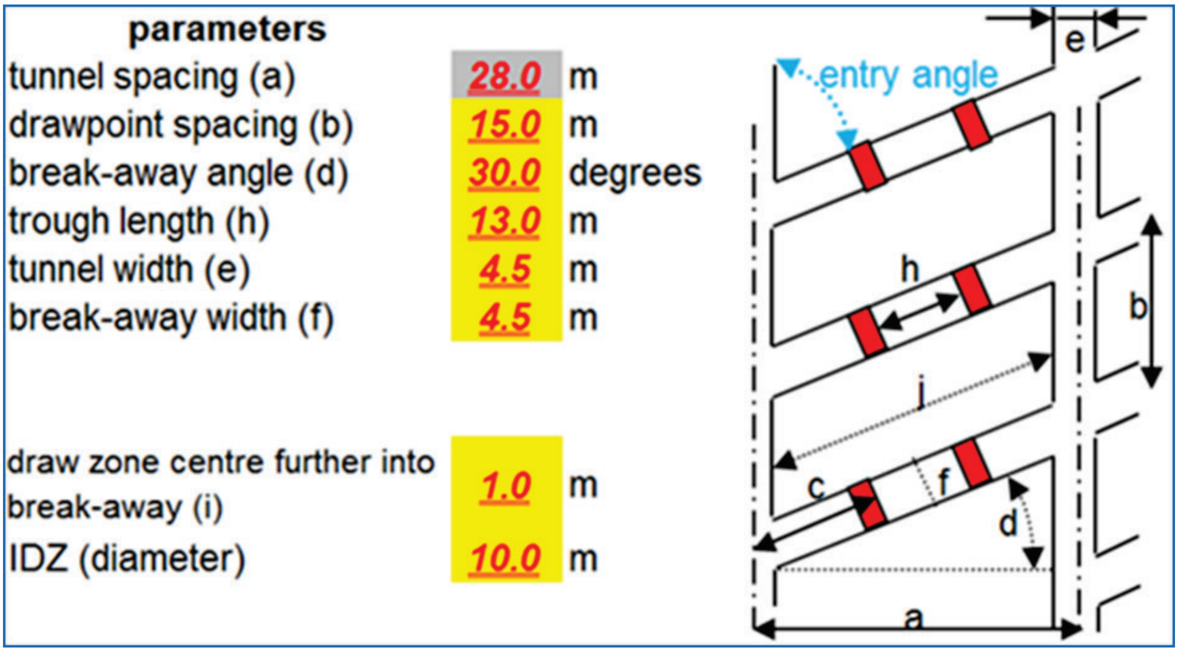


Figure by OT LLC 2014

16.4.1 Access

The access development includes the conveyor decline and shafts for ventilation and hoisting.

Shaft 1 is the existing pre-production access and services shaft. It is 6.7 m in diameter, concrete-lined, equipped with fixed-guides, and, sunk to a depth of 1,385 m. The steel headframe supports two winders. One winder operates a double-deck, 6 t capacity cage (1.5 m x 3.0 m) with a personnel capacity of 32 people per deck. The other winder operates two 9.5 t skips with 3.5 ktpd muck hoisting capacity. Mine air heaters connected to a sub-collar plenum provide heated intake air. Underground fans connected to ducts in the shaft provide exhaust ventilation during the pre-production period.

Shaft 2 will be a dual-purpose service and production shaft and a primary intake ventilation shaft. It will be 10 m diameter, concrete-lined, equipped with fixed guides, and sunk to a depth of 1,284 m. The shaft will be equipped with a service cage and have a capacity of 39 t and be able to accommodate a peak of 150 persons on a single deck.

Mine personnel and material access will commence through Shaft 1. Personnel utilise the Shaft 1 1300-level station for mine access with materials delivered to the 1344-level station until commissioning of Shaft 2. Shaft 2 will be the primary access for personnel, equipment, and materials upon service cage commissioning in mid-2017.

Primary access from Shaft 2 is along two access drives that connect the Shaft 2 1256-level station to the main workshops, offices, and extraction level. Traffic will travel in a clockwise direction from Shaft 2 to the workshops and mine workings in the footprint area.

Five shafts will be required to support Hugo North (including Hugo North Extension) Lift 1. A list of the shafts is in Table 16.4.

Table 16.4 Shaft Station Depths

Shaft	Diameter (m)	Depth (m)	Function
Shaft 1	6.7	1,385	Early development and intake
Shaft 2	10.0	1,284	Skipping, primary cage access, intake
Shaft 3	10.0	1,148	Intake
Shaft 4	11.0	1,149	Exhaust
Shaft 5	6.7	1,178	Exhaust

16.4.2 Apex and Undercut Level

The apex and undercut levels provide access tunnels for production drilling and blasting with the purpose of undercutting the deposit. Production holes are drilled from undercut level tunnels up and into parallel tunnels on the apex level. Development of the apex level allows inspection for undercut drillhole deviation prior to each blast.

16.4.3 Extraction Level

The extraction level is designed for the efficient development of drawbells and LHD operation to haul from drawpoints. The undercut is situated 17 m above the extraction level to provide adequate pillar between the levels. The undercut and apex drives are parallel to the extraction level production drives.

The extraction level drives will be spaced 28 m apart, using an El Teniente style drawbell layout with 15 m spacing. The drawpoints are oriented at a 60° angle to the extraction drives to optimise the pillar size between drawbells and accommodate loader access. The extraction drives drain from the centre to the perimeter drives to stop water from flowing into the exhaust raises and passes.

16.4.4 Haulage Level

The purpose of the haulage level is to collect material from the extraction level and undercut level and transport it to crushers for size reduction. The haulage level will be 44 m below the extraction level. It is designed to support one-way traffic from the crusher to the truck loading chutes and returning to the crusher. In general, it is located under the centre of the footprint, serving passes from each extraction drift. Haulage drives will be driven 5.4 m wide x 6.1 m high with fully arched back profile.

16.4.5 Intake Ventilation Level

The intake ventilation system is designed to provide fresh air to the mining footprint level, main travel ways, working areas within the mine, and the fixed facilities. Fresh air for the mining footprint level will be supplied through two sets of two intake tunnels parallel to the extraction perimeter drives, 5.0 m wide x 5.5 m high, running the length of the footprint. A series of 3.0 m diameter raises will connect the intake drives to the perimeter drives on the extraction level.

16.4.6 Exhaust Ventilation Level

The exhaust ventilation level allows passage of used air out of the mine. Fresh air enters the east and west side of the mining footprint, removing dust from LHD mucking, and exhausts down a two metre diameter central ventilation raise adjacent to the passes. Two parallel drives on the exhaust level, 5.8 m wide x 6.5 m high, will run the length of the deposit along the centre of deposit axis.

Exhaust drives also connect to exhaust raises from the haulage level in each truck loading chamber to collect dust from the truck loading chutes. Return air will exit the mine through 6.0 m high x 7.0 m wide return air drives.

The conveyor to surface and parallel service drive are pressurised with fresh air from Shaft 3, allowing dust generated from the conveyors to be exhausted to surface.

16.4.7 Crusher and Conveying Levels

Trucks haul from chutes to crushers on the west side of the mining footprint. Crushed material is transferred by a series of conveyors directly to surface or to the Shaft 2 hoisting system. Truck shop facilities will be constructed west of Crusher 1 location to provide optimal access and to minimise truck downtime.

The conveyor-to-surface system consists of one 130 m conveyor that transport material from Transfer 5 to three 2,200 m conveyors up to surface. This will be the primary material handling route for the LOM. Shaft 2 will serve as the initial material handling route to surface until the conveyor-to-surface system is commissioned. At this time the Shaft 2 system will serve as a backup material handling system.

16.4.8 Passes and Ventilation Raises

Vertical development will include shaft development, passes, and ventilation raises. With the exception of the shafts, all vertical development is planned to be done with raisebore and boxhole machines.

Two types of passes will be constructed to handle the production and development muck from the extraction and undercut levels:

- Central passes
- Perimeter passes

The bin will be raisebored from the exhaust level at a 3.5 m excavated diameter, 14.5 m long with a dip angle of 70° to the haulage truck chute chamber. The passes will be raisebored at a 2.8 m excavated diameter, 18 m long with a dip angle of 65° from the exhaust level to the extraction level. After being excavated, the passes will be lined with 20–50 mm rolled-steel plate (thickness dependent on throughput) capable of handling rock flow wear up 24 Mt.

Most of the ventilation raises will be 3.0 m diameter and range from 20–100 m long. An exception is the central exhaust raises, which are relatively short (16 m) and will be excavated at a two metre diameter. All ventilation raises will be supported with remotely applied fibre shotcrete.

16.5 Mine Support Facilities

16.5.1 Surface Facilities

The underground mine will require a number of surface facilities to support the underground operations. At Hugo North these will be: Shaft 1 area, production shaft farm, Shaft 4 area, and the conveyor-to-surface portal area. The only surface facility on the EJV Property will be Shaft 4.

Current facilities at the collar of Shaft 1 were constructed as required and have been expanded to suit requirements. Current facilities include offices, dryhouse, warehouse, lamp room, shop, generators, boiler plant, and miscellaneous ancillary facilities. Most of these facilities will stay in service until the completion of the mine construction.

The production shaft farm will include the collars of Shafts 2, 3, and 5. Also in this area are the

220 kV substation, shaft take-away conveyors, and overland conveyor to the concentrator coarse stockpile. The permanent mine office and dryhouse will be located near the collar of Shaft 2.

The Shaft 4 area will be equipped with the main exhaust fans and an electrical substation.

The underground conveyor to surface system will connect to a surface take-away conveyor and onto the overland conveyor.

16.5.2 Material Handling Design

Load haul dump (LHD) muckers will deliver run of mine from draw points to the grizzly stations on the extraction level.

Passes will connect the grizzly stations to the truck loading stations at the haulage level. Each in line truck loading station will be equipped with a hydraulically operated loading chute, complete with variable throat openings and active lip for total flow control, to load the haul trucks. The truck loading stations will be located at the perimeter and central passes to load the 160 t capacity (2 x 80 t trailers) side dump Powertrans road trains. The trucks will deliver to two crushers.

The design capacity of each of the crushers is 4.0 ktph, which will satisfy the 95 ktpd production target. The crusher sizing has been refined to reflect the latest vendor information for two 1,600 mm x 2,400 mm top service ultra duty (TSU) gyratory crushers. Crushed material discharges into a 640 t surge bin. Each crusher station will be equipped with a rock breaker and an overhead bridge crane for service. The station will be operated remotely from a central control facility on the surface.

Primary material flow will be diverted toward the conveyor to surface system will feed a short transfer conveyor and onto the first of a series of three incline conveyors to the surface. The conveyor to surface system will be the primary material handling system.

Material diverted towards Shaft 2 via the short horizontal conveyor feeds into a two-way diverter chute installed above a 5.0 kt material storage bin. Material is either fed directly into this bin or diverted onto a short conveyor for discharge into a second 5.0 kt material storage bin. Material will be reclaimed from bins onto the skip loadout conveyor via apron feeders and be discharged to skips for hoisting material to surface.

The conveyor to surface incline conveyor will deliver material to the new coarse stockpile feed conveyor and discharge material onto the stockpile. The stockpile feed conveyor will be parallel to the existing stockpile feed conveyor. The new stockpile feed conveyor will be similar in construction to the existing system for commonality of parts.

The total conveying and hoisting capacity from the underground is planned to be approximately 140 ktpd. This conveyor to surface system is planned to move an average daily throughput of 95 ktpd. Simulation work by OT LLC suggested trucking to the conveyor to surface system could have a capacity of 106 ktpd. The Shaft 2 hoisting capacity is designed to be 30 ktpd and Shaft 1 hoisting capacity is designed to be 3.5 ktpd. The material handling system will include five apron feeders and 16 belt conveyors.

Two-way diverter chute will be arranged to optimise operability and maintainability and to reduce geotechnical risk associated with large excavations. The underground conveyor system is shown in Figure 16.11 and Figure 16.12.

Figure 16.11 Underground Conveying System Layout – Conveyor to Surface

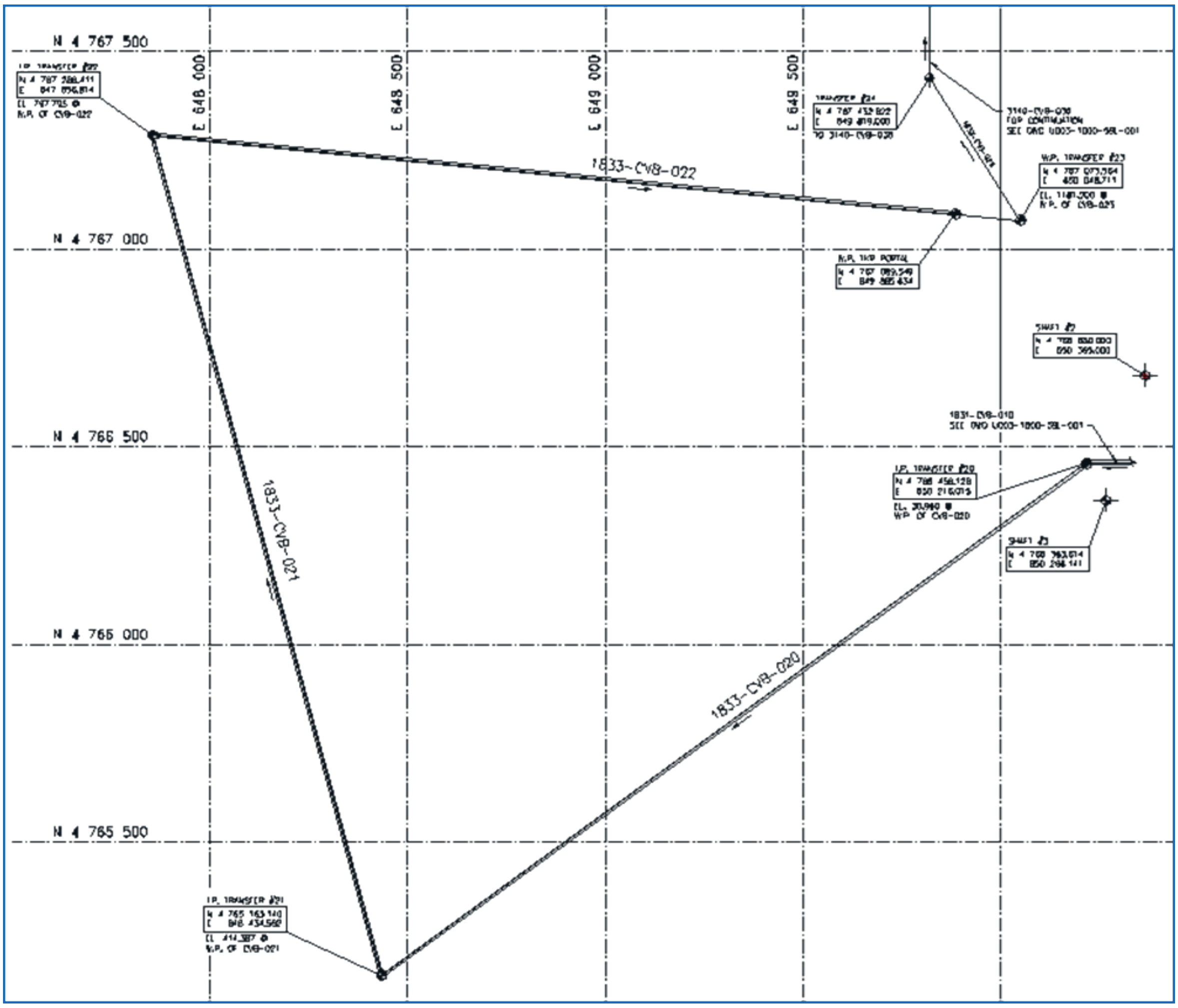


Figure by OT LLC 2014

Figure 16.12 Underground Conveying System Layout – Crusher Stations and Shaft 2

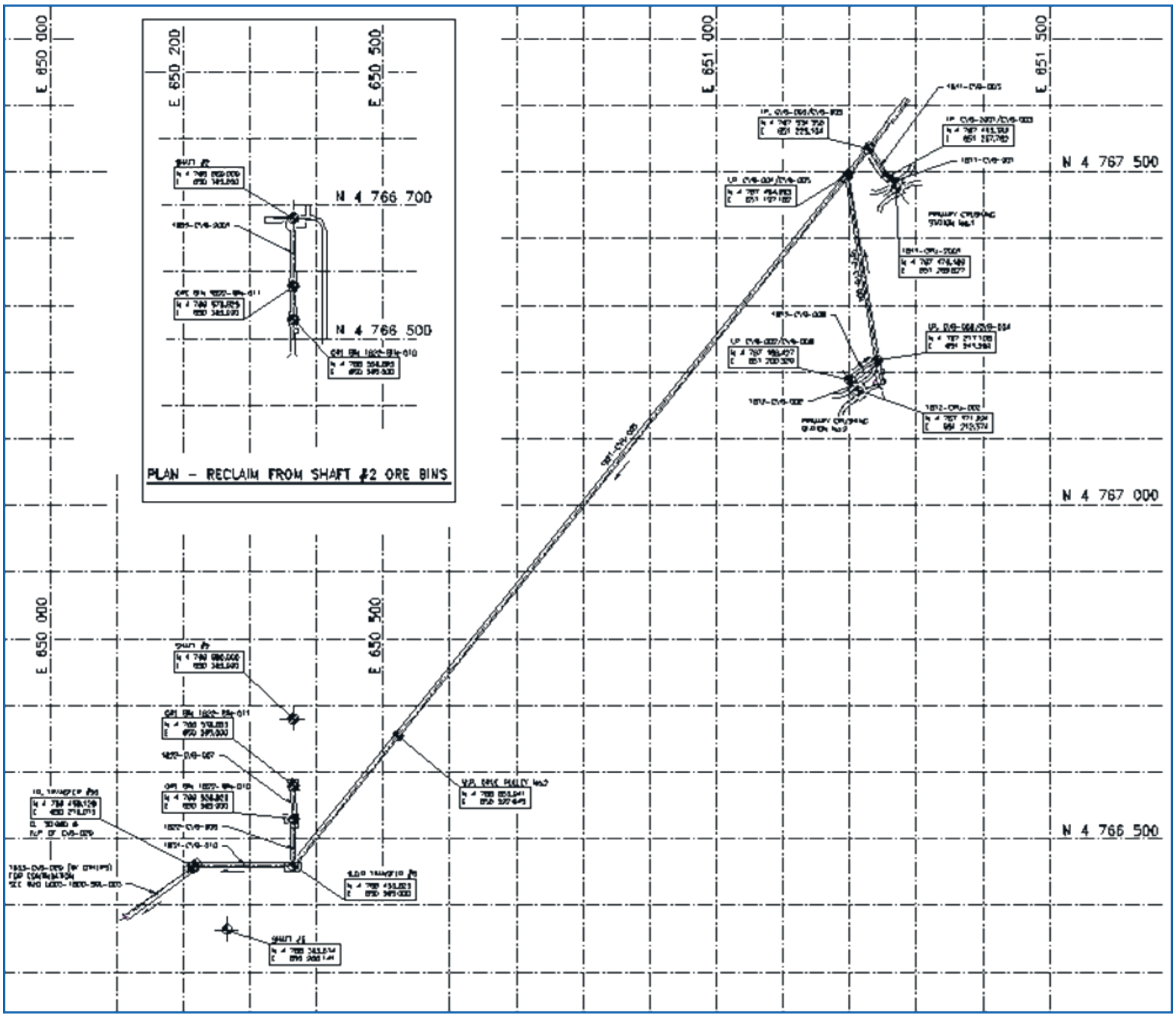


Figure by OT LLC 2014

Shaft 1 is equipped with skips and a hoist with a capacity of 3.5 ktpd. This is intended to be used for development hoisting only, and not for production hoisting.

Production hoisting will be through Shaft 2. Shaft 2 will utilise two x 60 t capacity bottom discharge skips to hoist the material from underground to the surface. The design capacity of the hoist is 30 ktpd over a planned operating time of 19.2 hours.

When completed, Shaft 2 will be 10 m in diameter and equipped with rigid guides. Skips will be loaded by a conveyor loading arrangement located on the –28.2 mRL, 1,202.2 m below collar. The surface discharge of material from the Shaft 2 skips will take place below collar level into a bin. The skip loading system is designed as an automated and continuous operation for loading the skips without stopping the loadout conveyors.

The Shaft 2 skips will discharge material into a 200 t capacity surface bin within the headframe of Shaft 2. Material will be reclaimed from the bin on an apron feeder. Reclaimed material will be discharged onto the 1,400 mm wide Shaft 2 discharge conveyor running at a belt speed of 2.5 m/s. The discharge conveyor will transfer material onto the existing open pit overland conveyor and stockpile feed Conveyor 1 to deliver material to the coarse stockpile.

The conveyor to surface incline conveyor will deliver ore to the new coarse stockpile feed Conveyor 2, and discharge material onto the stockpile. The stockpile feed Conveyor 2 will be parallel to the existing stockpile feed Conveyor 1. The new stockpile feed conveyor will be similar in construction to the existing system for commonality of parts.

16.5.3 Development Rock Handling

Before the Shaft 2 loadout and skip hoisting system is commissioned, all rock will be hauled by 50 t trucks to the Shaft 1 hoisting system. This will consist of a jaw crusher on top of a storage bin, with rock conveyed to a flask-loaded skip system.

At the time of commissioning the Shaft 2 loadout and skip hoisting system, an 8.5 ktph jaw crusher will be installed on top of Shaft 2 storage bin 011, and the trucks will haul rock to this crusher as well as the Shaft 1 jaw crusher. The crusher discharge will be fed into the bin for loading into the skips in Shaft 2. This material will be delivered to the concentrator stockpile.

When the first production gyratory crusher and conveying system is commissioned all production rock, and most development rock, will be handled through the production crusher and conveying system for delivery to the concentrator.

16.5.4 Mine Ventilation

At full production, fresh air will enter the mine through one of three shafts and exit through two dedicated exhaust shafts as well as the conveyor to surface portal. The ventilation system is primarily a pull design with the main exhaust fans on exhaust shafts. The system components are outlined in Figure 16.13. Mine air heaters will be installed on all intake shafts: Shafts 1, 2, and 3. Heaters will need to be running any time there is a possibility of the intake air being at freezing temperatures. The design temperature for the heated air entering the mine is +2°C. The system will use hot water from a central heating plant delivered to glycol heat exchangers to transfer heat to each mine air heater glycol loop, which in turn heats intake air from ambient to design discharge temperature.

Figure 16.13 Hugo North and Hugo North Extension Lift 1 Shafts and Ventilation Raises

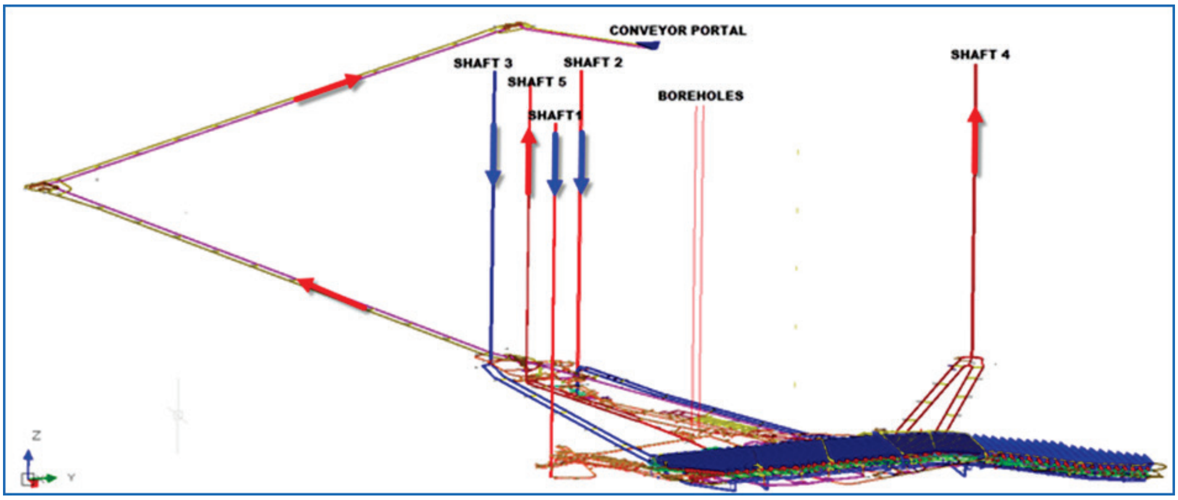


Figure by OT LLC

16.5.5 Equipment Fleet

The underground mobile equipment fleet is classified into seven broad categories:

- Mucking
- Haulage
- Drilling
- Raisebore / boxhole
- Utility and underground support
- Surface support
- Light vehicles

The major fixed equipment will include:

- Material handling (crushing and conveying)
- Fans and ventilation equipment
- Pumping and water handling equipment
- Power distribution equipment
- Data and communications equipment
- Maintenance equipment (shop furnishings)

16.5.6 Development

The development heading advance rates are based on simulations developed to model various advance scenarios, heading configurations, and crew situations. These rates are calibrated against actual job site performance and used in the scheduling package. The conveyor to surface (C2S) is developed from both surface and underground with planned breakthrough along CVB-020. The breakthrough location is driven by the availability of underground resources to commence incline development. Transfers are developed off critical path behind the advancing face by a dedicated mass excavation crew. The development rates used for the Hugo North (including Hugo North Extension) Lift 1 schedule are summarised in Table 16.5 and Table 16.6 outlines the development rates of the conveyor decline.

Table 16.5 Development Rate Summary

Area	Dimension (m) (width x height)	Development Rate (m/d)	
		Off Footprint	On Footprint
Undercut Drifts	4.0 m W x 4.2 m H	–	6.0
Undercut Perimeter	5.0 m W x 5.5 m H	–	4.3
Undercut Cross-cut	4.5 m W x 5.5 m H	–	4.3
Apex Rim	4.5 m W x 5.5 m H	–	6.0
Extraction Drifts	4.5 m W x 4.5 m H	–	4.3
Drawpoint Drifts	4.5 m W x 4.2 m H	–	4.3
Drawbell Drifts	4.5 m H x 4.2 m H	–	4.3
Extraction Perimeter	5.0 m W x 5.5 m H	–	4.3
Vent Drifts (on-ftp)	5.0 m W x 5.5 m H	–	4.3
Vent Drifts (on-ftp)	5.8 m W x 6.5 m H	–	3.3
Vent Shaft 5 Exhaust	6.0 m W x 6.0 m H	4.8	–
Vent Drift	6.0 m W x 7.0 m H	4.8	3.3
Raise Bore Cut-out	6.0 m W x 7. 0 m H	–	3.3
Haulage Drift Straight	5.4 m W x 6.1 m H	3.2	3.2
Haulage Drift Corner	6.0 m W x 6.1 m H	3.2	3.2
Conveyor	6.0 m W x 5.4 m H	5.1	–
Ramp Access	5.0 m W x 5.5 m H	6.2	4.3

Table 16.6 Main C2S Decline Development Rates

Decline Development	Primary Heading (m/d)	Muck-bays / Cross-cuts (m/d)
Conveyor Drive	4.6	1.6
Service Drive	5.0	1.2

C2s = conveyor to surface

Mass excavations for crushers, workshops and other key infrastructure will be required to support the caves. Each will have unique support requirements and excavation methodology, depending on ground conditions, geometry, access, and overall functionality.

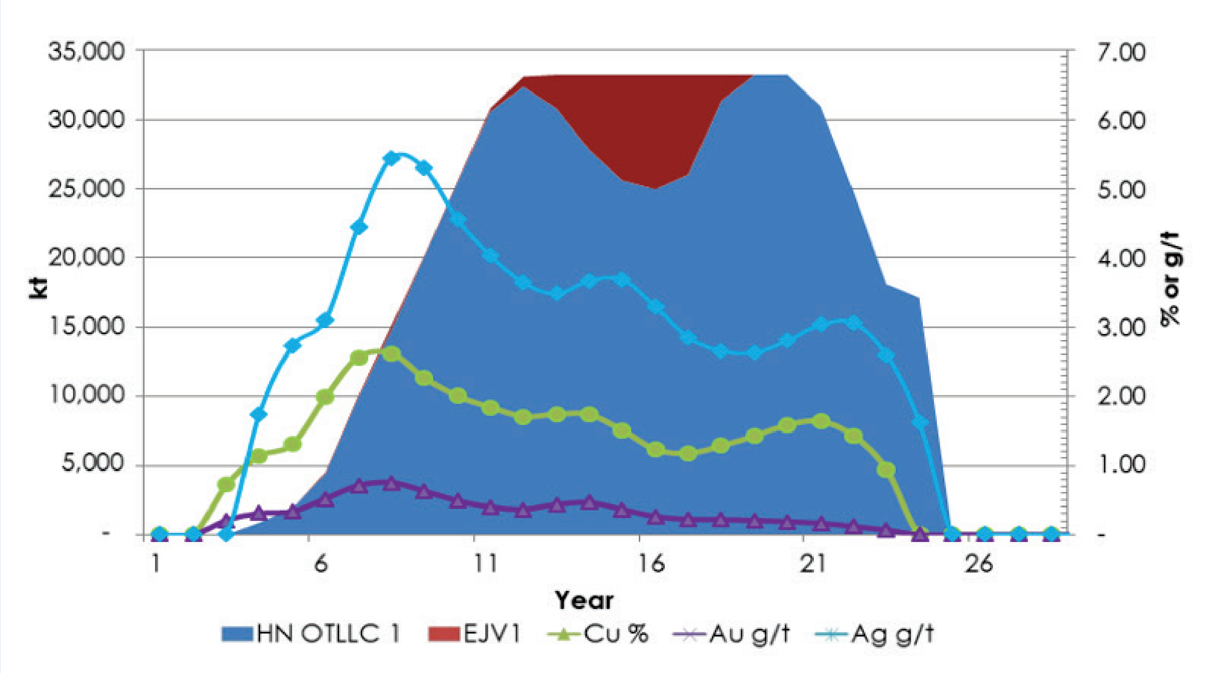
16.6 Underground Mine Schedules

16.6.1 Underground Production Schedule

Ore production from the Hugo North Lift 1 split between OT LLC and EJV ore is shown in Figure 16.14. The LHTR13 mine plan showed ore from EJV being mined by development in 2019. In LHTR16 there has been a two year delay. Year 1 is mid-2016 and the first ore from EJV is in 2021.

OT LLC plans to undertake engineering studies of expansion options in the continuing Feasibility Study for Oyu Tolgoi. This will include examining all production scenarios and associated expansion options. OT LLC plans a focused and structured review of the study work to be used in the capital approvals process as the operation developments. OreWin believes that further design work could identify opportunities to improve project economics via cost reductions and mine plan optimisation. This may result in further positive changes to the EJV development schedule that could bring first EJV ore forward relative to the current plan.

Figure 16.14 Hugo North Lift 1 Total Underground Material Movement



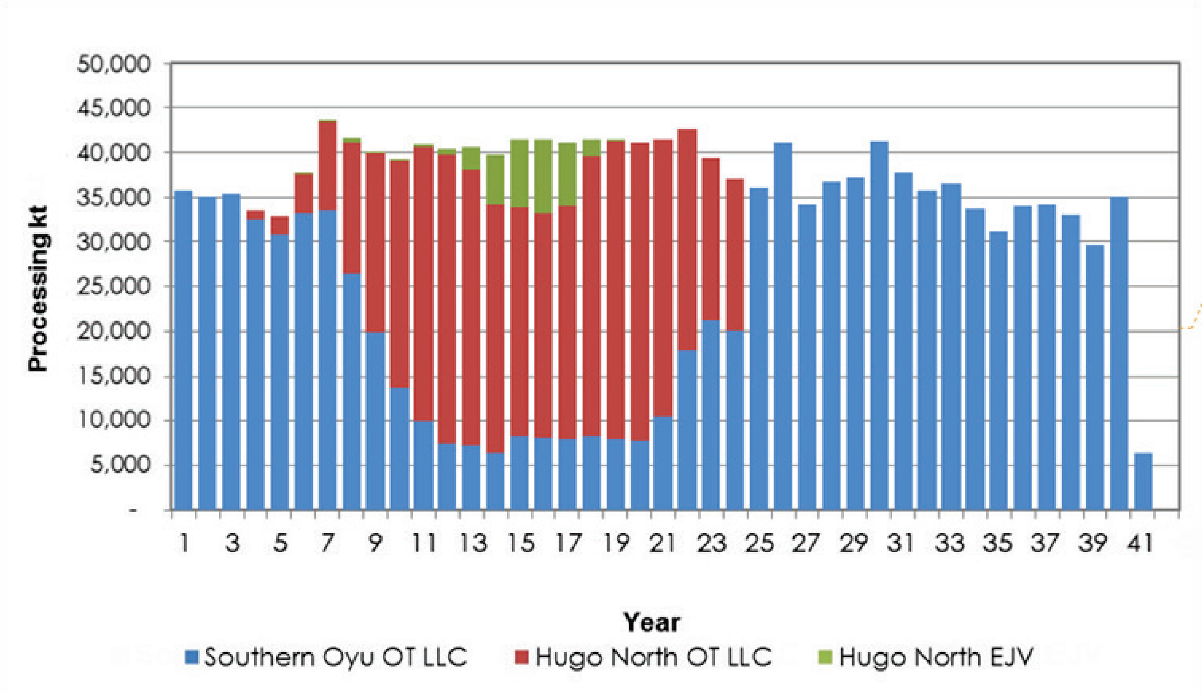
Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

16.6.2 Processing Schedule

The processing schedule was balanced to meet the available mill hours after the underground material was processed.

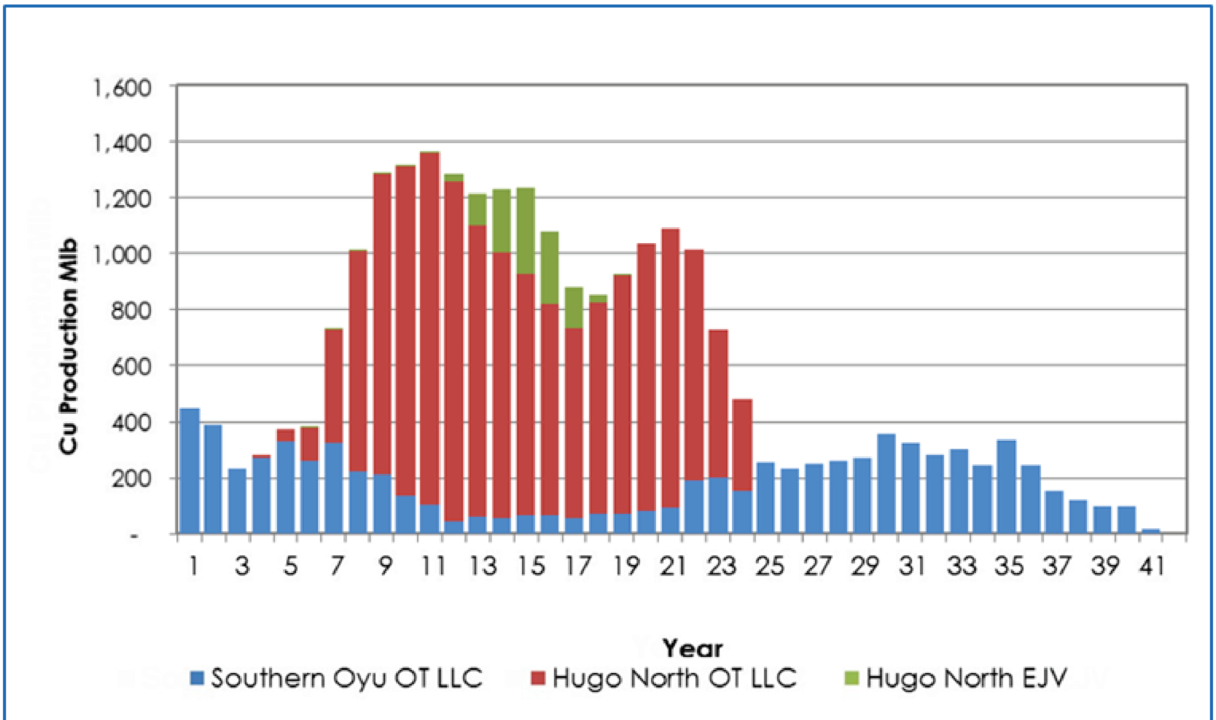
The processing schedule by source is shown in Figure 16.15. The recovered copper, gold, and silver production is in Figure 16.16 to Figure 16.18. The total processing schedule is detailed in Table 16.7 and the EJV processing schedule is in Table 16.8.

Figure 16.15 Ore Processing Schedule by Source



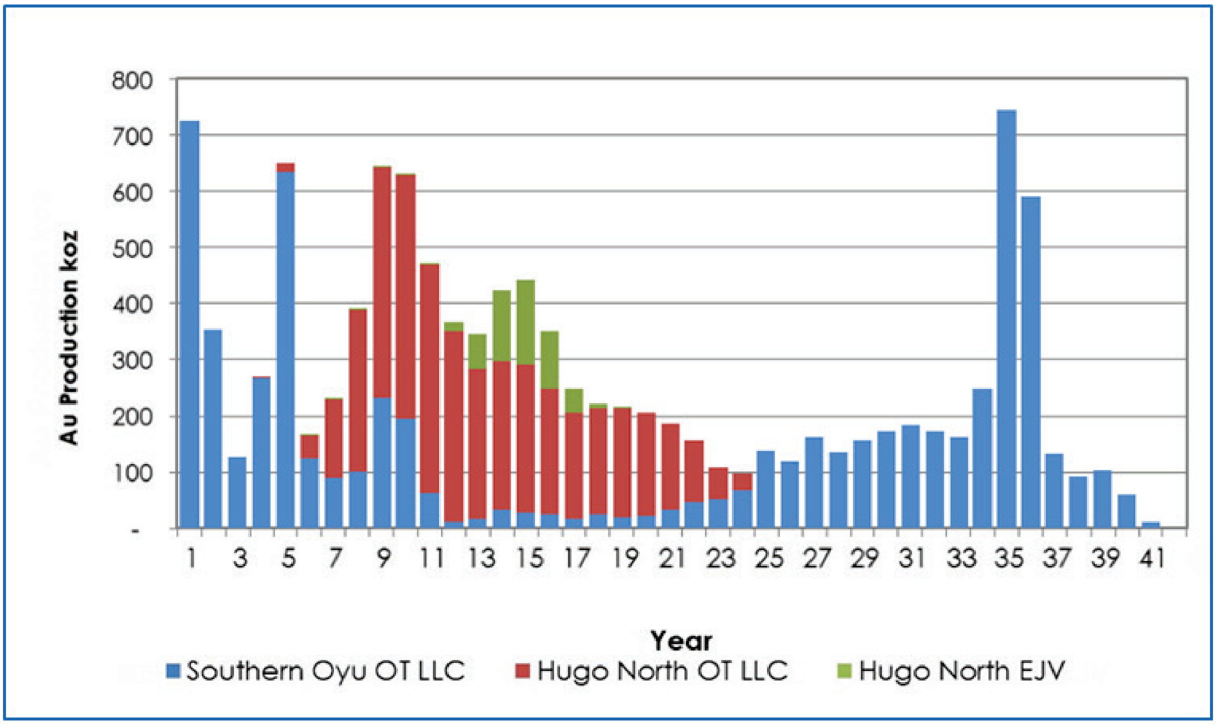
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV

Figure 16.16 LHTR16 Reserve Case Copper Production



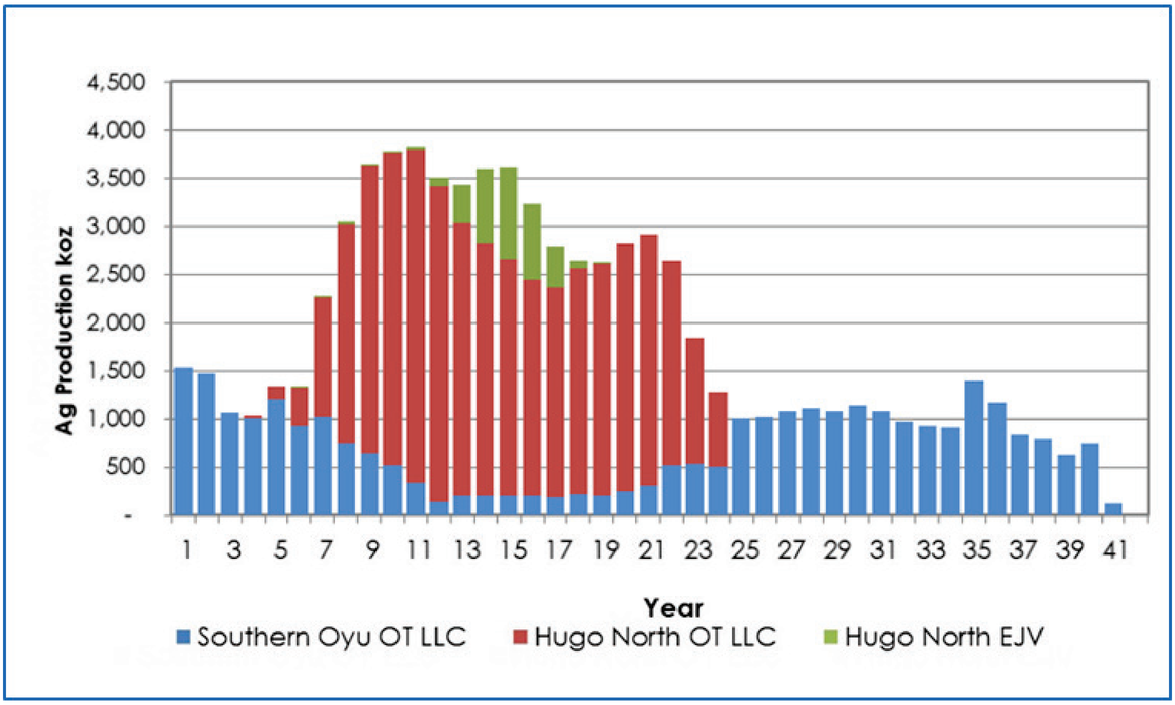
Note: Entrée has a 20% interest in ore extracted from Hugo North EJV

Figure 16.17 LHTR16 Reserve Case Gold Production



Note: Entrée has a 20% interest in ore extracted from Hugo North EJV

Figure 16.18 LHTR16 Reserve Case Silver Production



Note: Entrée has a 20% interest in ore extracted from Hugo North EJV

Table 16.7 LHTR16 Reserve Case Production Schedule – Total Oyu Project (OT LLC and EJV)

		Year											Total
Year Number		**1**	**2**	**3**	**4**	**5**	**6**	**11**	**21**	**31**	**41**	**51**	**Total**
Open Pit													
Ore	kt	39,771	46,001	46,323	23,628	41,534	38,190	181,650	124,089	233,101	257,485	–	**1,031,826**
Waste	kt	49,434	48,293	57,884	72,321	66,767	67,622	283,181	533,921	489,967	186,955	–	**1,856,343**
Total Movement	kt	89,205	94,294	104,206	96,002	108,300	105,812	464,832	658,010	723,068	444,440	–	**2,888,169**
Underground	kt	–	–	–	–	881	1,905	75,398	329,934	91,047	–	–	**499,165**
Processed	kt	29,986	35,704	34,991	35,350	33,456	32,812	202,194	409,528	387,464	340,908	6,482	**1,548,875**
	NSR	50.03	54.30	39.00	20.50	29.87	50.82	71.15	78.68	36.05	24.28	8.73	**49.78**
	Cu	0.55	0.65	0.57	0.37	0.45	0.59	1.20	1.36	0.68	0.38	0.18	**0.84**
	Au	0.84	0.83	0.42	0.16	0.34	0.82	0.40	0.31	0.17	0.33	0.11	**0.32**
	Ag	1.45	1.61	1.59	1.21	1.21	1.56	2.59	2.87	1.52	1.16	0.96	**1.92**
	As	10.35	24.77	49.95	33.71	18.48	18.46	82.05	80.39	92.45	59.86	37.42	**71.88**
	Tput	29.76	36.43	35.47	36.11	34.33	33.77	42.98	41.67	40.41	35.26	32.76	**39.13**
	F	2,147	2,156	1,924	1,704	1,855	1,747	1,791	2,027	1,837	1,707	1,406	**1,862**
	S	1.61	1.60	1.52	1.37	1.44	1.75	2.84	2.52	3.05	2.34	1.45	**2.52**
	Fe	7.81	7.31	6.97	6.48	6.79	6.50	5.52	4.59	5.58	6.31	6.24	**5.65**
	Mo	31.34	34.99	46.61	37.33	47.66	66.48	48.10	37.47	45.92	53.60	39.10	**45.39**
Bulk Concentrate	Conc kt	551	753	655	417	489	642	6,723	17,351	8,796	4,168	32	**40,577**
	Con Cu %	26.32	27.18	26.87	25.69	26.05	26.43	31.90	29.02	25.46	24.08	23.89	**28.00**
	Con Au g/t	34.80	29.90	16.86	9.63	17.23	31.50	9.53	5.90	5.11	18.64	12.42	**9.24**
	Con Ag g/t	62.86	63.57	69.97	79.74	66.24	65.22	65.02	57.51	53.35	70.74	125.19	**60.11**
	Con As ppm	92	130	291	294	157	210	1,203	1,213	1,799	1,236	1,253	**1,252**
	Con Mo ppm	1,094	1,063	1,597	2,031	2,089	2,178	927	567	1,297	2,810	5,107	**1,111**
	Con F ppm	603	654	587	512	547	506	401	388	464	532	421	**437**
Recovered Metal	Copper Mlb	319	451	388	236	281	374	4,728	11,100	4,938	2,212	17	**25,044**
	Gold koz	616	724	355	129	271	650	2,061	3,291	1,444	2,498	13	**12,051**
	Silver koz	1,113	1,539	1,473	1,068	1,042	1,346	14,054	32,081	15,089	9,480	128	**78,413**

Note: Table 16.7 is the total production as shown in the 2014 OTTR

Table 16.8 EJV Reserve Case Production Schedule

	Year														
Year Number	**1 to 5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**Total**
Mt	–	0.1	0.1	0.4	0.1	0.1	0.2	0.7	2.5	5.5	7.6	8.3	7.2	1.9	0.0	**34.8**
NSR $/t	–	9.71	12.03	72.39	105.29	99.01	59.61	117.77	148.41	134.75	126.28	95.53	57.54	38.89	20.72	**100.57**
Cu %	–	0.22	0.27	1.18	1.67	1.54	0.93	1.80	2.24	2.04	1.96	1.56	0.99	0.68	0.34	**1.59**
Au g/t	–	0.01	0.01	0.34	0.56	0.59	0.38	0.77	0.94	0.87	0.73	0.45	0.23	0.16	0.10	**0.55**
Ag g/t	–	0.60	0.81	2.87	4.33	3.90	2.68	4.35	5.80	5.09	4.52	3.42	2.15	1.51	0.77	**3.72**
Conc kt	–	1	2	13	5	5	8	33	130	288	409	400	271	55	0	**1,619**
Con Cu %	–	16.90	17.43	30.88	32.09	31.33	25.62	36.78	39.05	35.64	33.84	29.67	23.90	20.95	18.68	**31.40**
Con Au g/t	–	0.60	0.68	8.10	9.84	10.84	9.51	14.30	14.86	13.88	11.55	7.88	4.95	4.30	5.20	**9.96**
Con Ag g/t	–	45.37	51.25	71.09	78.33	74.90	69.44	83.65	95.26	83.89	73.27	61.07	48.84	43.90	39.45	**68.97**
Con As ppm	–	6,174	5,759	457	450	589	1,050	406	437	395	351	323	429	484	717	**392**
Con F ppm	–	229	280	270	409	371	330	283	305	359	380	393	361	325	239	**365**
Copper Mlb	–	0	1	9	4	3	5	27	112	226	305	262	143	26	0	**1,121**
Gold koz	–	0	0	3	2	2	2	15	62	128	152	101	43	8	0	**519**
Silver koz	–	1	3	29	13	12	18	89	398	776	963	785	425	78	0	**3,591**

Minor figure differences may occur due to rounding errors. Year 1 is 2016.

17 RECOVERY METHODS

17.1 Introduction

Entrée's share of products will, unless Entrée otherwise agrees, be processed at the OT LLC Facilities by paying milling and smelting charges. The OT LLC Facilities are not intended to be profit centres and therefore, minerals from the EJV Property will be processed at cost. OT LLC will also make the OT LLC Facilities available to Entrée at the same terms if spare processing capacity exists to process other suitable ores from Lookout Hill, outside the area comprised in the EJV Property.

Oyu Tolgoi, including the EJV Property, is being developed in phases:

- Phase 1 – was all the work required to bring OT LLC's Southwest zone into full commercial production through commissioning and ramp-up of Lines 1 and 2, by the addition of essential services and infrastructure. The Phase 1 concentrator was commissioned in early-2013. Nameplate capacity of 96 ktpd was achieved 6 August 2013. Operating data acquired since that time have been used in Phase 2 design, which addresses the delivery of Hugo North underground plant feed via Lift 1 in conjunction with open pit mining.

- Phase 2 – all additional work required to process Hugo North (including Hugo North Extension) Lift 1 production plus open pit plant feed to match Phase 1 SAG mill capacity, including:

  - The addition of a fifth ball mill to achieve a finer primary grind P_{80} of 150–160 µm for a blend of Hugo North (including Hugo North Extension) and open pit feeds, compared to 180 µm for Southwest zone.
  - Additional roughing and column flotation capacity to process the higher level of concentrate production when processing the higher grade Hugo North (including Hugo North Extension) plant feed.
  - Additional concentrate dewatering and bagging capacity.

There is minimal allowance for incremental expansion beyond Phase 2 other than to ensure that Phase 2 will not interfere with possible future expansion.

17.2 Concentrator Production 2013–2015

The concentrator commenced plant commissioning in January 2013 with production of first copper–gold concentrate on 31 January 2013. Commercial production was achieved in September 2013. The ramp-up of the concentrator progressed at a rate that would be normally expected for a project of this scale. Mill throughput averaged approximately 104 ktpd in Q4.

Concentrate production has progressively increased since 2013, as a combination of increasing mill throughput and grade and improvements in concentrator performance with recovery. Concentrates grades have been at or near design, particularly for copper, despite lower feed grades, as a result metal production has improved as mill throughput and feed grade have improved.

TRQ reported that compared to 2014, 2015 Oyu Tolgoi production increased 19.3%, concentrate production increased 39.9%, copper production increased 36.3% and gold production increased 10.9%. TRQ report they expect Oyu Tolgoi to produce 175,000 to 195,000 tonnes of copper and 210,000 to 260,000 ounces of gold in concentrates in 2016 with lower gold production due to mining lower grade gold zones and from processing lower grade stockpiles.

17.3 LHTR16 Metallurgical Parameters

The metallurgical parameters used for the EJV plant feed in 2014 OTTR were issued in Base Data Template 31 (BDT31). The relevant metallurgical data and formulae are shown in Table 17.1 to Table 17.5. The complete set of parameters from BDT31 are shown in Section 13.

The parameters used for Hugo North were applied to all Hugo North including Hugo North Extension plant feed. Although only limited test work has been carried out on the EJV area it is considered that the results indicate Hugo North Extension is similar to the rest of Hugo North.

The throughput rate algorithm is as used in IDP10 and was developed by SGS from regression analysis of CEET simulation runs for 30,000 Southwest zone blocks over Years 1 through 30 and the SGS database of projects. This formula was applied to all the blocks in the mining model and used for production scheduling.

Table 17.1 Base Data Template 31 – Copper Recovery

All Plant Feed
a x [(b x Cu%) / (1+b x Cu%)] x [1–exp(–b x Cu%)]
Hugo North a = 95 b = 15

Table 17.2 Base Data Template 31 – Gold Recovery

All Plant feed
C x (d x Cu Recovery)
Hugo North c = 9.8 d = 0.80

Table 17.3 Base Data Template 31 – Silver Recovery

All Plant feed
13 + 0.8 x (Cu Recovery)

Table 17.4 Base Data Template 31 – Copper in Concentrate

Hugo North
2.9 x (Cu) + (11.4 x Cu : S) + 15.3

Table 17.5 Base Data Template 31 – Arsenic and Fluorine in Concentrate

Arsenic in concentrate (ppm) [m x ConCu % x As (ppm)] / Cu%	Fluorine in concentrate (ppm)
For Southwest Zone plant feed: m = 0.125 For all Other plant feed: m = 0.780	0.3 x Fluorine in feed (ppm) for all plant feed

The throughput rate algorithm shown in Table 17.6 was developed by SGS from these relationships and the SGS database of projects. This formula was applied to all the blocks in the mining model and used for production scheduling.

Table 17.6 Plant Throughput Rates

All Plant feed
Flotation feed P_{80}=113 x $Ci^{0.26}$ x $SPI^{-0.60}$ x $BM^{0.88}$ Maximum P_{80} guideline = 220 µm
Throughput in tph (instantaneous = 29,320 x $Ci^{0.19}$ x SPI $^{-0.36}$ x BM $^{-0.24}$
Maximum throughput = 5.5 ktph (hydraulic limitation)

17.3.1 Concentrator Capacity Constraints

The parameters described below are considered the major capacity determinants for the OTFS14 concentrator conversion design.

The peak production plateau from the Hugo North (including Hugo North Extension) Lift 1 underground mine is 95 ktpd / 33.25 Mtpa, with additional tonnage supplied from open pit orebodies to progressively higher limits set by:

- SAG milling capacity (annual average tonnage varies primarily with SPI from 81–117 ktpd).
- Ball milling capacity (soft constraint, with pumping and cyclone changes, but ultimately limited by flotation losses).
- Tailings pumping volumetric capacity (approximately 121 ktpd through one tailings line after applying 92% availability).
- Flotation and concentrate handling equipment (approximately 125 ktpd at peak underground heads, whenever open pit ore is not available).

- Current water permit limit of 870 L/s with seasonal water balance variation at the tailings dam from summer evaporation, winter ice formation, and spring thaw (steady-state tonnage limit still undefined but expected to be up to 145 ktpd at OTFS14 average annual unit raw water projection of 0.47 m^3/t (concentrator only) with wastewater recycle to tailings thickeners).

The capacity of the grinding circuit to receive ore is measured in terms of available mill hours at a specific rate. This is expressed as TPUT, the annual tonnage achievable in 8,059 running hours (92% availability) through Lines 1–2. Design was based upon the then-current 'MP08v2' 'No Expansion' mine plan. The Central zone feed from the Oyu Tolgoi ML are particularly soft and have correspondingly high TPUT values. The capacity to treat them is limited by other plant constraints such as the hydraulic limitations of the tailings system.

The concentrator volumetric capacity may be dependent on either the concentrate or tailings production rates. The OTFS14 production basis is to operate at the lesser of TPUT or the tailings handling capacity (121 ktpd, or 44.2 Mtpa).

17.3.2 Blended Processing of Underground Material and Open Pit Plant Feed

Separate processing of Hugo North ore was recommended in the 2009 Technical Evaluation Group (TEG) review and adopted in IDOP and DIDOP. However, following the independent decision to constrain Phase 2 to the original two grinding lines in Phase 1, there was found to be little potential to segregate processing conditions because of the Phase 1 plant design, where the products from the separate grinding lines are combined before flotation. Even if it proved possible to provide separate and equal flotation and pumping capacities for each line, and to replicate the sampling arrangements for separate processing and accounting for tailings streams, there remained little ability to separate the process water systems to allow independent pH control of both flotation circuits.

It was subsequently decided to select a compromise of grinding and flotation conditions for the different feed types, and to process underground and open pit feed by blending through Lines 1 and 2. Hugo North (including Hugo North Extension) would provide up to 95 ktpd of the maximum concentrator capacity of 121 ktpd. Open pit feed would vary as required to keep the concentrator at its maximum capacity. This also led to a change in philosophy, where grinding synergy would be maximised by combining hard and soft plant feed for maximum capacity and minimum unit cost, while trying to minimise the consequences of negative flotation synergy in terms of sub-optimal concentrate grade and recovery at compromise conditions. This has had a negative impact on Central zone ore reserves of recoverable metal, but a positive impact on project economics.

The optimum conditions for treatment of Southwest zone, Hugo North (including Hugo North Extension), and Central zone vary significantly in terms of primary grind and regrind sizes and also in operating pH in flotation roughing and cleaning. Hugo North (including Hugo North Extension) ore carries the highest value and so compromise processing conditions are set much closer to those that are optimal for its copper and gold recovery, than for those that are optimal for Central zone ore metallurgy.

17.4 Process Design Criteria

The process design criteria are the key elements used for plant design. This section discusses the overall design assumptions and constraints for selection of equipment for the major process plant duties. The LHTR13 design criteria were modified to accommodate the concentrator conversion for OTFS14. They include, for example, criteria for sizing the SAG and ball mills, pebble crushers, flotation cells, regrind Vertimills, filtration and thickening units, and concentrate storage and bagging facilities.

Mass balance flows and ore analyses for plant design were taken from the MP08v2 based on 2021, the year of peak concentrate production and near-peak overall tonnage processed. All concentrator conversion upgrades were based on MP08v2.

The co-processing of Hugo North (including Hugo North Extension) and OT LLC's Central zone ore allows the low-arsenic, high-copper Hugo North to dilute the high-arsenic Central zone ore to keep the concentrate below penalty limits (3,000 ppm arsenic). After providing additional capability with the 5th ball mill, grinding and volumetric throughput were maximised by allowing the flotation feed P_{80} to flex within the range already experienced with finer grained ore in Phase 1.

The development of the design criteria is an iterative process in which process assumptions must match and keep pace with test results, mine plans, economic constraints, vendor data, etc. For example:

- Grinding test work and preliminary mill selection provide the key capacity input to the mine, resulting in a production plan. In many cases, increments are determined by the largest available equipment or the size of the equipment already installed to minimise holding costs for insurance spares.
- Flotation recoveries and concentrate analyses provide the head grade-related capacity and product quality constraints used to tune the mine plan to maximise NSR while still producing a readily marketable product.
- The production plan is incorporated into the design criteria and ultimately drives the next mass balance.
- The mass balance usually identifies shortfalls or inconsistencies that demonstrate the need for additional test work before ultimately refining the production plan.

The capacity of the concentrator conversion plant is constrained by the tailings volumetric capacity when softer Hugo North (including Hugo North Extension) and Central zone are processed.

The tailings volumetric capacity is based on the maximum motor power installed for pumping tailings through the overland tailings pipeline to the TFS. This limit is similar to that derived from recent CFD analysis of the tailings thickener feed distributor. The TPUT constraint is based on parameters developed in the grinding test work, notably SPI (SAG Power Index), MBI (Modified Bond Index) and Ci (Minnovex Crushing Index). These parameters are inputs to the Minnovex formulae that generate the grinding model outputs, specifically TPUT (throughput, or instantaneous grinding rate) and the P_{80} product sizing to flotation feed.

Metallurgical grades and recovery models developed from test work used for flotation predictions are based on meeting the optimum primary and regrind ranges, which has been the design objective. An additional ball mill (Ball Mill 5) was required to compensate for the higher SAG mill capacity with underground and Central zone ore feed. The softer ore results in a higher SAG throughput, but requires a higher ball mill to SAG mill power ratio to maintain flotation feed P_{80}.

The Ball Mill 5 circuit is identical to the existing four ball mill lines and will be operated in parallel with them. For MP08v2, the total ball milling power was capable of achieving a predicted P_{80} of 140 µm when Southwest zone and Hugo North (including Hugo North Extension) were to be processed concurrently and Central zone ore was to be introduced only as Hugo North production ramped down. The primary grind and regrind size range assumptions are shown in Table 17.7.

Table 17.7 Primary Grind and Regrind Target Size Ranges

Orebody	Primary Grind P_{80}, µm	Regrind P_{80}, µm
Hugo North	125–160	40–45
Southwest Zone	150–180	30–40
Central Zone Chalcopyrite	180–200	30–40
Central Zone Chalcocite	180–200	30–40
Central Zone Covellite	180–200	30–40

In addition, a contingency plan exists for configuration of the fifth mill in series rather than in parallel, should additional SAG mill capacity be developed by upstream debottlenecking. Flotation feed top size is controlled more effectively by series operation than by parallel operation, especially when the new feed to the circuit is pre-classified at a size coarse enough to allow additional grinding effort to be directed only to the coarsest 20 wt% of particles with the lowest recovery, rather than spreading it across the entire distribution that is coarser than the target grind. The net effect is a steeper flotation feed particle size distribution.

The regrind circuit has ample capacity to maintain the target grind for efficient concentrate cleaning at 121 ktpd capacity.

The metallurgical relationships developed are typically correlations between copper head grade and recovery and Cu : S ratio for concentrate grade.

Flotation cell criteria are compared in Table 17.8 at the peak head grade condition. Retention times are specified per cell, with eight cells in line in roughing, four cells in cleaning, and four cells in cleaner scavenging.

Table 17.8 Flotation Cell Design Criteria

Parameter	Rougher	Cleaner	Scavenger	Column
Cu concentrate grade (%)	15	30.8	15	42.9
Stage Cu recovery (%)	96	87	87	60
Carrying capacity, maximum (tph/m^2)	1.5	2	2	1.75
Retention time (minutes / cell)	2.5	2.5	2.5	–

Flotation circuit design is constrained by layout, available area, cell froth-carrying capacity limits, and minimum residence time requirements. Because of the change to much higher grade Hugo North (including Hugo North Extension) ore, eight additional 160 m^3 rougher bank cells have been selected for installation in the flotation area reserved for expansion in the Phase 1 design. An additional rougher bank was selected over a cleaner and cleaner scavenger bank because the rougher circuit was approaching its carrying capacity limits, as well as the rougher stage recovery being lower than the cleaner stage recovery in operation on Southwest ore. Residence time considerations are limited to maintaining minimum per cell residence times of 2.5 minutes to minimise short-circuiting potential. The rougher and cleaner cell retention scale-up factors relative to the latest SGS bench test work are1.65 and 2.5, respectively.

The design cleaning circuit recovery, at 3.0% copper in the feed, is 96%. With rougher losses, this equates to 93% overall copper recovery at peak head grade.

Additional column cells have been included to process the expected increased volume of concentrate. The column cell dimensions are identical to Phase 1 (5.5 m diameter x 16 m high). The concentrator conversion will require six new columns.

The concentrate thickener sizing parameters were based on test work; where it was determined that one additional 23 m diameter thickener, identical to the two supplied in Phase 1, will be required. Although the Phase 2 concentrate volumes are triple the concentrate volumes in Phase 1, the Phase 1 concentrate thickeners were so significantly over-sized that the addition of a third similar thickener will suffice for the conversion. The intent is to run two units and have one on standby, compared to current operation with one unit operating and one on standby.

The concentrate thickening and storage design criteria (Table 17.9) assume the following:

- Use of Magnafloc 5250 or equivalent anionic flocculant.
- Specific settling rate of 0.055 m^2/tpd at flocculant dosage of 10–15 g/t and 0.04 m^2/tpd at flocculant dosage of 15–20 g/t.
- Feed auto-dilution to 10%–15% solids.

Table 17.9 Concentrate Thickening and Storage Design Criteria

Design Parameter	Unit	Phase 1	Phase 2
Concentrate Flow	tph	118.7	240
Concentrate Flow	tpd	2,849	5,291
Unit Thickening Rate	m^2/tpd	0.055	0.055
Area Required	m^2	157	291
Thickeners Provided	ea	2	3
Diameter	m	23	23
Area Provided	m^2	830	1,245
Concentrate Tanks	ea	1	2
Concentrate Tank Volume	m^3	4,200	8,400
Storage Capacity	h	42.8	26.6
Desired Capacity	h	>28	>24

The Phase 1 concentrate filtration sizing parameters were based on Southwest zone concentrate test work performed by Larox at a 25 µm P_{80}. Existing operations data are used for Phase 2 design. The filtration rate for Southwest at 35 µm is taken as the midpoint between the peak and median three-day moving average filtration rates from May to December 2013, scaled up to the expected Phase 2 P_{80} of 40 µm. They result in the addition of two more 144 m^2 horizontal plate filters, identical to the two supplied in Phase 1. The design criteria include:

- Concentrate storage requirement minimum of 28 hours.
- Filtration rate of 0.75 tph/m^2.
- Cake moisture of 8.5%.
- Cake bulk density of 1.99 t dry solids per square metre.
- Filter cycle time of 10.5 minutes.

Concentrate bagging design is based on existing operations data. Operations reports that the maximum bagging rate, without circuit upgrades, is 3,934 tpd (wet) based on three of four bagging modules operating simultaneously. For Phase 2 the following design upgrades are required to increase the bagging plant capacity:

- Automation of the sampling, sealing, and scanning stages to allow the use of four modules simultaneously, providing a 33% increase in capacity.
- Installation of four additional modules. It is conservatively estimated that shared use of the existing roller conveyors will result in the four new modules providing a capacity increase of 50% instead of 100% because of queuing interference.
- Increase of bag capacity from 2.0–2.5 t. This would reduce the number of bags being filled by 20% and should result in an almost 25% increase in capacity (note that actual bag filling time is not capacity limiting). Rather than increase bag height, it is

recommended that the vibration cycle be extended and the cross section of the base of the bag be increased to improve stability.

With these upgrades the bagging plant will have a product design bagging rate of 411 tph (wet) (378 tph (dry)). At a planned usage rate of 7,100 h/a, the bagging capacity would be 2.7 Mtpa compared to a peak planned production of 1.9 Mtpa. This may obviate the need to automate, although this may be desirable from the perspective of operating cost reduction.

No additional tailings thickening capacity is planned for Phase 2 as the conversion is based upon the existing tailings capacity.

17.4.1 Equipment Supply

The selection of process equipment suppliers for the concentrator was based on sole-sourcing from existing Phase 1 suppliers. Along with the benefits of operator familiarity and commonality of spares, sole-sourcing was particularly appropriate in the following circumstances:

- To the same manufacturer as used in Phase 1 when long-term, high-level technical support will be necessary for the life of the operation.
- To the same manufacturer and equipment model / size as used in Phase 1 when larger equipment has not been proven up and when Phase 1 design has made provision for certain models and model dimensions, e.g., Phase 1 ball mill aisle, Phase 1 flotation cells, and Phase 1 pressure filter suppliers.
- To suppliers with which Rio Tinto Procurement has negotiated strategic agreements, e.g., supplier of general electrical equipment and variable-speed drives.

17.5 Process Plant Description

This section describes the flowsheet and general arrangement of the expanded processing facilities, starting at reception of ore from the overland conveying system and continuing through the concentrator to concentrate load-out and the distribution of tailings at the storage facility.

The description includes the modifications to be made to process Lines 1 and 2 to accept higher milling rates and head grades following the first three years after ore delivery from Hugo North (including Hugo North Extension) Lift 1.

17.5.1 Overview

The primary crushing and overland conveying systems that deliver crushed ore to the coarse ore stockpile do not need to be modified for Phase 2. The underground provides for the delivery of ore to the existing coarse ore storage gantry via an additional parallel conveyor, which was allowed for in the Phase 1 design.

The Oyu Tolgoi project employs a conventional SAG mill / ball mill / grinding circuit (SABC) followed by flotation, as shown in the basic flowsheet (Figure 17.1).

Coarse ore is slurried and ground to approximately 2.0 mm in semi-autogenous grinding

(SAG) mills. Screening of the discharge separates out +15 mm particles, which are transferred to pebble crushing for size reduction and then returned to the SAG mills. About 10%–15% of the feed circulates from the SAG mills to the pebble crushers, depending on ore type and grate condition. SAG mill screen undersize is ground further in ball mills operating in closed circuit with cyclones.

Figure 17.1 Basic Oyu Tolgoi Concentrator Flowsheet – Phase 1

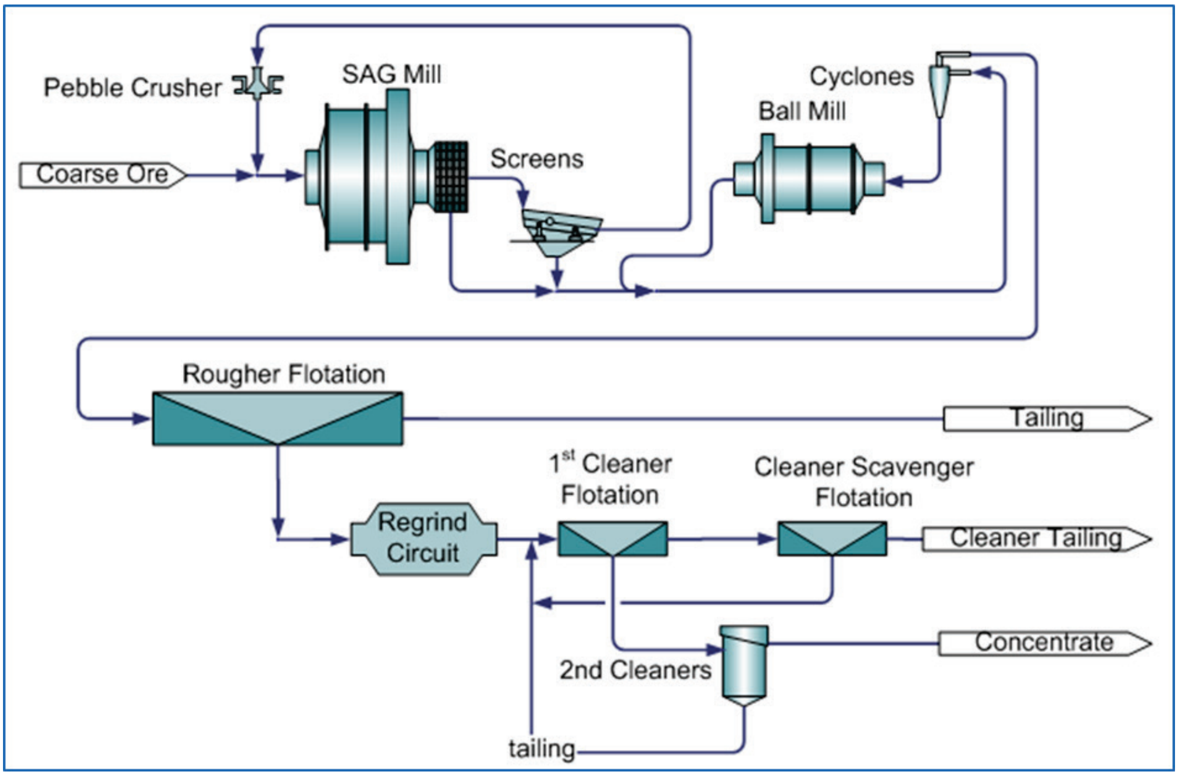


Figure by OT LLC 2014

The cyclone underflow returns to the ball mills, while the overflow with an 80% passing size of 140–180 µm is distributed by gravity to the rougher flotation cells. The rougher concentrate is then reground in vertical tower mills to 35 µm before delivery to the first stage cleaners. The concentrate from the first stage cleaners is pumped to the column cells, which produce the final grade concentrate.

Tailings from the cleaner and rougher flotation cells are combined, thickened, and pumped to the TSF, where they settle to their terminal density, allowing the recycle of process water to the concentrator. The cleaner concentrate is thickened, filtered, bagged, and shipped to market.

Phase 1, which commenced production in 2013, uses two grinding lines, each consisting of a SAG mill, two parallel ball mills, and associated downstream equipment to treat up to 100 ktpd of ore from the Southwest zone pit. Softer ore from the Central zone pit will be processed and combined with Hugo North (including Hugo North Extension) underground ore, concentrator feed rates will be as high as 121 ktpd, which represents the tailings handling capacity of the plant. The Phase 2 concentrator development programme optimises the concentrator circuit to enable it to maximise recovery from the higher grade Hugo North (including Hugo North Extension) ore.

When Cell 2 of the TSF becomes available for use, the tailings pumping system will be upgraded to feed TSF Cells 1 and 2. Before the underground mine reaches full capacity, Lines 1 and 2 will be expanded to allow them to handle both higher tonnage and higher grade material. The ball milling, rougher flotation, flotation columns, concentrate filtration, thickening, bagging and bagged storage facilities will be upgraded to accommodate the gradual introduction of ore from underground. In general, the augmentations embody the operational and maintenance philosophies guiding the design of Phase 1 and provide, as much as practicable, a seamless production environment.

The intent of Phase 2 is to treat all of the high-value Hugo North (including Hugo North Extension) ore delivered by the mine, supplemented by OT LLC's open pit ore to fill the mill to its capacity limit. The open pit feeds have different optimal processing conditions than does the Hugo North ore, and the concentrator operation will target capturing maximum value from the higher NSR of the underground ore. These conditions approximate those for Southwest zone ore but will not be optimal for Central zone ore, and the concentrate grade and recovery from the Central zone ore has been corrected accordingly. The high-grade of Hugo North (including Hugo North Extension) ore will generate high tonnages of concentrates, which will beneficially dilute impurities, particularly arsenic from the Central zone ore. Figure 17.2 is a block diagram of the process on completion of Phase 2.

Figure 17.2 Oyu Tolgoi Project Concentrator - Overall Block Diagram on Completion of Phase 2

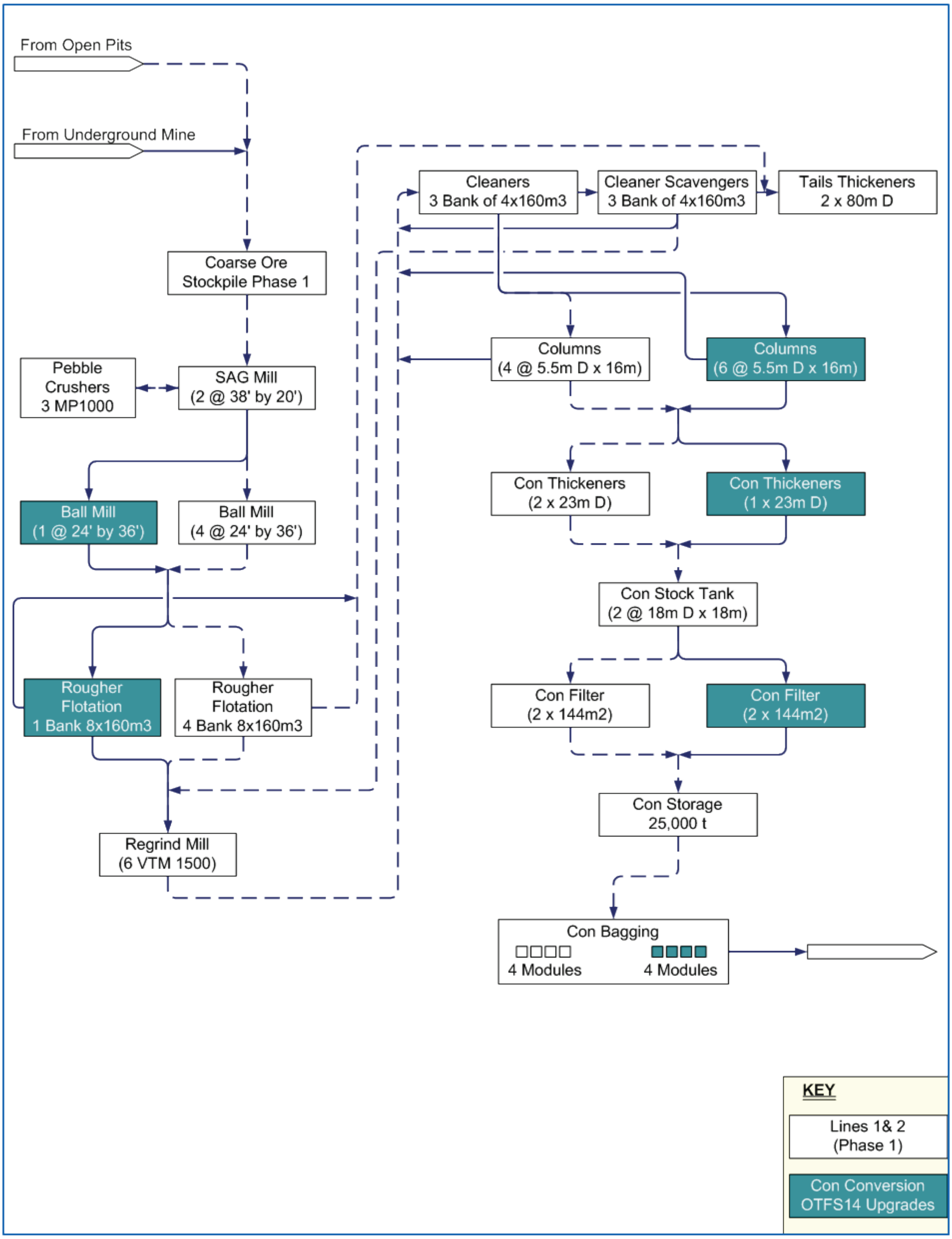


Figure by OT LLC

The existing concentrator substation to the south will be expanded to supply the additional electrical loads. The Phase 1 bagging plant will be expanded by the addition of four more bagging modules. This expansion was anticipated in the Phase 1 design, and ample room was provided for the new equipment.

17.5.2 Reagent and Grinding Media Storage and Supply

The conversion will share facilities with the Lines 1–2 reagent supply systems. The modifications to the reagent system are described below. In general, the aim is to have 45 days of reagent inventory on hand at or near the plant site.

- Lime – No additional lime storage capacity, beyond the four 1.0 kt silos installed in Phase 1 is required. An additional metering station will be required at the new rougher bank and the column cells.
- Primary Collector – The primary collector will be Aerophine 3418A (sodium di-isobutyl dithiophosphinate). Consumption will peak at nearly 1,700 kg per day, approximately 65% more than the Phase 1 usage. The Phase 1 system has ample dilution capacity to supply the conversion. An additional metering station will be required at the new rougher bank.
- Secondary Collector – The proposed on-site inventory for Phase 1 is 40 t, which has not been increased for the conversion. An additional metering station will be required at the new rougher bank. No secondary collectors are currently added in Phase 1.
- Frother – Frother distribution in Phase 1 provides for the use of two frothers, methyl isobutyl carbinol (MIBC) added neat, and a secondary frother (polyglycol ether or similar) added as a low concentration solution in water. Primary frother consumption in Phase 2 will be roughly equal to Phase 1 design at 15 g/t, peaking at nearly 1,800 kg per day due to a reduction in estimated consumption, as corroborated by May to December 2013 consumption reports. No additional frother tankage will be required. Delivery will be in 18 m^3 isotainers off-loaded by forklift and placed on a racking system, from which the contents will be pumped to the plant storage. Additional metering stations for each type will be required at the new rougher bank.
- Tailings Flocculant – The major flocculant will be a non-ionic type such as Magnafloc 338. Tailings flocculant use will increase to 2,400 kg per day, proportionate to tonnage. No new flocculant preparation equipment will be installed. The proposed reagent inventory is considered adequate for Phase 2. Recent testing of an alternate flocculant has led to higher underflow densities at significantly reduced consumption.
- Concentrate Flocculant – The flocculant used for concentrate thickening is an anionic variety, such as Magnafloc 5250. Concentrate flocculant demand will increase to 110 kg per day, but the Phase 1 capacity is sufficiently under-utilised that expansion will not be necessary. An additional flocculant metering pump and dilution system will be installed. Reagent inventory will be increased to five bulk bags.
- Water Treatment Chemicals –The existing anti-scalant and corrosion inhibitor supply systems will be adequate for both the process and raw water systems. The reagent inventory is also adequate for Phase 2.
- Grinding Media – No additional inventory is required for SAG milling.

For ball milling, the new Ball Mill 5 will use the existing 1.6 kt ball storage system for 75 mm balls and the ball conveying system will be modified to deliver to it. An additional inventory of 192 t of 75 mm media in quarter height isotainers is provided.

Using Phase 1 regrind media consumption estimates, the regrind mills will consume about 22 tpd of 16 mm media, reducing on-site inventory to eight days of operation. However, actual operating data for 2013 indicate a large decrease in consumption, from the design 2013 plan of 130–60 g/t for Southwest zone ore for OTFS14. Long-term consumptions in regrind milling are budgeted in terms of g/kWh for the various ore types.

17.5.3 Raw Water Supply

Raw water is used for:

- Cooling;
- Gland seal;
- Domestic and fire water;
- Column and filter wash water, and
- Total water inventory make-up to replace water lost to evaporation and to the settled tailings.

Raw water is delivered by pipeline from the lagoon to the raw water tank, from where it is pumped through cartridge filters to the grinding and air compressor cooling systems. Spent cooling water will supply a second gland seal water tank interconnected with the Phase 1 gland seal water tank. Excess spent cooling water will flow by gravity to the tailings collection box and make its way to the process water tank via the tailings thickener overflow; any shortfall in gland seal water requirement will be made up directly from the cooling water supply.

The concentrator conversion equipment will be serviced by the existing water system with minimal modification. The gland seal water storage capacity will be expanded and appropriate connections added to the existing network.

17.5.4 Process Water

The bulk of the process water is added to the SAG mill feed chutes and the cyclone feed pump boxes in high volumes at low pressure. The ball mills are secondary addition points. The rest of the process water is circulated around the mill at higher pressure for sprays, utility hoses, and other miscellaneous uses. A booster pump is provided for high-pressure washing of the mill liners. The increased tonnage in Phase 2 will require additional process water but no system modifications.

17.5.5 Water Balance

The concentrator raw water demand varies seasonally due to evaporation, ice formation on the TSF, and the release of water during spring thaw. The total site raw water demand has been estimated to range from a low of 678 L/s in June to as high as 932 L/s in the February–March period, with an average of 732 L/s. The design groundwater pumping capacity is 900 L/s. Utilising drawdown of the lagoons will slightly reduce the lagoon recharge rate, but the current projection is that the peak instantaneous raw water demand could exceed 900 L/s at the Phase 2 volumetric limit of 121 ktpd, and approach it at the average of 117.43 ktpd in the peak Phase 2 year (2021). This compares with the long-term average Gunii Hooloi groundwater extraction of 870 L/s approved by the MEGDT based on average usage over 40 years. The largest water loss, 564 L/s, is the entrained water in the settled tailings. The Phase 1 design specified a final tailings settled density of 73.5%. That value has not been realised to date and a value of 70% has been used in the water balance model.

17.5.6 Concentrator Power

With the addition of the concentrator conversion loads, the peak operating load demand from the existing 220 kV concentrator substation will increase by an estimated 20 MW (from 116–136 MW), and the nominal operating (diversified) load will increase by an estimated 19 MW (from 106–125 MW). The operating power demand includes the diversity, demand, and percent duty factors specific to the type of equipment and process.

Total demand for Phase 1 and the concentrator conversion combined during normal operating conditions is estimated at 150 MW peak operating load and 144 MW nominal operating (diversified) load. This includes the peripheral 35 kV ring loads to the concentrator account. This nominal operating load results in an estimated annual power consumption of 1,093,800 MWh for the combined concentrator, an incremental increase of 161,400 MWh for the concentrator conversion.

The existing concentrator 35 kV line will distribute power through cable feeders to the following:

- One 16 MVA, 35 kV–10.5 kV Ball Mill 5 oil-filled transformer, and
- One 16 MVA, 35 kV–6.3 kV oil-filled transformer from a new 35 kV GIS switchgear section to be added.

The modifications will provide power for all of the new conversion equipment, in addition to the power demands of the relocated air compressors and the new column cells.

18 PROJECT INFRASTRUCTURE

18.1 Introduction

Most of the infrastructure facilities required for the Oyu Tolgoi project were completed during Phase 1. The facilities discussed in this section are summarised in Table 18.1. A site plan showing the key infrastructure and locations of the plant and mines is shown in Figure 18.1. The EJV LHTR16 Hugo North Extension mining area is to the north of the Oyu Tolgoi ML. All infrastructure is currently within the OT LLC licence area.

Table 18.1 Summary of Infrastructure Facilities

Facility	**Phase 1**	**LHTR16**
Power Supply	From China	No change
220 kV Substations	Central substation	No change
	Concentrator substation	No change to concentrator 220 kV substation
	Shaft farm substation	Shaft farm substation to be modified
Power distribution	220 / 35 / 10.5 kV	Upgrade existing 35 and 10.5 kV systems
Standby-power	2 x 20 MW diesel power stations	No change
Access Roads	Internal access roads	Expanded internal access
	OT Road	Wildlife crossings added
	Concentrate logistics facilities	Expanded logistics facilities
	North gatehouse	–
Airport	Regional airport	No change
Camp Accommodations	SOT camp (2,818 beds)	SOT camp expansion (1,580 beds)
	Manlai camp (2,921 beds)	No additional construction camp facilities required
	Erchim camp (879 beds)	–
	Javkhlant camp (1,722 beds)	–
	Khanbogd Camp (1,539 beds)	–
Maintenance Facilities	Gobi Maintenance Complex	UG facilities
	Open Pit Truck Shop	–
	Toyota Workshop	–
Administration Building	410-person office	–
Central Mine Dry	1,200 lockers	–
Water Systems	Undai River diversion	No change
Water distribution	Raw water	Expansion of existing systems
	High pressure firewater	Expansion of existing systems

Facility	Phase 1	LHTR16
	Domestic water	Expansion of existing systems
	Sewer	Expansion of existing systems
	Return water	No change
Raw Water Supply from Borefield	900 L/s	No change
Water Treatment	Water treatment & bottling plant	No change
Wastewater Treatment	4,200 equivalent person	No change
ICT	Distributed control system	Expansion of existing systems
	Electrical monitoring system	Expansion of existing systems
	Local area network / voice-over internet protocol	Expansion of existing systems
	Fire alarm system	Expansion of existing systems
	Access control system	Expansion of existing systems
	Closed-circuit television	Expansion of existing systems
	Cable television	Expansion of existing systems
Operations Warehouse	8,100 m^2 + 4,500 m^2	6,600 m^2
Medical Centre	Medical centre	No change
Fire Station	Built during early construction	No change
Central Heating	2.0 x 7.0 + 2.0 x 29 MW central heating plant	2.0 x 29 MW expansion + 2.0 x 15 MW diesel backup
Waste Disposal	Solid Waste and Recycling	Recycling and composting building. Two landfill cells
	Two leachate cells	One leachate cell
	Incinerator	No change
Fuel Storage:		
Mobile Fleet	3,600 kL diesel , 100 kL gasoline	No change
Diesel Power Station	200 kL diesel	No change
Underground Diesel Storage	–	Expansion for underground operation
Core Management	Core Management Centre	No change
Construction Water	Supplied by 19 site bores	by raw water system
Batch Plants	Batch Plant No. 1 – 60 m^3/hr	No change
	Batch Plant No. 2 – 240 m^3/hr	–
	Batch Plant No. 3 – 40 m^3/hr	–

Figure 18.1 Oyu Tolgoi Project Site Plan

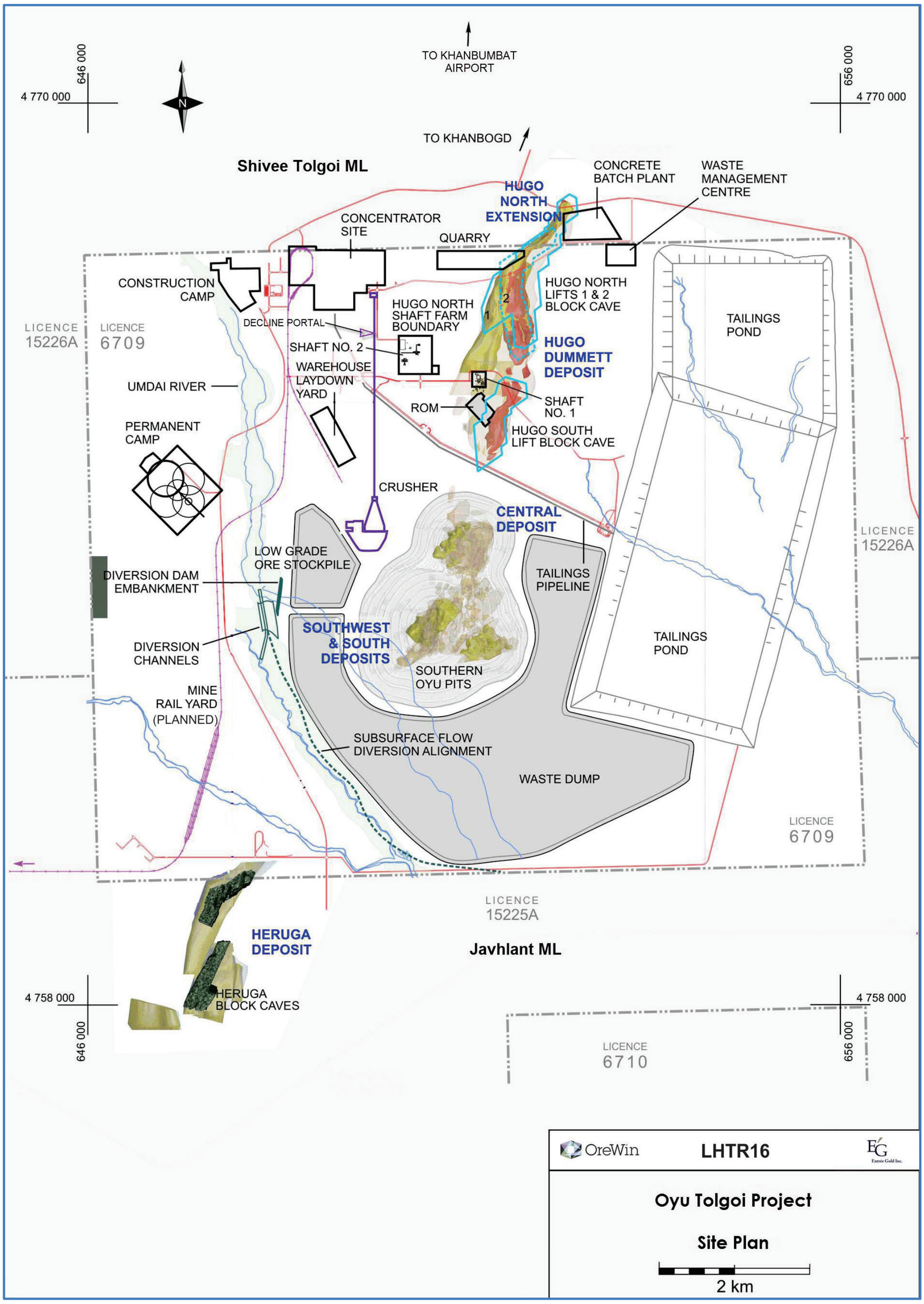


Figure by OreWin.

18.2 Power

18.2.1 External Supply

OT LLC has a Power Purchase Agreement with the Inner Mongolia Power Corporation to supply power to the Oyu Tolgoi project. The term of this agreement covers the commissioning of the business, plus the initial four years of commercial operations.

In August 2014, TRQ announced that OT LLC had signed a Power Sector Cooperation Agreement (PSCA) with the GOM for the exploration of a Tavan Tolgoi-based independent power provider (IPP). The aim of the PSCA is to lay out a framework for long-term strategic cooperation between the GOM and OT LLC for a comprehensive energy plan for the South Gobi region. Participation in the PSCA meets OT LLC's obligation in the IA to establish a long-term power supply within Mongolia four years from the commencement of commercial production. Signing of a PSCA has reset the four years obligation while the opportunity for the establishment of an IPP at Tavan Tolgoi is studied.

The PSCA provides a framework for a broad range of power-related issues, including the establishment of a power generation source, transmission lines, and power imports. The centrepiece of the PSCA is an open, international tender process to identify and select an IPP to privately fund, construct, own, and operate a power plant to supply electricity, with Oyu Tolgoi as the primary consumer.

OT LLC plans to actively participate in the processes of the PSCA to ensure that there is a timely and reliable power supply solution for Oyu Tolgoi and this approach is endorsed.

In May 2015, as part of the agreement between stakeholders for the UDP, OT LLC committed to providing working assumptions for a financing plan towards supporting a long term power agreement with a Tavan Tolgoi power station.

18.2.2 On-site Distribution

Power is distributed through 220 kV / 35 kV transformers which provide power to 35 kV substations to supply the concentrator ring loads, including primary crushing, conveying, and tailings pumping, some infrastructure loads, and the borefield loads. Both medium and low-level voltages are used for power distribution. Medium voltages are 35 kV, 10.5 kV, 6.3 kV, 3.3 kV, and 1.0 kV, all 3-phase and 50 Hz. Low voltages are 690 V and 400 V, both 3-phase, and 220 V, single-phase at 50 Hz.

18.3 Transport and Logistics

Internal roads for the Oyu Tolgoi project are unpaved and maintained for suitable and safe access across the mine. Concentrate and supplies are currently transported along a 105 km sealed road that has been constructed to the Mongolian–Chinese border crossing at Gashuun Sukhait.

OT LLC has constructed a 3.25 km concrete airstrip and the site is serviced by charter and scheduled flights to and from Ulaanbaatar. The design criteria are set to service commercial aircraft up to the Boeing 737–800 series aircraft. Ulaanbaatar has an international airport, and Tsogttsetsii, and Dalanzadgad each have regional airports.

The GOM has committed to providing OT LLC with non-discriminatory access to any railway constructed between Mongolia and China. GOM is currently constructing a standard gauge single-track heavy-haul rail from the Tavan Tolgoi coal mine (approximately 120 km to the north-west of Oyu Tolgoi) to Gashuun Sukhait, ultimately to be interconnected with the Chinese rail network at Ganqimaodao on the Chinese side of the border. Once constructed, the South Gobi Rail alignment would pass across the Javhlant license and therefore represents an opportunity for eventual connection of the mine to the rail network. Rail line construction is approximately 50% complete but could be finished as early as 2018. The railway construction is currently halted due to lack of funding. The route of the rail line is shown in Figure 18.2.

A rail corridor has been allowed for to connect the Oyu Tolgoi project and the Tavan Tolgoi rail and enters the project area from the south–west corner through the Javhlant and heads north to a rail yard and then on to the warehouse and concentrate storage building. An allowance has been made in the project site layout for a rail link to the operation and rail link has been included in the alternate production cases analysis to the site for the transport of:

- Concentrate (outbound to various Chinese smelters).
- Coal for the power plant (inbound from Mongolian coal mines).
- Diesel fuel (inbound from Russia).
- Other inbound equipment and consumables.

Figure 18.2 Oyu Tolgoi Regional Road and Rail

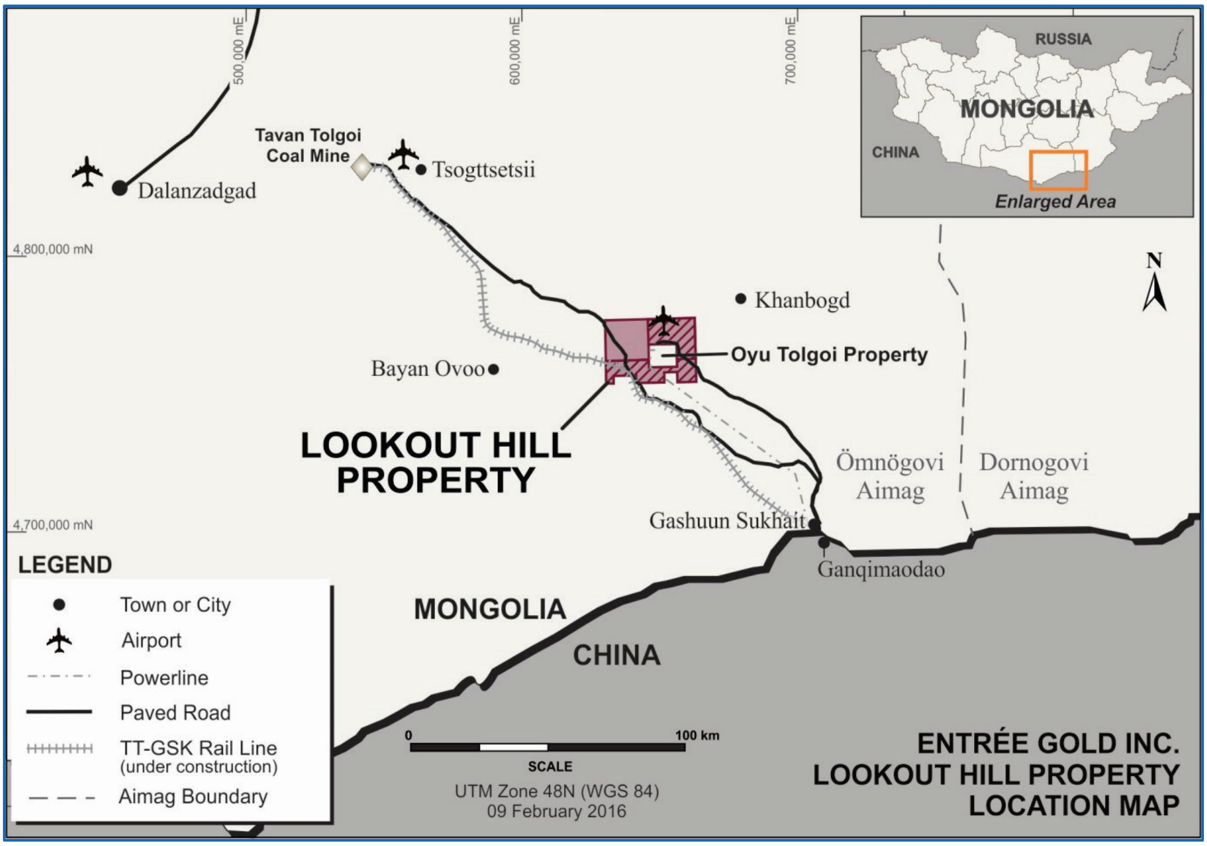


Figure by Entrée 2016

18.4 Administration and Support

The administration and support infrastructure includes the administration building, North gatehouse, medical centre, fire station, operations warehouse, central mine dry batch plants and core management facility.

Accommodation is currently provided to the Oyo Tolgoi project through on site and satellite camps. Messing facilities are included in the camps. A recreation centre is located in the main camp area. Some personnel live in Khanbogd, located approximately 35 km to the north–east.

The current maintenance facilities support the plant and infrastructure, open pit construction and light vehicle fleets. The current fuel storage facilities will support the open pit and current plant and infrastructure configuration.

Information and communications technology (ICT) provides control, monitoring, and communications systems. These facilities are provided within the plant, mine and infrastructure facilities.

18.4.1 Water Management

18.4.1.1 Water Supply

Due to low average annual precipitation in the project area, water management and conservation are given the highest priority in all aspects of project design.

The development of a borefield to access groundwater reserves within the Gunii Hooloi aquifer basin has been established as the most cost-effective option to meet the raw water demand for the project. Water from the borefield is used for process water supply, dust suppression in the mining areas, and potable use. Another major component of the water management plan is the diversion of the Undai River to accommodate project facilities. Undai River water is not used by the mine; the diversion is to preserve this water in the environment.

OT LLC has affirmed it is committed to water conservation and has benchmarked its water conservation efforts against other mines by assessing factors such as quantified water consumption per tonne of concentrate produced. The current water budget is based on the use of 550 L/t and operating performance of the concentrator suggests this is a reasonable estimate. The water consumption compares favourably with other large operations in similar arid conditions.

Based on the first two hydrogeological investigation programmes, the Gunii Hooloi aquifer has been demonstrated and approved by the MEGDT to be capable of providing 870 L/s, based on usage over 40 years and with limitations on drawdown that ensure that the main body of the aquifer remains in confined conditions.

Updated hydrogeological modelling, completed in 2013, and based on all three hydrogeological investigation programmes, demonstrates that the Gunii Hooloi aquifer is capable of providing 1,475 L/s, based on the same time and drawdown conditions.

Hydrogeological analytical study and reporting, to Mongolian norms, remains to be completed in order to demonstrate and gain approval from the MEGDTof updated approved water reserve for the Gunii Hooloi aquifer.

18.4.1.2 Distribution and Use

Raw water distribution from the borefield lagoon to the site and throughout the site is designed as a gravity flow system. Two DN900 ductile iron pipes deliver raw water from the lagoon to the concentrator water tank, then to individual buried pipes that convey water to other functional areas of the site; pipe burial depth is 2.5 m. Raw water is provided to the concentrator, the main camp area, (including the water treatment plant), the Production Shaft Farm, the central heating plant, the warehouses, the open pit and central maintenance truck shops, and the primary crusher. Raw water will be provided to the underground mine for makeup and other services during construction and operations. Local flow meters are provided to monitor raw water consumption in each area.

The borefield lagoon for raw water storage is about 4.5 km away from site. The lagoon can hold 400,000 m^3 of water to provide approximately one week of emergency / buffer storage in case of any interruption in the supply of water from the borefield.

Minimising water use throughout all the operational aspects has been a key focus of attention during mine planning and design. As examples of water conservation planning, the following initiatives have been implemented:

- Reuse of cooling water –The process plant is the largest consumer of water. Within the plant, all water discharged from the cooling systems, still categorised as clean water, is sent to the process water pond for reuse in the concentrator.

- High-efficiency tailings thickeners – The tailings thickener at Oyu Tolgoi uses advanced techniques and is able to achieve a tailings solids content of 60%–64%, which significantly reduces the amount of water sent to the TSF. These design modifications help to greatly reduce the amount of reclaim water released and evaporative losses from the TSF.

- High-efficiency TSF reclaim – The TSF has been designed so that tailings are deposited in discreet cells, rather than broadly across the facility, to reduce evaporative losses. The entire base of the TSF rests on natural or installed clay and includes a comprehensive seepage collection system to minimise seepage losses. The TSF reclaim system has been designed to ensure that all supernatant water and collected seepage is returned to the process plant for reuse.

- 100% mine water recovery – All water encountered in the underground and open pit mines is recovered for use as process water or for dust suppression. Recovery of mine water helps to reduce site demand for raw water from the Gunii Hooloi aquifer. From a water balance perspective, this mine recovery water has conservatively not been included as inflow.

- 100% treated wastewater reuse – All treated wastewater produced in the site wastewater treatment plant will be reused in the process plant or for dust suppression.

- 100% truck wash water reuse – A comprehensive water treatment system has been installed at the project mine truck washing facility to allow all truck wash water to be continuously recycled and reused.

- Lagoon floating cover – A floating cover is placed over the entire raw water storage lagoon to eliminate evaporative water losses and to limit the accumulation of dust within the lagoon.

- Selection of low or zero water use equipment – Examples of this include the selection of air cooling systems at the hazardous waste incinerator and central heating plant.

Ongoing attention to water conservation will be maintained during operation through the continuous review of key performance indicators for water use and implementation of additional water conservation measures.

18.5 Tailings Storage Facility

For the first 18 years of production, the TSF will consist of two cells, each approximately 4 km^2 in size, to store a total of 670 Mt of tailings. The facility will be constructed in two stages, starting with Cell 1 and then continuing with Cell 2. The general arrangement of the cells is shown in Figure 18.3.

Each cell will be divided into four parallel sub-cells by berms. Berms, or 'splitter dykes', will constrain the active tailings beach to one sub-cell. An alternative method of tailings deposition management, whereby the number of spigots is increased to include the south-west side of the tailings, is being evaluated. This would eliminate the splitter dikes and present a cost savings. Supernatant water will run down the active beach to the eastern embankment and flow from there to one of two reclaim ponds situated on the north-east corner of Cell 1 and south-east corner of Cell 2. The two reclaim ponds may be combined in future by eliminating the central north embankment of Cell 1. However, the two cells would need to be combined within the next two years to eliminate the centre dike between Cells 1 and 2. The current cost estimate is conservatively based on each cell being raised independently, with some duplication of one of four walls for each cell.

The original impoundment design is based on the assumption that the tailings beach will slope from the deposition point to the reclaim pond at an average of 1%. Sensitivity analyses were completed for beach slopes varying from 0.7% to 1.5% for the starter dam facility. At flatter beach slopes, the eastern dike must initially be raised more quickly (while the western dike is raised more slowly). Likewise, flatter beach slopes tend to correspond to lower placed tailings density, which requires the embankments to be raised more quickly. Rates of rise in 2015 reduced considerably, indicating both melting of winter ice and tailings consolidation.

Figure 18.3 Tailings Storage Facility (TSF) – General Arrangement of Cells 1 and 2

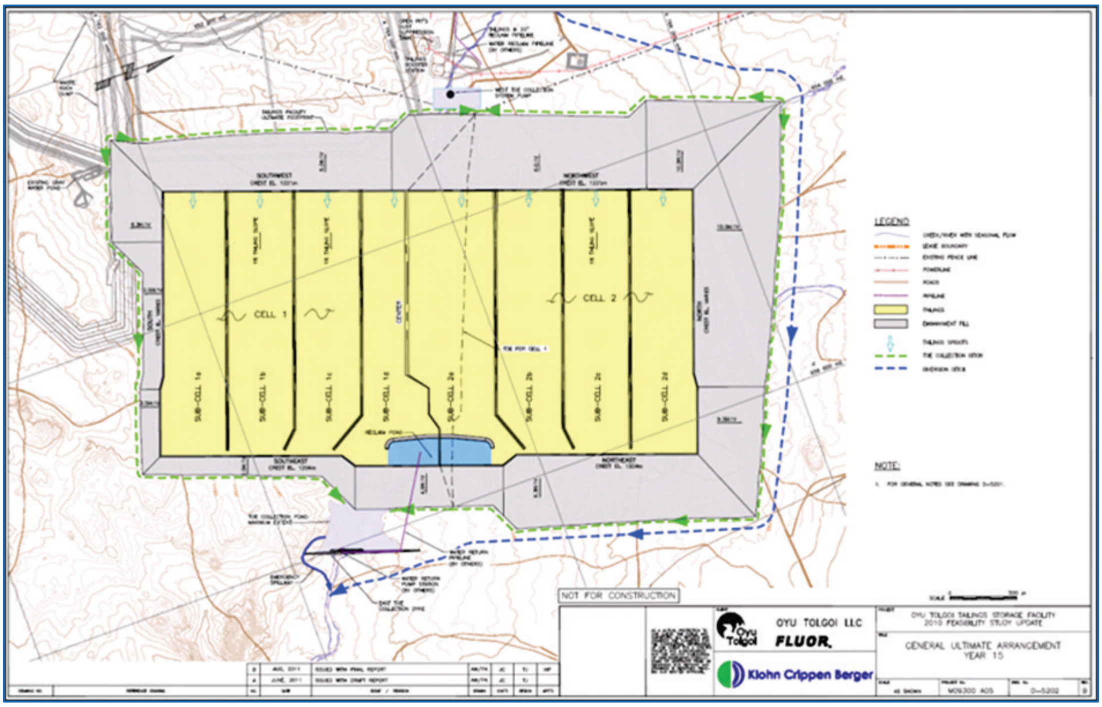


Figure by OT LLC 2014

19 MARKET STUDIES AND CONTRACTS

Shipment of Oyu Tolgoi concentrates commenced in July 2013. Concentrate is sold in-bond free-on-board at a bonded yard on the Chinese side of the border in Ganqimaodao. Sales contracts were signed for 100% of Oyu Tolgoi's 2015 concentrate production and 90% of 2016 planned production; over 80% of concentrate production has been contracted for up to eight years.The concentrate is loaded into 2 t bags and shipped 'delivered at place' (DAP) by truck to the Mongolian–Chinese bi lateral trade border at Gashuun Sukhait (GSK)–Ganqimaodao, and also to the dedicated customer pickup facility at the Huafang terminal in China, approximately 7 km from the border. At these locations, the customers will pay for the copper concentrate by means of a letter of credit and take responsibility for delivery of the concentrate by truck or train to the respective smelters.

OT LLC has developed a marketing strategy for the Oyu Tolgoi project, including the EJV Property. Key considerations in the development of the marketing strategy include:

- Location of customer compared to imported material landed at Chinese ports (OT LLC to pay freight differential from mine to customer versus port to customer).
- Precious metals recovery and payment.
- Length of contract.
- Percentage of off-take to smelters versus traders.
- Percentage of tonnage on contract versus spot.
- Percentage of feed for any one smelter.
- Number of customers for a given scale of operation.
- Management of concentrate quality and volume during commissioning and ramp-up.
- Alternate off-shore logistics and costs.
- Delivery point and terms.

Product specifications are updated for the short-term and medium-term planned production schedules. OT LLC communicates and discusses any specification changes with Oyu Tolgoi customers. The commercial terms are planned be in line with conditions on the international concentrates market. The smelter terms used in this study are from OTFS14. OTFS14 is based on OT LLC's assessment of the copper market and standard smelter terms in general use throughout the industry.

Under the terms of the Joint Venture Agreement appended to the Earn-In Agreement (Article 12), Entrée retains the right to take the product in kind. For LHTR16 it has been assumed that the sales of concentrate have been undertaken by OT LLC production using the same smelter terms, transport and other marketing costs as for the OT LLC concentrate.

19.1 Supply and Demand Forecasts

The OT LLC analysis of the copper market suggests long-term dynamics for copper will be driven by a combination of factors. Significant increases are forecast in copper consumption per capita, owing particularly to the industrialisation and urbanisation of China and other emerging markets. A back-drop of strong copper demand and constrained supply is expected to offer fundamental support to copper prices. In recent years, supply has failed to respond quickly enough to increased demand from emerging regions. Global electrification and the growth of China and India will drive the increasing intensity of use per capita GDP.

Copper demand will also benefit from a greater long-term focus on renewable sources of energy and energy-efficient technologies such as wind turbines and electric / hybrid vehicles, which are of copper-intensive fabrication.

The forecast risks in bringing on new copper supply pertain to technical difficulties, increased political unrest, the length of time required for permitting and approvals, and unforeseen disruptions caused by operational failures, strikes, and labour shortages.

19.1.1 Global Copper Smelting Capacity

Overall, global smelting capacity is expected to increase by the end of 2025. China is forecast to see the majority of growth in the next five years. Historically, raw material constraints have resulted in low utilisation rates, which have exacerbated the regional Chinese demand for concentrate, and this trend is forecast to continue. The issue in the years ahead will be the availability of concentrates for the custom smelters as Chinese capacity continues to grow. The market for custom, or traded, concentrates – those that are mined and processed by different companies – now accounts for more than half of the copper concentrates processed.

The proportion of total concentrate production accounted for by the custom market has risen in recent years due to the rapid growth of the custom smelting industries in China and, to a lesser extent, India. Despite limited domestic resources, Chinese companies have invested heavily in smelting capacity and are highly dependent on the custom market for raw materials.

20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 Environmental and Social Impact Assessment

Holders of a ML in Mongolia must comply with environmental protection obligations established in the Environmental Protection Law of Mongolia, Law of Environmental Impact Assessment and the Minerals Law. These obligations include preparation of an environmental impact assessment (EIA) for mining proposals, submitting an annual environmental protection plan (EPP), posting an annual bond against completion of the protection plan and submitting an annual environmental report.

OT LLC has posted environmental bonds to the MEGDT in accordance with the Minerals Law of Mongolia for restoration and environmental management work required for exploration and the limited development work undertaken at the site. OT LLC pays to the Khanbogd Soum annual fees for water and road usage, while sand and gravel use fees are paid to the Aimag government in Dalanzadgad.

OT LLC has completed a comprehensive Environmental and Social Impact Assessment (ESIA) for the Oyu Tolgoi project, including the EJV property. The culmination of nearly 10 years of independent work and research carried out by both international and Mongolian experts, the ESIA identifies and assesses the potential environmental and social impacts of the project, including cumulative impacts, focusing on key areas such as biodiversity, water resources, cultural heritage, and resettlement.

The ESIA also sets out measures through all project phases to avoid, minimise, mitigate, and manage potential adverse impacts to acceptable levels established by Mongolian regulatory requirements and good international industry practice, as defined by the requirements of the Equator Principles, and the standards and policies of the International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), and other financing institutions. The IFC and the EBRD have similar, but not identical, definitions for the scope of an impact assessment. Both institutions frame assessments in terms of a project's 'area of influence'. The guidance provided by both IFC and the EBRD was utilised in defining the scope of the ESIA. The Oyu Tolgoi ESIA builds upon an extensive body of studies and reports, and Detailed Environmental Impact Assessments (DEIAs) that have been prepared for project design and development purposes, and for Mongolian approvals under the following laws:

- The Environmental Protection Law (1995)
- The Law on Environmental Impact Assessment (1998, amended in 2001)
- The Minerals Law (2006)

These initial studies, reports and DEIAs were prepared over a six-year period between 2002 and 2008, primarily by the Mongolian firm Eco-Trade LLC, with input from RPS Aquaterra on water issues.

The original DEIAs provided baseline information for both social and environmental issues. These DEIAs covered impact assessments for different project areas, and were prepared as separate components to facilitate technical review as requested by the GOM.

OT LLC has implemented and audited an environmental management system (EMS) that conforms to the requirements of ISO 14001 : 2004. Implementation of the EMS during the construction phases will focus on the environmental policy; significant environmental aspects and impacts and their risk prioritisation; legal and other requirements; environmental performance objectives and targets; environmental management programmes; and environmental incident reporting. The EMS for operations consists of detailed plans to control the environmental and social management aspects of all project activities.

Following submission and approval of the initial DEIAs, the GOM requested that OT LLC prepare an updated, comprehensive ESIA whereby the discussion of impacts and mitigation measures was project-wide and based on the latest project design. The ESIA was also to address social issues, meet GOM (legal) requirements, and comply with current IFC good practice.

For the ESIA the baseline information from the original DEIAs was updated with recent monitoring and survey data. In addition, a social analysis was completed through the commissioning of a Socio-Economic Baseline Study and the preparation of a Social Impact Assessment (SIA) for the project. The requested ESIA, completed in 2012, combines the DEIAs, the project SIA, and other studies and activities that have been prepared and undertaken by and for OT LLC.

Table 20.1 summarises the previous key baseline studies and core DEIAs prepared for the Oyu Tolgoi project, and Table 20.2 summarises of the supplementary DEIAs and studies.

Table 20.1 Baseline and Core DEIA Studies for the Oyu Tolgoi Project

EIA Study Title	Description	Date	Status
Environmental Baseline Study for Oyu Tolgoi	Covers geography, geological, hydrology, hydrogeology, soil, climate, air quality, flora and fauna, the socio-economic status, and infrastructure of the Oyu Tolgoi site and its surrounding areas.	2002	No approval required
Environmental Baseline Study for Town Planning	Covers geography, geological, hydrology, hydrogeology, soil, climate, air quality, flora and fauna, the socio-economic status and infrastructure of potential development and interconnecting infrastructure areas for Khanbogd town developments.	2012	No approval required
Oyu Tolgoi EIA Volume I: Transport and Infrastructure Corridor from Oyu Tolgoi to Gashuun Sukhait	DEIA of the road and power line proposal from Oyu Tolgoi to the Gashuun Sukhait border crossing. Provides approval for access through the South Gobi Strictly Protected Area (SGSPA). A number of amendments have been undertaken to address changing alignments.	2004 2006 2010 2012	Approved Approved Approved Approved
Oyu Tolgoi EIA Volume II: Water Supply from the Gunii Hooloi Aquifer	DEIAs for the proposed aquifer and water supply system for the provision of a sustainable water supply to the Oyu Tolgoi. A number of amendments have been completed to capture developments in the groundwater resource assessment and water supply pipeline design.	2004 2009 2010 2012	Approved Approved Approved Approved
Oyu Tolgoi Volume III: Oyu Tolgoi Mining and Processing Facilities	DEIA of the open pits, underground mine, concentrator, tailings, and all facilities and support infrastructure located within the Oyu Tolgoi Mining License Area (MLA). The assessment was largely based on IDP05, but reflected the general permitting layout of May 2006. The maximum production rate was assumed to be 85 ktpd.	2006 2012	Approved Approved
Oyu Tolgoi Volume IV: Coal Fired Power Plant	EIA documentation drafted for a coal-fired power plant at the Oyu Tolgoi site. An amendment has been undertaken to reflect updates in design for three 150 MW generating units.	2006 2011	Not submitted Approved

Table 20.2 Supplementary DEIA Studies for Oyu Tolgoi

Project EIA Component	Description	Date	Status
Fuel Station Facility	DEIA for the fuel facility built in 2004 within the MLA. Amendment completed for extension of the fuel depot.	2005 2010	Approved Approved.
Shaft 1	DEIA for Shaft 1, including headframe facilities, waste rock, and water disposal.	2005	Approved.
Shaft 2	DEIA for Shaft 2, including headframe facilities, waste rock, and water disposal.	2006	Approved.
Diesel Power Station	DEIA for the diesel power station located within the MLA.	2007	Approved.
Waste Water Treatment Plant	Supplementary DEIA for the construction camp waste water treatment plant expansion to 4,000-person equivalent capacity.	2007	Approved.
Quarry Batch Plant and Quarry	DEIA of hard rock quarry, concrete batching plant, and crusher located at the northern boundary of the MLA.	2007	Approved.
20 MW Diesel Power Plant	The assessment included the initial development of 6 x 2 MW diesel power stations followed by a Stage 2 addition of four 2 MW diesel generators.	2007	Approved.
Chemicals	Covers the importation, storage, use, and disposal of chemicals. Amendments have been undertaken to update chemicals being used in construction, commissioning, and operation.	2008 2011 2012	Approved Approved Approved
Javhlant ML – Entrée Lease Area	DEIA for future project facilities, infrastructure, and Heruga underground mine located within the southern Javhlant-Entrée lease area.	2009	Approved
Shivee Tolgoi ML – Entrée Lease Area	DEIA for project facilities, infrastructure, and portion of the Hugo Dummett underground mine located within the northern Shivee Tolgoi ML – Entrée lease area (Shivee West).	2009	Approved
Main Fuel Storage Facility	DEIA for the main fuel storage facility within the Oyu Tolgoi ML.	2011	Approved
Undai River Diversion Detailed Environmental Impact Assessment	DEIA for diversion of the Undai River.	2011	Approved
Oyu Tolgoi to Khanbogd Power Line	Covers the development of a 35 kV power line connecting Oyu Tolgoi to Khanbogd. DEIA has been developed, but approval was obtained based on a DEIA screening submission.	2012	Approved (based on screening submission)

For the purposes of the ESIA, the 'project' constitutes the direct activities that are to be financed and / or over which the project can exert control and influence through the project design, impact management, and mitigation measures. This includes:

- All Oyu Tolgoi project facilities within the Oyu Tolgoi ML area and surrounding 10 km buffer zone, including the following key features:

  - Open pit mining facilities
  - Underground mining facilities
  - Accommodation camps
  - Construction-related activities and facilities, including concrete batch plant, quarry, and laydown areas
  - Power generation facilities
  - Heating plant and boilers
  - Crusher
  - Concentrator
  - Tailings storage facility
  - Water management facilities (including diversion of the Undai River)
  - Waste water management facilities for camps and mining operations
  - Waste management facilities (municipal and industrial)
  - Waste rock storage facilities
  - Access roads within the ML area
  - Vehicle and equipment maintenance and repair facilities
  - Fuel storage facilities
  - Electrical power distribution infrastructure
  - Administration buildings and catering facilities
- Airport facilities, including a temporary and permanent airport and associated local access roads to the Oyu Tolgoi mine site.
- Contractor accommodation camps adjacent to Khanbogd soum.
- Potential dedicated off-site worker accommodation planned for Khanbogd soum.
- Gunii Hooloi water abstraction borefield and the water pipeline supplying the mine, as well as maintenance roads, pumping stations, construction camps, storage lagoons, and other support infrastructure.
- Infrastructure improvements (and associated resource use) by Oyu Tolgoi between the mine site and the Chinese border, including the 220 kV power transmission line, the access road that will be used for concentrate export, construction camps, local water boreholes, and borrow pits.
- Dedicated border crossing at Gashuun Sukhait for the exclusive use of the Oyu Tolgoi project.

- The concentrate will be sold by Oyu Tolgoi at the Mongolia–China border crossing at Gashuun Sukhait. The point of sale marks a key boundary to the project area.
- Infrastructure components that may be transferred to third-party ownership in the future.

A number of infrastructure components of the project considered within the ESIA will be constructed by OT LLC but may be transferred at some stage to public or third party operation and / or ownership. Transfer of these infrastructure components to public operation and ownership will limit the degree of control that OT LLC can exert over their management and operation. These infrastructure components, which may be owned and operated by the GOM and will or may be used by members of the public and / or other commercial operations, include:

- The permanent airport, which is planned to be handed over to the GOM after the completion of the project construction phase.
- The road from the Oyu Tolgoi project to the Chinese border at Gashuun Sukhait, which follows the alignment for the designated national road and is planned to be handed over to the GOM upon completion of the project construction phase.
- The dedicated border crossing facility at Gashuun Sukhait, which will be operated by the Mongolian authorities.
- The 220 kV electricity transmission line from the Chinese border to Oyu Tolgoi, which may become owned by the GOM.

20.2 Environmental and Social Baseline

Plans for ongoing data collection and studies are set out in the corresponding impact assessment chapters and management plans of the ESIA, as well as supplementary Operational Management and Monitoring Plans, to ensure baseline data continues to improve and that the results of ongoing monitoring and improved knowledge are integrated into updated and revised management plans and procedures.

In each baseline chapter of the ESIA, the following issues were considered in order to draw together the data and provide an overview of the sources, robustness, and validity of the original data:

- Clarity of data sources with key references cited, ensuring a clear appreciation of the origin of information used.
- Identification of third-party data verification undertaken by OT LLC.
- Clear descriptions of the methodologies used to develop the baseline data.
- Identification of where OT LLC has commissioned further data collection, or where data collection remains ongoing.

The baseline chapters presented in the ESIA are, necessarily, a summary of an extensive body of research and assessment that has been ongoing over many years covering the biophysical environment and human environment.

The biophysical environment baseline addresses the following topics:

- Climate and climate change.
- Air quality.
- Noise and vibration.
- Topography, geology, and topsoils.
- Water resources.
- Biodiversity.
- Ecosystem services.

The human environment baseline addresses the following topics:

- Population and demographics.
- Employment and livelihoods.
- Land use.
- Transport and infrastructure.
- Cultural heritage.
- Community health, safety, and security.

20.2.1 Future Project Elements not Directly Addressed in the ESIA

In addition to the Oyu Tolgoi project elements identified above, certain other activities and facilities are expected to be developed over time, either as part of or in support of the project, which do not constitute part of the project for the purposes of the ESIA. These include:

- Long-term project power supply. Under the terms of the IA, OT LLC will source electricity from within Mongolia within four years of the commencement of project operations. OT LLC may develop a coal-fired power plant within the Oyu Tolgoi ML project area to provide the required power from Mongolian sources.

- The rail link to be constructed from the South Gobi into China from the Tavan Tolgoi area will have significant impacts in terms of reducing the volume of heavy vehicles transporting concentrate from Oyu Tolgoi. This will require additional studies and analysis but is likely to have an overall positive impact.

20.3 Environmental Impacts and Mitigation Measures

OT LLC has identified impacts and planned mitigation measures for the Oyu Tolgoi project. The key impacts that have been identified are:

- Climate and Air Quality

- Noise and Vibration
- Topography, Geology, and Topsoils
- Water Resources
- Biodiversity and Ecosystem
- Land Use and Displacement
- Heritage
- Communities and Community Members

20.3.1 Climate and Air Quality

The key issues in terms of potential impact to air quality include:

- Dust emissions, together with their impact on human health and their potential to cause nuisance to those exposed.
- Emissions of potentially polluting gases: sulphur dioxide, oxides of nitrogen, and carbon monoxide, and their potential impact on human health.
- Emissions of other potentially hazardous species, including hydrochloric acid , dioxins and furans, cadmium, lead, mercury , hydrogen fluoride , and their potential impact on human health.
- Emissions of greenhouse gases (principally CO_2).

20.3.2 Noise and Vibration

Those receptors considered relevant to the Oyu Tolgoi project noise include:

- Worker accommodation facilities within the ML area, which will be used during the operational and decommissioning phases of the project.
- Established and permanent winter herder camps, although these are farther than 10 km from the project area. The herder winter camp resettlement programme undertaken to move herders away from the construction activities associated with the project was completed in 2004. Oyu Tolgoi has since developed new winter camp locations and wells for relocated herder families that previously had established nomadic camps within 10 km of the project site.
- Local population in the vicinity of project activities outside the project area, including the infrastructure corridor to the south, the airports, and the borefield and its associated infrastructure, although the borefield operation is not expected to be a significant source of noise.

Khanbogd, the nearest soum centre, is 35 km to the north-east of the project area and is therefore not expected to be affected by noise during operations. Should this position change with, for example, future developments connected to the Oyu Tolgoi project, all necessary studies and approvals will be undertaken in accordance with the project Standards.

Through a review of the Oyu Tolgoi project design basis, construction schedule, scoping and baseline assessment, the key noise and vibration issues considered to be associated with the project include:

- Noise impacts on herders from the operation of the Oyu Tolgoi to Gashuun Sukhait road.
- Noise impacts on herders from the construction and use of the permanent airport.
- Noise impacts on workers within the project area.

The screening assessments and acoustic modelling undertaken for the ESIA have demonstrated that, with appropriate mitigation, the noise and vibration impacts of the Oyu Tolgoi project will be negligible.

Aircraft noise will be noticeable for several kilometres from the airport. Modelling and monitoring of noise at the airport have shown that these impacts are minor, of short duration, and limited to daytime when a flight is landing or taking off.

20.3.3 Topography, Geology, and Topsoils

Actual and potential impacts on the topography, geology, and topsoil arising from the construction, operation, and closure of the project are as follows:

- Construction of mine infrastructure, including the TSF and waste rock dump (WRD) areas.
- Impacts associated with the open pit.
- Block caving mining activities, resulting in a surface subsidence zone.
- Creation of structures such as the camps and shaft headframe.
- Diversion of the Undai River and other ephemeral watercourses.
- Losses of topsoil from erosion by wind and water around earthworks, topsoil stockpiles, and rehabilitated areas.
- Potential subsidence impacts of the area overlying the Gunii Hooloi aquifer.

Impacts during closure will relate to legacy issues associated with the open pit, block caving, TSF, WRD, and potential settlement associated with drawdown of the deep aquifer that will have been used to supply the project's operational water requirements. While the scope here discusses closure at the end of the project, OT LLC reviews the potential for early or forced closure on an annual basis. The Closure Plan, which was prepared based on the June 2012 design status.

OT LLC has stated that it aims to prevent and mitigate, as far as practically possible, impacts on topography, landscape, geology, and topsoil. The key design measures taken to avoid impacts are listed below.

- As areas are decommissioned, e.g., the closure of the first cell of the TSF, progressive rehabilitation and landscaping will be undertaken, allowing vegetation to become established without any impacts from grazing by herd animals, which will be kept out by the project area fence.

- The WRD areas will be rehabilitated progressively. Stored topsoil will be used to rehabilitate the lower slopes of the waste rock facilities where the risk of losing the topsoil through windblown erosion is limited. The WRD area will not be used by underground mining operations; at the end of the operational life of the open pit, the remaining active areas will be stabilised and rehabilitated. This rehabilitation will be carried out concurrently with the underground block caving, with the aim of having the WRD rehabilitation completed when the open pit is completed.

- Mitigation of the impacts on the topography and landscape will focus on the final design of the WRD, preferably resulting in a similar profile to the Khanbogd Mountain or the steep-sided Javhlant Mountain.

- OT LLC has an obligation under the Land Law to carry out landscaping to lessen the visual impact of buildings. This will include assigning part of the built areas within the MLs as a green zone. Plants are currently being grown at a nursery in Khanbogd near a local well.

20.3.4 Water Resources

The following key water resources issues were identified in the ESIA:

- The impact of the various elements of the project on surface water systems, including ephemeral watercourses and ephemeral and permanent springs. These impacts could affect water quantity, quality, or the length of time an ephemeral watercourse sustains surface or groundwater flows over the course of a year.

- The impact of the project's water demand on the deep aquifer water resources of Gunii Hooloi and its significance to the overall water resources of the region and impacts on potential future water use.

- The impact of the project on shallow aquifer resources across the Project Area of Influence.

These key aspects of surface water systems, deep groundwater resources, and shallow groundwater resources are influenced by a variety of interactive impacts, including:

- Impacts on flora and fauna due to potential disruptions to ephemeral surface water and groundwater flows and springs, and access to these water sources by wildlife.

- The impact of the diversion of the Undai River on downstream springs and water users and risks to the Undai diversion from the adjacent WRD and other infrastructure, including the quality of the water that drains from these features.

The impact on surficial aquifers and local ephemeral watercourses of water abstraction for construction water supply and of dewatering associated with excavation and operation of the open pit and underground workings.

- The impact of water abstraction for construction purposes from locations outside the project area.
- The impact of the abstraction of deep aquifer water resources, which are generally non-potable, on shallower potable water aquifers, including the surficial aquifers along the ephemeral watercourses used by herders and wildlife.
- Impacts on herder water supplies, particularly at their winter camps, which are critical for the maintenance of their livelihoods.
- The impact of the increased water demand due to the known and predicted future increase in population of Khanbogd soum centre.

The impacts on the aquifers in the Gunii Hooloi basin are influenced by the project water demand. Minimising water demand is a key performance indicator that has been at the forefront of the project designs. Examples include choosing sanitary ware that reduces water consumption through to using treated and recycled wastewater in the concrete batch plant.

20.3.5 Biodiversity and Ecosystem

In 2011, OT LLC implemented a Regional Biodiversity Assessment (RBA) as part of the risk assessment process for impacts on various identified biodiversity features. Proposed mitigation options for the potential impacts on specific biodiversity features are addressed in the ESIA.

There are a number of uncertainties relating to the likelihood and magnitude of project-induced impacts on biodiversity features. These uncertainties relate to the likelihood for impacts to shallow water systems and associated biodiversity features resulting from drawdown of the deeper regional aquifer and from mine dewatering. Although the RBA process categorised the likelihood of impacts as low, and thus a risk assessment of medium / low, the following hydrological items are still considered to retain some degree of inherent uncertainty in impact risk assessment:

- Effect of dewatering on the mine surface area.
- Maintaining surface water and groundwater flow in the Undai River.
- Connectivity between the deep Gunii Hooloi aquifer and overlying surficial and alluvial aquifers and the deep Galbyn Gobi aquifers.
- Connectivity between the deep Durulj Mount Southern aquifer and overlying surficial aquifers.

Most, if not all, of these issues, impacts, and associated mitigation actions are addressed within either the Biodiversity Mitigations or other chapters of the ESIA.

Mitigation actions have been developed for all potential critical and high risk impacts to priority biodiversity features. In addition to these measures, OT LLC plans to provide wildlife underpasses for the Oyu Tolgoi to Gashuun Sukhait road owing to concerns about connectivity issues before the mitigation actions take effect, even though loss of connectivity was originally ranked as only a medium risk. OT LLC is currently in discussions with project financing lenders and biodiversity advisors to explore the best suite of mitigation actions and / or offsets to reduce the potential habitat fragmentation that may occur as a result of the construction of the Oyu Tolgoi to Gashuun Sukhait road.

Actions OT LLC will take to mitigate low and moderate risk impacts to priority biodiversity features, or impacts to lower priority biodiversity features, include:

- Water Resources Management Plan.
- Atmospheric Emissions Management Plan.
- Land Use Management Plan and related Land Disturbance Procedures.
- Non-Mineral Waste Management Plan.
- Hazardous Materials Management Plan.

OT LLC has committed to a goal of Net Positive Impact (NPI) on biodiversity, residual impacts on priority biodiversity features will be offset to achieve this goal. The RBA programme implemented in 2011 included the preparation of a Biodiversity Offset Strategy for the project that outlines what needs to be done to achieve an NPI on biodiversity.

Predicted residual impacts include direct habitat loss, indirect habitat loss, and increased mortality from increased hunting, increased collecting, collisions with vehicles and power lines, and increased numbers of natural predators. Conservation of the Asiatic wild ass is recognised as the highest priority for Oyu Tolgoi, given the international importance of the Southern Gobi region to this rapidly declining, globally endangered species and the residual impacts it is likely to be significant to the project.

20.3.6 Land Use and Displacement

OT LLC will require land for the mine and ancillary facilities such as the TSF, concentrator, batch plant, airport, Gunii Hooloi borefield and water pipeline, and transport / infrastructure corridor between Oyu Tolgoi and Gashuun Sukhait. Displacement impacts arising from the construction, operation, and closure phases of the project are as follows:

- Total physical displacement of herder households from the project area and displacement of winter camps from a 10 km residential exclusion zone around the project area.
- Economic displacement of herders affected by reduced access to and / or loss of summer pastures due to land taken for the airport.
- Division of pastures caused by the construction of linear project components, including the Oyu Tolgoi-to-Gashuun Sukhait Road and the water supply pipeline (construction corridor).
- Disruption to herding activities.
- Loss of wells and other impacts to water availability / quality, e.g., impeded access to wells.

- Overall reduction of pastureland in Khanbogd soum, leading to increased competition for grazing and over-use of remaining grazing land.

Significant residual land use and displacement impacts after the implementation of mitigation measures by Oyu Tolgoi will include:

- Herder resettlement and associated changes to herding activities and livelihoods as a result of physical and economic displacement.
- Reduction in the overall quantity of grazing land available for local pastoralists.
- Division of pastures for some herder families, affecting seasonal migration routes and access to grazing land and other resources.
- Increases in mining-related employment and new and diversified land-based and non-land-based income opportunities and associated increases in income and household wealth.
- Improved pastureland management within the soum, including positive changes to livestock raising and production, and thus rural livelihoods.

The overall impact of physical and economic displacement of herders is significant and will require resettlement with well-designed and well-implemented livelihood restoration and pastureland management programmes.

The loss of pastures and other land use changes is likely to be adverse for local herders in the short-term, but effective implementation of the Resettlement Action Plan is expected to potentially result in benefits for affected herders in the long-term from increased income generation opportunities, education, training assistance, and other regional community development programmes being implemented by OT LLC.

20.3.7 Heritage

OT LLC has attempted to design out impacts to archaeological heritage. Wherever possible, changes have been made to the location of fixed project elements and the design of project linear features, such as the roads and the water pipeline, in consideration of archaeological findings.

Mitigation measures are summarised below.

- Realignment of the Oyu Tolgoi-to-Gashuun Sukhait Road – Archaeological investigations for the original (2004) Oyu Tolgoi-to-Gashuun Sukhait transport corridor identified significant material archaeological findings, which was one of several factors leading to the realignment of the road. Further surveys were conducted for revised routing options in 2006 and again in 2010 and 2011. The 2010 investigations discovered five burial sites that were subject to rescue excavations by Mongolian Academy of Sciences Institute of Archaeology in 2011. No additional sites along the corridor were found to be at risk of road construction impacts during the most recent survey. As a result, potential impacts are considered to have been avoided.
- Alignment of the Gunii Hooloi Water Supply Pipeline – a number of possible grave sites were identified close to the Gunii Hooloi borefield water-gathering pipelines and

production boreholes (OT S-1, OT S-2, and OT S-3). As a result, the main pipeline alignment and connection network were designed to avoid damage to the graves.

No significant finds were encountered within the footprint of both the temporary or permanent airports, and therefore no design changes were made on the basis of archaeological significance.

Many of the impacts on cultural heritage have already been realised in relation to land disturbance, topsoil stripping, and construction of new access roads and associated borrow pits. Existing and possible future impacts are listed below:

- Physical loss of tangible heritage (physical resources) from physical land disturbance associated with the construction phase of the project.
- Indirect disturbance of tangible heritage through the operation of construction vehicles and machinery, operations vehicles, dust deposition, and vibration effects.
- Damage and / or deliberate disturbance of heritage by project workers and / or incomers to the region.
- Loss of intangible heritage over time as the patterns of work, kinship, worship, and sources of income change; this includes the loss of 'traditional livelihoods' as herders transition from subsistence to waged-based employment.

During the operations phase, the potential for permanent physical disturbance of archaeological and paleontological sites is expected to be low, since the scale and intensity of additional earthworks and engineering activities will be limited in comparison to the construction phase. Similarly, further impacts during the decommissioning phase are expected to be limited because any further major ground disturbance is unlikely.

However, some levelling, landscaping, contouring, and other land-based activities do have the potential to result in further minor archaeological impacts. Should these activities remain within the existing disturbance footprint, no additional significant impacts are expected to be identified during and post operations. Nevertheless, predicted changes to traditions and the traditional way of life are considered long-term effects.

20.3.8 Communities and Community Members

The potential impacts of the Oyu Tolgoi project on the human environment may extend farther than the direct physical impacts of the Project on the biophysical environment. As a result, the Project Area of Influence (for the purposes of the ESIA) also extends to include:

- Communities and community members that will be directly affected by the project in ways that are foreseeable and within the reasonable control of the project during construction, operations, and closure. This includes economically and physically displaced persons such as herder families whose winter camps and access to traditional summer pastures may be affected by the project.
- Communities and community members that may be directly affected by population influx, e.g., effects on water supply, wastewater, solid waste, housing, and other public services or facilities, including Khanbogd soum and Khanbogd soum centre

- Communities and herder households that may be affected by potential changes to local and regional groundwater supplies in the Gunii Hooloi basin, downstream of the Oyu Tolgoi site, and along transportation corridors where access to, and water supplies in, established herder wells may be affected.

20.3.9 Cumulative Impacts

Cumulative impacts are defined by the IFC as the combination of multiple impacts from existing projects, the proposed project, and / or anticipated future projects that could result in significant adverse and / or beneficial impacts that would not be expected in the case of a stand-alone project.

Geographical areas, communities, and regional stakeholders could be subject to cumulative impacts from further developments at the Oyu Tolgoi project together with other existing or planned projects, trends, and developments within the South Gobi region. These will include:

- Macro-economic impacts across the Mongolian economy.
- Impacts on communities and infrastructure in the South Gobi region related, for example, to influx, economic changes, and pressure on infrastructure. Specifically, within Omnogovi aimag, this includes the soums of Khanbogd, Bayan Ovoo, Manlai, and Tsogttsetsii and the aimag capital, Dalanzadgad.
- Biodiversity impacts related to the fragmentation of ecosystems by roads and other infrastructure.
- Impacts on water resources in terms of both shallow aquifers for herder water supplies and deep aquifers for potential industrial water supplies.

20.4 Health, Safety, Environmental, and Social Management Plans

Operations Phase Management Plans have been developed and implemented that control the HSES management aspects of all project activities since the completion of construction in December 2012 and the commencement of mining operations. The management plans address the management of health, safety, environment, and social aspects associated with the project. The scope of coverage for these plans is defined as follows:

- The physical and biological environment as may be affected by activities associated with on-site and off-site project facilities, managed under the integrated Health, Safety, and Environment Management System (the 2012 Oyu Tolgoi HSE MS), including biodiversity, air quality, water resources, waste management, transportation, emergency response, mine closure and rehabilitation, and health and safety.
- Occupational health and safety (OHS) issues that are managed under the integrated 2012 Oyu Tolgoi HSE MS.
- Social and community issues, which are managed under the Oyu Tolgoi Social Management System (SMS) during the construction and operations phases. The SMS is aligned with the Rio Tinto Communities Standard, and some issues that involve both community issues and HSE issues are managed jointly under the integrated 2012 Oyu Tolgoi HSE MS. Social issues addressed under the SMS include those related to

community relations, consultation and stakeholder engagement, labour / worker management, community health and safety, influx management, resettlement, cultural heritage, regional development, and other potential socio-economic impacts of the project on third parties.

20.5 Water Management

20.5.1 Water Conservation

Minimising water use throughout all the operational aspects has been a key focus of attention during mine planning and design. As examples of water conservation planning, the following initiatives have been implemented:

- Reuse of cooling water – The process plant is the largest consumer of water. Within the plant, all water discharged from the cooling systems, still categorised as clean water, is sent to the process water pond for reuse in the concentrator.

- High-efficiency tailings thickeners – The tailings thickener at Oyu Tolgoi uses advanced techniques and is able to achieve a tailings solids content of 60%–64%, which significantly reduces the amount of water sent to the TSF. These design modifications help to greatly reduce the amount of reclaim water released and evaporative losses from the TSF.

- High-efficiency TSF reclaim – The TSF has been designed so that tailings are deposited in discreet cells, rather than broadly across the facility, to reduce evaporative losses. The entire base of the TSF rests on natural or installed clay and includes a comprehensive seepage collection system to minimise seepage losses. The TSF reclaim system has been designed to ensure that all supernatant water and collected seepage is returned to the process plant for reuse.

- 100% mine water recovery – All water encountered in the underground and open pit mines is recovered for use as process water or for dust suppression. Recovery of mine water helps to reduce site demand for raw water from the Gunii Hooloi aquifer. From a water balance perspective, this mine recovery water has conservatively not been included as inflow.

- 100% treated wastewater reuse – All treated wastewater produced in the site wastewater treatment plant will be reused in the process plant or for dust suppression.

- 100% truck wash water reuse – A comprehensive water treatment system has been installed at the project mine truck washing facility to allow all truck wash water to be continuously recycled and reused.

- Lagoon floating cover – A floating cover is placed over the entire raw water storage lagoon to eliminate evaporative water losses and to limit the accumulation of dust within the lagoon.

- Selection of low or zero water use equipment – Examples of this include the selection of air cooling systems at the hazardous waste incinerator and central heating plant.

Ongoing attention to water conservation will be maintained during operation through the continuous review of key performance indicators for water use and implementation of additional water conservation measures.

20.5.2 Ongoing Work Programmes

Ongoing work programmes for developing water resources include:

- Gunii Hooloi Resource – Completion of updated modelling and analytical calculation of water resource based on data from final bore drilling installation, supplementary drilling, and testing programme and initial operational data.
- Oyu Tolgoi Regional Model – Updating the hydrogeological model for the Oyu Tolgoi region based on supplementary drilling and testing programme and updated monitoring, including monitoring response from open pit development to further define and understand the regional influence of the mine operations.
- Khanbogd Resource – Completion of hydrogeological model and analytical calculation of water resource based on supplementary Khanbogd drilling and testing programme.
- Undai River Assessment – Review of monitoring of the Undai River diversion, including hydrogeological and ecological assessment of the performance of the established spring and the influence on downstream shallow water conditions.

Detailed modelling will be undertaken as part of the studies for the project expansions to identify the water resources and obtain the permit requirements.

20.6 Progressive Rehabilitation and Closure Planning

Progressive rehabilitation and planning for closure is a critical and integral part of the business process and demonstrates a commitment to sustainable development. Progressive rehabilitation involves the continuous technical and biological rehabilitation of disturbed areas following completion of works activities. Closure planning involves the development of strategies to avoid or mitigate potential environmental and social impacts associated with closure to the extent that is financially appropriate.

20.6.1 Progressive Rehabilitation

The progressive rehabilitation planning that forms part of the Oyu Tolgoi Closure Plan adheres to all regulatory requirements of the GOM and industry best practices as stated in IFC, EBRD, and Rio Tinto performance standards.

Progressive reclamation will be performed on any areas of the mine site where it is deemed practical to do so and with consideration of the need to preserve future mine expansion options. Disturbed areas that are no longer used in the active operation will be technically and biologically rehabilitated concurrently with ongoing mining operations, as practicable.

Significant progressive rehabilitation opportunities exist for the technical and biological rehabilitation of disturbed land following completion of construction. Examples include:

- Historically used temporary airport.
- Historically used borrow pits and quarries used to support construction activities (e.g., of airport, Oyu Tolgoi to Gashuun Sukhait road).

- Land disturbed areas following completion of installation of underground pipelines (e.g., for the Gunii Hooloi raw water supply pipeline).
- Land disturbed areas following completion of drilling activities (e.g., from exploration).
- Historically used tracks and access roads (e.g., the diversion road used during construction of the Oyu Tolgoi to Gashuun Sukhait road).
- Any other areas that have been subject to land disturbance during construction, but which are no longer used.

Opportunities for further progressive reclamation related to the underground and open pit mines or surface facilities and infrastructure are more limited. The main ones presented in the Closure Plan relate to the following:

- Any facility that is either redundant or no longer in use will be decommissioned and closed.
- Landfill cells and lagoons at the waste management centre will be progressively maintained during operations by placing a rock cover over the waste every day. The waste disposal grounds have a life of up to 30 years, after which the cell will be closed and a second phase initiated if necessary.
- The WRD are currently planned to be progressively reclaimed, as practicable, over the mine operating life. The dumps will be constructed with set-back berms so that the slopes can adhere to the final stable configurations during operations. Completed parts of the dump will be covered with a suitable thickness of NAF material during operations, followed by progressive placement of topsoil / growth media and revegetation, where possible.
- TSF cells will be the first to be completed and will be allowed to desiccate over time. Alternatively, a NAF cover may be constructed progressively over PAF tailings surfaces, taking into account the potential to re-use those cells for tailings deposition in the future. In the meantime, to mitigate environmental impacts due to inactive and dry tailings surfaces, interim reclamation measures may include the placement of a thin layer of NAF cover to protect against wind erosion and maintain surface water run-off quality.

There are potential opportunities for local communities and herder groups to participate in the implementation of several progressive rehabilitation measures that could result in economic benefits and capacity development for those involved. The Closure Plan outlines some of these opportunities.

20.6.2 Closure Planning

The Oyu Tolgoi Mine Closure Plan is based on the design status at that time. The Closure Plan documents the outcomes of the closure study conducted with the following objectives:

- Compliance with the Rio Tinto corporate Closure Standard.
- Compliance with relevant international guidelines and directives.
- Documentation of closure vision, objectives, and targets.

- Early development of strategies to meet closure objectives and targets.
- Early identification of likely site-specific closure issues and assessment of risks.
- Identification of action items that should be conducted to manage and mitigate risks and enable efficient and effective closure methods and technologies in the future.
- Preparation of a preliminary closure schedule based on current information.
- Estimation of costs associated with the closure, developed to a study level suitable for the feasibility study. Costs have been included in the capital and operating and economics sections of LHTR16.
- Development of a multi-disciplinary information resource.

20.6.3 Post-closure Monitoring

A large number of parameters will be monitored during the closure and post-closure phases of the mine, to characterise both physical and chemical stability of the project area and the environmental impact of the project.

Physical stability monitoring at the site will cover the following facilities, structures, and features:

- The open pit and future subsidence area.
- Mine site and disturbed areas.
- Waste rock dumps and TSF.
- Undai River diversion.
- Site security features.

The Closure Plan describes the post-closure chemical stability monitoring at specific facilities, such as the following, in more detail:

- Open pit and subsidence area.
- Mine site and disturbed areas.
- Waste rock dumps.
- Tailings storage facility.
- Undai River diversion.
- Gunii Hooloi borefield (water levels).

21 CAPITAL AND OPERATING COSTS

21.1 Entrée – OT LLC Earn-In Agreement Costs Terms

The following is a summary of the terms of the EJV relating to cost allocation and revenues to Entrée. Under the terms of the EJV, Entrée may be carried through to production, at its election, by debt financing from OT LLC with interest accruing at OT LLC's actual cost of capital or prime +2%, whichever is less, at the date of the advance. Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from sale of Entrée's share of products. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of operations for the month.

All costs of operations will be allocated at the time the programme and budget is adopted between the EJV Property and the Oyu Tolgoi Property, based on the proportions in which each of them benefits most from such operations and:

- OT LLC shall bear and pay for one hundred percent (100%) of such costs allocated to the Oyu Tolgoi Property and all associated liabilities including for Environmental Compliance; and
- The balance of such costs shall be borne and paid by the Participants in accordance with their respective Participating Interests, subject to any elections allowed under the EJV.

If it is impracticable to fully allocate costs of operations between the EJV Properties and the Oyu Tolgoi Property at the time that a programme and budget is adopted, such costs will be provisionally allocated based on all information available to the Participants respecting the EJV Properties and the Oyu Tolgoi Property and, if warranted based on additional information obtained from future operations, will be re-allocated to equitably reflect the relative benefits to each such property. Any such provisional or definitive allocation or re-allocation of costs as aforesaid will be agreed by the Participants. A failure to agree will be a dispute for the purposes of the dispute resolution procedure. For illustration purposes only, if a shaft is sunk on the EJV Properties which also provides access to the Oyu Tolgoi Property and fifty-five percent (55%) of mineral production is from the Oyu Tolgoi Property and forty-five percent (45%) of mineral production is from the EJV Properties, Entrée would have responsibility for a share of those costs equal to its Participating Interest multiplied by forty-five percent (45%).

Under the terms of the Earn-In Agreement, any mill, smelter and other processing facilities and related infrastructure on the Joint Venture Properties will be owned exclusively by OT LLC and not by Entrée. The OT LLC Facilities are specifically excluded from the assets of the Joint Venture Properties and the use and operation of them is specifically excluded from the activities carried out under the Earn-In Agreement. All costs of constructing and operating the OT LLC Facilities will be solely for the account of OT LLC, and will not be included in Programs and Budgets or taken into account in calculating or adjusting the respective participating interests of OT LLC and Entrée. OT LLC has to pay all such costs when due and will keep the assets of the Joint Venture Properties free from any encumbrances pertaining to OT LLC Facilities.

Entrée's share of products will, unless Entrée otherwise agrees, be processed at the OT LLC Facilities by paying milling and smelting charges. The OT LLC Facilities are not intended to be profit centres and therefore, minerals from the EJV Properties will be processed at cost (using industry standards for calculation of cost including an amortisation of capital costs). The amortisation allowance for capital costs will be calculated in accordance with generally accepted accounting principles determined yearly based on the estimated quantity of minerals to be processed for Entrée's account during that year relative to the total design capacity of the processing facilities over their useful life.

For the analysis in LHTR16 Entrée have advised that under the terms of the EJV, OT LLC is responsible for 80% of all costs incurred on the EJV Property, including capital expenditures, and Entrée for the remaining 20%, subject to the following exceptions:

- OT LLC is responsible for 100% of costs incurred on the EJV Property to the extent the costs benefit the Oyu Tolgoi ML; and
- Costs relating to construction or operation of mill, smelter and other processing facilities are solely for the account of OT LLC, with Entrée paying milling and smelting charges at cost (using industry standards for calculation of cost including an amortization of capital costs).

21.2 Charges to the EJV

The EJV defines the charges to the EJV, exclusions and changes for the particular phase of the project. The costs that may be charged are:

- Property acquisition costs, rentals, royalties and other payments
- Labour and employee benefits
- Materials, equipment and supplies
- Equipment and facilities furnished by OT LLC
- Transportation of employees and material necessary for operations
- Contract services and utilities
- Insurance premiums
- Damages and losses
- Legal and regulatory expense
- Audit cost of annual audits
- Taxes
- District field supervision and camp expenses
- Administrative Charge

The Administrative Charge amount is to reimburse OT LLC for its home office overhead and general and administrative expenses to conduct each phase of the project. The Administrative Charge is in lieu of any management fee and for taxes based on production. The Administrative Charge is calculated as a percentage of the Allowable Costs. Allowable Costs are defined as all charges to the Business Account excluding:

- The Administrative Charge;
- Depreciation, depletion or amortisation of tangible or intangible Assets;
- Amounts charged for property acquisition costs, rentals, royalties and other payments,
- Legal and regulatory expenses and
- Marketing costs.

The four phases defined in the EJV and the percentage of Allowable Costs applicable are:

- Exploration Phase – (A) 2% of Allowable Costs under third party contracts which contain an allowance for contract administration or overhead by the third-party; (B) 5% of Allowable Costs under third-party contracts not included in (A) which provide for aggregate contract expenditures of more than $50,000; and (C) 10% of all other Allowable Costs.
- Development Phase – 2% of Allowable Costs.
- Major Construction Phase – 1% of Allowable Costs.
- Mining Phase –2.5% of Allowable Costs

The phases may be conducted concurrently. For the LHTR16 the Development Phase percentage of 2% and the Mining Phase percentage of 2.5% has been applied. The following is a representative list of items that are expressly covered by the Administrative Charge:

- Administrative supervision, which includes all services rendered by managers, department supervisors, officers and directors of OT LLC for Operations;
- Accounting, data processing, personnel administration, billing and record keeping in accordance with governmental regulations and the provisions of the EJV, and preparation of reports;
- The services of tax counsel and tax administration employees for all tax matters, including any protests, except any outside professional fees which the Management Committee may approve as a direct charge;
- Routine legal services rendered by outside sources including property acquisition, attorney management and oversight, and support services provided by OT LLC legal staff concerning any litigation; and
- Rentals and other charges for office and records storage space, telephone service, office equipment and supplies.

21.3 Capital and Operating Costs

The capital and operating costs in LHTR16 for the LHTR16 Reserve Case are those that were prepared for OTFS14. The OTFS14 costs represent the most current estimate for Oyu Tolgoi and have yet to be updated with a new study. Although the costs have not been escalated or modified from the OTFS14 estimates they are considered to still remain valid. The commencement date for expenditure has been assumed to be July 2016, whereas in OTFS14 the original start date was January 2014.

The estimate includes all expenses to operate and maintain the Oyu Tolgoi plant that are attributable under the Earn In Agreement. Key cost assumptions are:

- All costs are expressed in Q1'14 U.S. dollars, based on fixed exchange rates.
- Costs before the Notice to Proceed is approved are excluded.
- Escalation is excluded from the costs.
- No cost of financing is included.
- Royalties and joint venture fees are included.
- Power has been treated as a purchased utility from a third-party provider.

LHTR16 Reserve Case total costs are shown in Table 21.1.

Table 21.1 EJV Operating Expenditures – Hugo North Extension Lift 1

Description	Unit	Total
Mining Costs	$/t	4.99
Processing Costs	$/t	7.90
Tailings Costs	$/t	0.40
Operations Support	$/t	3.17
Infrastructure	$/t	1.15
Depreciation - Mining Assets	$/t	12.50
Depreciation - Process Assets	$/t	3.61
Total Operating Expenditure	**$/t**	**33.73**
Administration Charge	$/t	0.83
Total	**$/t**	**34.56**

Note: Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

The Oyu Tolgoi project capital cost estimate represents the overall development and includes the Hugo North (including Hugo North Extension) Lift 1 underground mine, supporting declines and shafts, the concentrator conversion project, and the infrastructure expansion project. The capital estimate also includes the costs associated with the EPCM and Owner's project execution teams.

The Entrée capital costs and participant share of Entrée capital costs for Hugo North Lift 1 are shown in Table 21.2.

The estimates for each major component cover:

- The direct field cost of executing the project.
- Indirect cost associated with the design, construction, and commissioning of the new facilities.
- Mongolian customs duties, Mongolian VAT.
- Some allowances for contingency.

Table 21.2 EJV Expansion and Sustaining Capital Expenditure

Description	Unit	Total
Total EJV Capital Costs		
Expansion Capital Costs		
Shaft 4	$M	17.8
Hugo North Lift 1 Underground Construction	$M	69.7
Hugo North Lift 1 Underground Development	$M	119.8
Sustaining Capital Costs		
Hugo North Lift 1	$M	227.7
Total EJV capital Costs	**$M**	**434.9**
Entrée Gold Capital Cost Participant Share	%	20%
Expansion Capital Costs		
Shaft 4	$M	3.6
Hugo North Lift 1 Underground Construction	$M	13.9
Hugo North Lift 1 Underground Development	$M	24.0
Sustaining Capital Costs		
Hugo North Lift 1	$M	45.5
Total Entrée Gold Capital Cost Participant Share	**$M**	**87.0**

1. Totals may not match due to rounding.
2. Capital includes only direct project costs and does not include non-cash shareholder interest, management payments, foreign exchange gains or losses, foreign exchange movements, tax pre-payments, or exploration phase expenditure.

In OTFS14 all operating cost estimates were prepared on a first principles basis wherein all expenses have been quantified as much as possible and unit cost rates applied. Estimates were prepared by major operating cost function, as follows:

- Underground mine.
- Process plant – inclusive of concentrator and bagging plant.
- Tailings – inclusive of tailings pumping, tailings dewatering, and tailings storage facility.
- Infrastructure.
- General and Administrative (G&A) – inclusive of operations support.
- Geosciences.

Operating cost estimates were also developed by expense type classified into the following categories:

- Labour – cost to employ all direct OT LLC staff.
- Fixed overheads – accommodation and meals, travel, business overheads, insurances, and general expenses.
- Utilities – power and water charges.
- External services – third-party contracted services.
- Materials and supplies – fuels, equipment spares and parts, process consumables and reagents, other maintenance materials.

22 ECONOMIC ANALYSIS

22.1 Introduction

The financial analysis has been prepared using the following long-term metal price estimates: copper at $3.08/lb; gold at $1,304/oz and silver at $21.46/oz. The after-tax NPV at 8% discount rate (NPV8) attributable to Entrée for the LHTR16 Reserve Case is $106 M. OTFS14 assumed that the timing for the restart of the underground mine would occur at the commencement of 2015, even though this did not occur, the economic analysis of the Mineral Reserve remains valid and the costs and revenues are delayed by the same timing. Based on the TRQ expectation that underground development will restart in mid 2016 the discounted cash flow has been calculated assuming Year 1 is 2016. A summary of the EJV Property production and financial results is shown in Table 22.1.

Mine site cash costs are shown in Table 22.2. Cash costs are those costs relating to the direct operating costs of the mine site, namely:

- Mining
- Concentration
- Tailings
- Operational Support Costs
- Infrastructure
- Depreciation Charge
- Administration Fees

Table 22.1 EJV LHTR16 Reserve Case Financial Results

Description	Units	Total
Total OT Processed	bt	1.5
EJV Property Results		
EJV Processed	Mt	34.8
NSR	$/t	100.57
Cu Grade	%	1.59
Au Grade	g/t	0.55
Ag Grade	g/t	3.72
Copper Recovered	Mlb	1,121
Gold Recovered	koz	519
Silver Recovered	koz	3,591
Total Cash Costs After Credits	$/lb Payable Copper	0.99
NPV (8%) After Tax (Entrée)	$M	106
NPV (8%) Before Tax (Entrée)	$M	142

1. Metal prices used for calculating the Hugo North Extension underground Net Smelter Return (NSR) are as follows: copper at $3.01/lb; gold at $1,250/oz; and silver at $20.37/oz, all based on long-term metal price forecasts at the beginning of the mineral reserve work. The analysis indicates that the mineral reserve is still valid at these metal prices.
2. The NSR has been calculated with assumptions specific to Hugo North Extension for smelter refining and treatment charges, deductions and payment terms, concentrate transport, metallurgical recoveries and royalties.
3. The block cave shell was defined using a NSR cut-off of $15/t NSR.
4. For the underground block cave, all mineral resources within the shell have been converted to mineral reserves. This includes low grade Indicated mineral resources and Inferred mineral resources, which has been assigned a zero grade and treated as dilution.
5. Only Measured mineral resources were used to report Proven mineral reserves and only Indicated mineral resources were used to report Probable mineral reserves.
6. EJV is the Entrée—OT LLC Joint Venture. The EJV includes a portion of the Shivee Tolgoi ML and all of the Javhlant ML. Both the Javhlant ML and the eastern portion of the Shivee Tolgoi ML are held by Entrée for the EJV. The EJV Property is operated by Rio Tinto on behalf of OT LLC. Entrée has a 20% interest in the mineralisation extracted from the EJV Property and OT LLC has an 80% interest.
7. The base case financial analysis has been prepared using the following current long term metal price estimates: copper at $3.08/lb; gold at $1,304/oz; and silver at $21.46/oz.
8. The mineral reserves reported are not additive to the mineral resources.

Table 22.2 EJV Unit Operating Costs by Copper Production

Description	Unit	LOM Average
Mine Site Cash Cost	$/lb Payable Copper	1.11
TC/RC, Royalties & Transport	$/lb Payable Copper	0.54
Total Cash Costs Before Credits	**$/lb Payable Copper**	**1.66**
Gold Credits	$/lb Payable Copper	0.60
Silver Credits	$/lb Payable Copper	0.06
Total Cash Costs After Credits	**$/lb Payable Copper**	**0.99**

Includes mining and process assets depreciation and administration charge.

22.2 Model Assumptions

The basis of the operational framework of the mine used in the analysis is the Earn In Agreement, Mongolian legislation, and the terms of the IA and UDP between OT LLC and the GOM.

The capital and operating costs in LHTR16 for the LHTR16 Reserve Case are those that were prepared for OTFS14. The OTFS14 costs represent the most current estimate for Oyu Tolgoi and have yet to be updated with a new study. Although the costs have not been escalated or modified from the OTFS14 estimates they are considered to still remain valid. The commencement date for expenditure has been assumed to be July 2016, whereas in OTFS14 the original start date was January 2014.

Cash flows are assumed to occur evenly during each year and a mid-year discounting approach is taken. The discount rate applied to the project is 8% per annum. This includes long-term metal prices of $3.08/lb copper, $1,304/oz gold and $21.46/oz silver. These prices were judged to be reasonable against similar studies released over the last 12 months.

22.2.1 Treatment of Cash Flow Items

For the analysis in LHTR16 Entrée have advised that under the terms of the EJV, OT LLC is responsible for 80% of all costs incurred on the EJV Property, including capital expenditures, and Entrée for the remaining 20%, subject to the following exceptions:

- OT LLC is responsible for 100% of costs incurred on the EJV Property to the extent the costs benefit the Oyu Tolgoi ML; and
- Costs relating to construction or operation of mill, smelter and other processing facilities are solely for the account of OT LLC, with Entrée paying milling and smelting charges at cost (using industry standards for calculation of cost including an amortization of capital costs).

Also under the terms of the EJV, Entrée may be carried through to production, at its election, by debt financing from OT LLC with interest accruing at OT LLC's actual cost of capital or prime +2%, whichever is less, at the date of the advance. Debt repayment may be made in whole or in part from (and only from) 90% of monthly available cash flow arising from sale of Entrée's share of products. Such amounts will be applied first to payment of accrued interest and then to repayment of principal. Available cash flow means all net proceeds of sale of Entrée's share of products in a month less Entrée's share of costs of operations for the month. Therefore, Entrée will not be obliged to contribute cash to the EJV for its portion of operating and capital expenditures and will receive 10% of its share of cash flow from the EJV until such time as any loans outstanding are repaid and 100% thereafter.

The treatment of each key cash flow item included in the Entrée cash flow calculation is outlined in Table 22.3. As a guiding principle, the effective value of revenue and costs used in to calculation of Entrée net cash flow were based on an appropriate revenue or cost driver (e.g. EJV milled tonnes) multiplied by the total project revenue or cost base (i.e. OT LLC and Entrée processing costs) multiplied by its working interest (e.g. 20%).

The Net Cash Inflow – After Effective Realisation and Operating Costs – is the income that Entrée receives under the terms of the EJV.

Table 22.3 Treatment of Entrée Cash Flow Items

Cash Flow Item	Calculation Treatment
Gross sales	**Total EJV Revenue x 20%**
Less:	
Concentrate transport	Total concentrate transport costs x (EJV concentrate produced / total concentrate produced) x 20%
Treatment and refining charges	Total treatment and refining charges x (EJV concentrate produced / total concentrate produced) x 20%
Royalties	Gross Sales Value x 5%
Operating Expenditure	
Mining costs – Hugo North	Total Hugo North operating cost x (EJV Hugo North mined tonnes / total Hugo North mined tonnes) x 20%
Processing costs	Total processing cost x (EJV mined tonnes / total mined tonnes) x 20%
Tailings costs	Total tailings cost x (EJV mined tonnes / total mined tonnes) x 20%
General and Administration (G&A)	n/a
Operations support	Total operations support cost x (EJV mined tonnes / total mined tonnes) x 20%
Infrastructure	Total infrastructure cost x (EJV mined tonnes / total mined tonnes) x 20%
Depreciation – mining assets	Total Shaft 4 capital cost x (EJV Hugo North mined tonnes / total Hugo North mined tonnes) x 20% Total Hugo North Lift 1 capital cost x (EJV Hugo North Lift 1 mined tonnes / total Hugo North Lift 1 mined tonnes) x 20%
Depreciation – process assets	Processing capital depreciation x (EJV milled tonnes / total milled tonnes) x 20%
Net Cash Inflow – After Effective Realisation and Operating Costs	**Gross Sales less Effective Realisation and Operating Costs**
Administration charge	1.00% of the net cash flow until 2021less 2.50% of the net cash flow from 2022
Total Net Cash Inflow less After Administrative Charge	**Net Cash Inflow less Administration Charge**
Income tax expense	Net cash inflow x 25% tax rate
Net Cash – After-Tax	**Net Cash Inflow Administration Charge less Income Tax Expense**

Total EJV revenue is generated from production sourced from EJV Hugo North Extension Lift 1.
Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

22.3 Project Results – LHTR16 Reserve Case

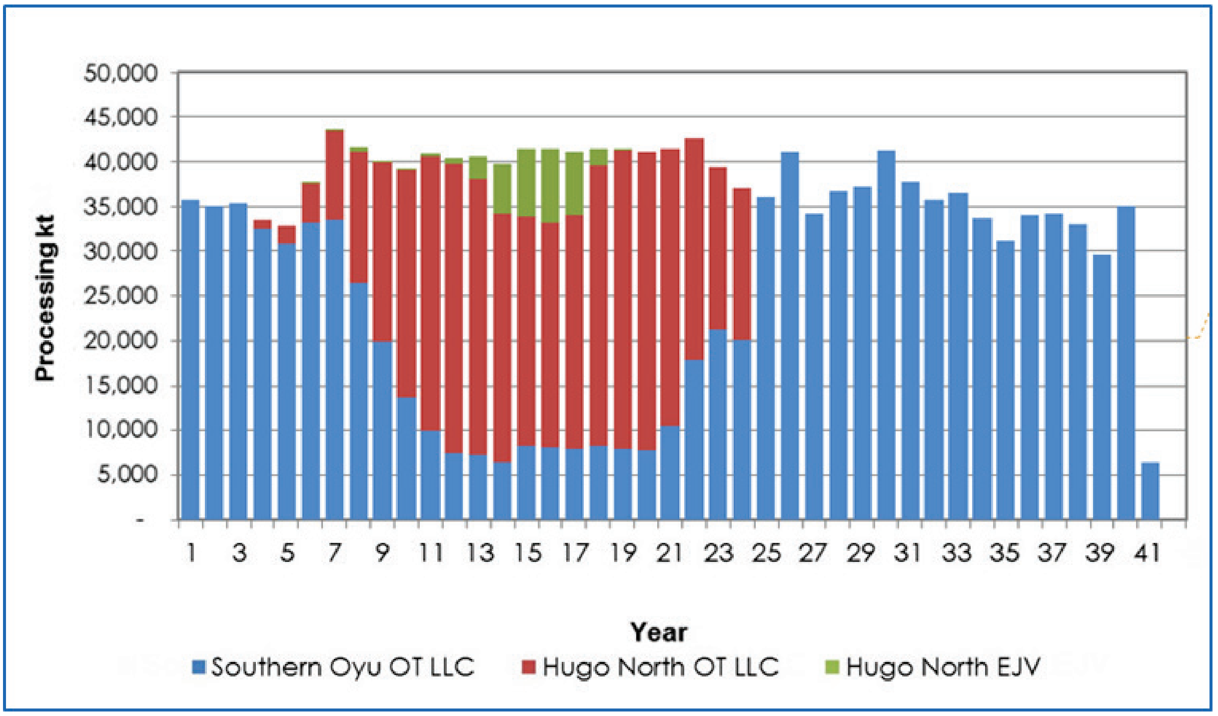
The after-tax NPV8 attributable to Entrée for the LHTR16 Reserve Case is $106 M. A summary of the LHTR16 Reserve Case financial results is shown in Table 22.4. Long-term metal prices used for the analysis are copper $3.08/lb, gold $1,304/oz, and silver $21.46/oz.

Table 22.4 LHTR16 Reserve Case Financial Results – Entrée – Discount Rate Sensitivity

Discount Rate	Net Present Value ($M)	
	Before-Tax	After-Tax
Undiscounted	440	328
5.0%	215	160
6.0%	187	139
7.0%	163	121
8.0%	**142**	**106**
9.0%	124	93
10.0%	109	81

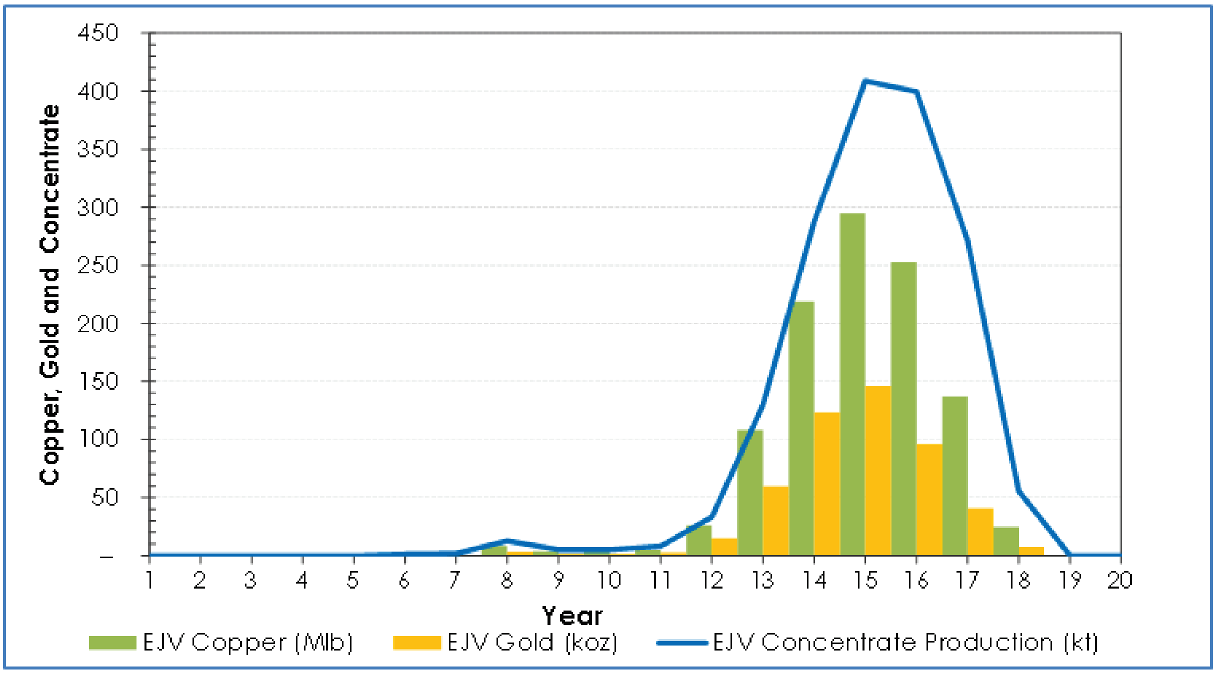
LHTR16 Reserve Case Processing and concentrate and metal production are summarised in Figure 22.1 and Figure 22.2 respectively.

Figure 22.1 LHTR16 Reserve Case Processing – OT LLC and EJV



Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

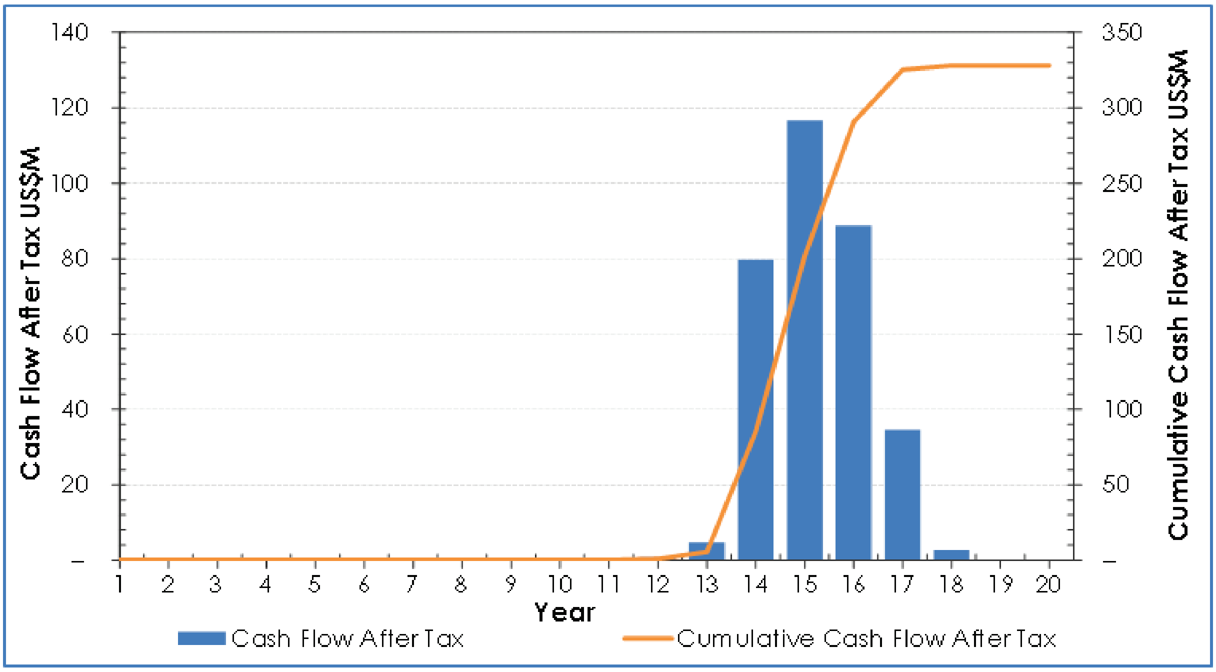
Figure 22.2 LHTR16 Reserve Case EJV Concentrate and Metal Production



Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

Cumulative cash flow for the LHTR16 Reserve Case is depicted in Figure 22.3. The revenues and operating costs have been presented in Table 22.5, along with the net sales revenue value attributable to each key period of operation. A complete cash flow is provided in Figure 22.4.

Figure 22.3 LHTR16 Reserve Case Cumulative Cash Flow to Entrée – After Financing (Undiscounted)



Entrée has a 20% interest in ore extracted from the Hugo North Extension deposit.

Table 22.5 LHTR16 Reserve Case Operating Costs and Revenues – OT LLC and EJV

Operating Costs & Revenue	Total $M	LOM Average $/t ore milled
Gross Sales Revenue	**4,050**	**116.4**
Less: Realisation Costs		
Concentrate Transport	162	4.6
Treatment & Refining	217	6.2
Government Royalty	210	6.0
Total Realisation Costs	**589**	**16.9**
Net Sales Revenue	**3,461**	**99.5**
Site Operating Costs		
Mining* (all sources)	174	5.0
Processing	275	7.9
Tailings	14	0.4
Operations Support	110	3.2
Infrastructure	40	1.2
Depreciation Charge	561	16.1
Administration Fees	29	0.8
Total	**1,203**	**34.6**
Operating Margin	**2,258**	**64.9**
Participant Share		
OT LLC	1,807	51.9
EJV	452	13.0
Total	**2,258**	**64.9**

1. Totals may not match due to rounding.
2. Capital includes only direct project costs and does not include non-cash shareholder interest, management payments, foreign exchange gains or losses, foreign exchange movements, tax pre-payments, or exploration phase expenditure.

Table 22.6 LHTR16 Reserve Case Cash Flow (Undiscounted) – EJV and Entrée

Cash Flow Statement	Year	1 to 5	6 to 10	11 to 20	21 to 30	Total
Gross Sales EJV	**$M**	**–**	**59**	**3,991**	**–**	**4,050**
Less:						
Concentrate Transport	$M	–	3	159	–	162
Treatment & Refining Charges	$M	–	4	214	–	217
Royalties	$M	–	3	207	–	210
Net Sales Revenue EJV	**$M**	**–**	**50**	**3,411**	**–**	**3,461**
Operating Costs						
Mining Costs	$M	–	5	169	–	174
Processing Costs	$M	–	7	268	–	275
Tailings Costs	$M	–	0	14	–	14
Operations Support	$M	–	3	108	–	110
Infrastructure	$M	–	1	39	–	40
Depreciation – Mining Assets	$M	57	149	183	45	435
Depreciation – Process Assets	$M	–	5	121	–	126
Total Operating Costs EJV	**$M**	**57**	**170**	**902**	**45**	**1,174**
Operating Surplus / (Deficit) EJV	**$M**	**-57**	**-120**	**2,509**	**-45**	**2,287**
Underground Capital Contribution (Direct Lease)	$M	–	–	–	–	–
Administration Charge	$M	1	4	23	1	29
Surplus / (Deficit) from EJV	**$M**	**-58**	**-124**	**2,487**	**-46**	**2,258**
Participant Share of Entrée (20%)	**$M**	**-12**	**-25**	**497**	**-9**	**452**
Loan Funding / (Repayment)	$M	12	25	-58	9	-12
Before-Tax Cash Flow Entrée	**$M**	**–**	**–**	**440**	**–**	**440**
Taxation Impact	$M	–	–	111	–	111
After-Tax Cash Flow Entrée	**$M**	**–**	**–**	**328**	**–**	**328**

Year 1 in LHTR16 is assumed to be 2016

22.4 Cost Sensitivity Analysis

The changes in the after-tax NPV at 8% discount rate for a range of copper and gold prices are shown in Table 22.7.

Table 22.7 Metal Price Sensitivity Analysis – Entrée LHTR16 Reserve Case

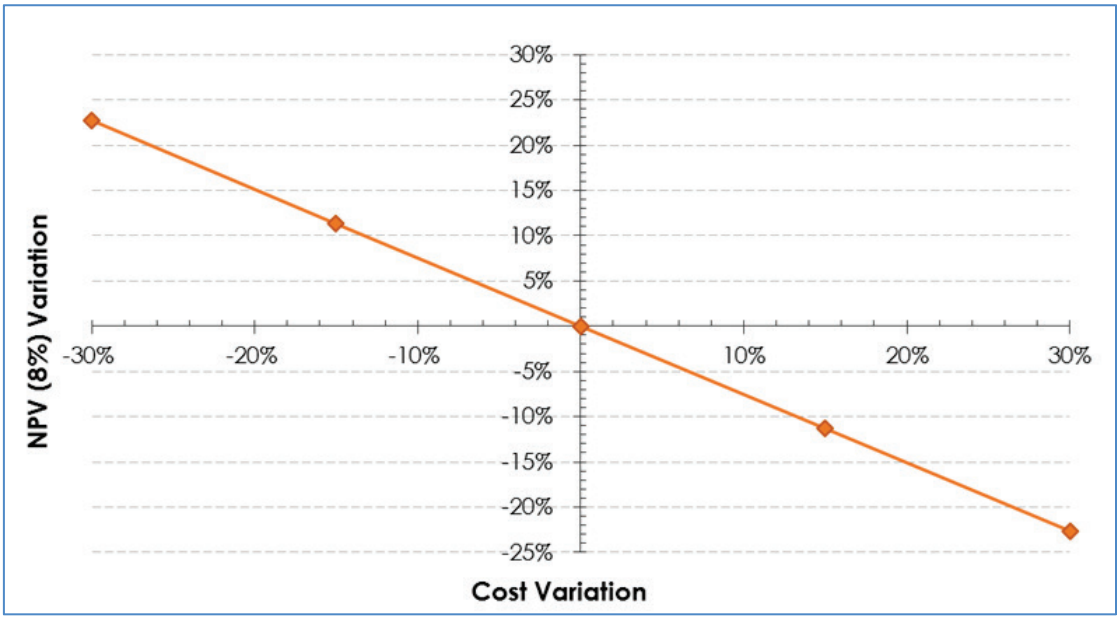
After-tax Values NPV8 $M	Gold Price/oz				
Copper Price/lb	**1,000**	**1,150**	**1,304**	**1,500**	**2,000**
2.00	45	48	52	56	68
2.50	69	73	77	81	93
3.08	99	102	106	110	122
3.50	120	123	127	132	144
4.00	145	149	152	157	169

A costs sensitivity analysis of the after-tax NPV8 was performed for LHTR16 Reserve Case. The results are shown in Table 22.8 and Figure 22.4.

Table 22.8 LHTR16 Reserve Case Costs Sensitivity Analysis

After-Tax NPV8 ($M)	Cost Sensitivities				
	-30%	**-15%**	**–**	**15%**	**30%**
LHTR16 Reserve Case (Entrée)	130	118	106	94	82

Figure 22.4 Cost Sensitivity Analysis – After-Tax NPV8 to Entrée



23 ADJACENT PROPERTIES

The EJV Property is immediately adjacent to OT LLC's Oyu Tolgoi mining license, which hosts porphyry copper–gold mineralisation within the Hugo Dummett (South and North) deposit and within the SOT zones (Southwest, South, and Central zones). The 2014 OTTR released by TRQ decribes the Oyu Tolgoi ML. From Ulaan Khud in the north to Heruga in the south, the known copper–gold–molybdenum deposits now span a distance of 20 km along what has been termed the Oyu Tolgoi structural trend. Developments on the Oyu Tolgoi project are relevant to Entrée's Hugo North Extension and Heruga Mineral Resources as they are being developmed by OT LLC with the Hugo North Extension.

24 OTHER RELEVANT DATA AND INFORMATION

24.1 Alternative Production Cases

Oyu Tolgoi is a very large project that includes four separate deposits. The long-term development of Oyu Tolgoi would involve the development of the resources on all deposits. Alternative Production Cases have been developed to provide early-stage analysis of the development flexibility that exists with respect to later phases of the Oyu Tolgoi deposits (Heruga, Hugo South, and Lift 2 of Hugo North).

While it is outside of the scope of reserve reporting, as part of the long-term development strategy OT LLC continues to examine the Alternative Production Cases to better define future work plans and prepare for investment decision points. The mine designs developed by OT LLC and considered in the Alternative Production Cases are shown schematically in Figure 24.1 and listed below:

- SOT Open Pits (Reserves)
- Hugo North Lift 1 Block Cave (Reserves)
- Hugo North Lift 1 Block Cave (Resources Indicated and Inferred)
- Hugo North Lift 2 Block Cave (Resources Indicated and Inferred)
- Hugo South Block Cave (Resources Inferred)
- Heruga Block Cave (Resources Inferred)

The mine designs above that are in the Alternative Production Cases and on the EJV Property are:

- Hugo North Extension Lift 1 Block Cave (Reserves)
- Hugo North Extension Lift 2 Block Cave (Resources Indicated and Inferred)
- Heruga Block Cave (Resources Inferred)

Under NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised.

Development of these deposits will require separate development decisions in the future based on the prevailing conditions and the development experience obtained from developing and operating the initial phases of Oyu Tolgoi.

Figure 24.1 Alternative Production Cases Mining Areas

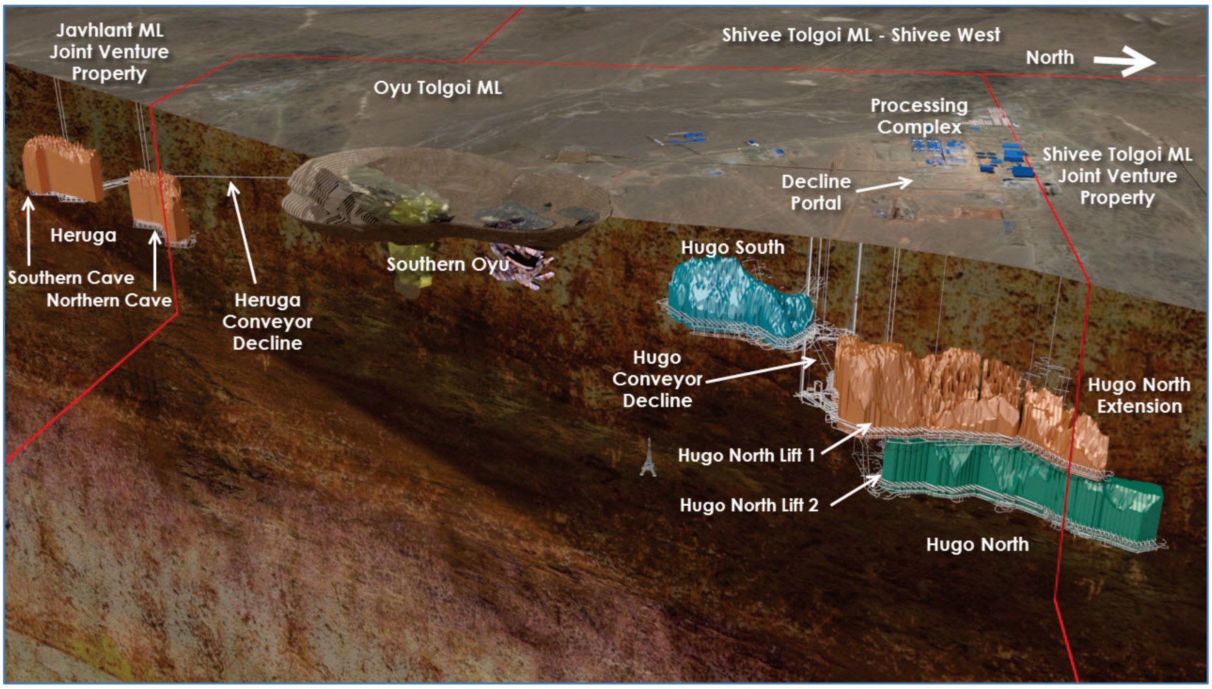
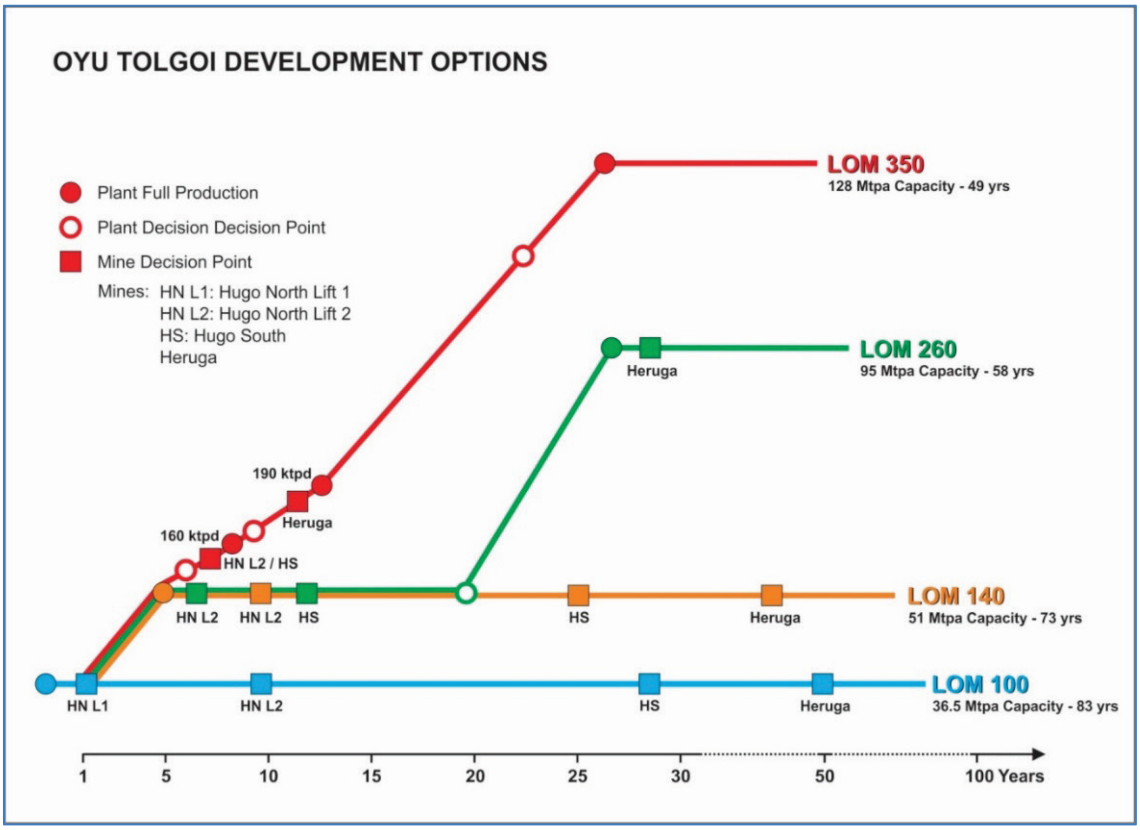


Figure by OreWin 2014

Figure 24.2 shows an example of the decision tree for the possible development options at Oyu Tolgoi including the EJV Property. This has been updated to include options that take advantage of productivity improvements in plant throughput that have begun to be recognised in the process plant. The decision tree shows options assuming that continuous improvements in plant productivity are achieved over the next five years. Then there would be key decision points for plant expansion and the development of new mines at Hugo North Lift 2, Hugo South, and eventually Heruga. This provides an opportunity as OT LLC will have the benefit of incorporating actual performance of the operating mine into the study before the next investment decisions are required. OT LLC plans to continue to evaluate Alternative Production Cases in order to define the relative ranking and timing requirements for overall development options.

Figure 24.2 Oyu Tolgoi Development Options



These Alternative Production Cases will be part of the strategic planning that is being undertaken by OT LLC. There are four production cases, the initial case assumes no expansion of the plant and three Alternative Production Cases that assume expansions to the plant capacity described by the decision tree shown in Figure 24.2. The Alternative Production Cases are:

- LOM 140 - Continuous improvement of plant throughput of 5.0% per year for five years.
- LOM 260 - LOM 140 plus a 100% plant expansion after approximately 20 years.
- LOM 350 - Progressive expansion of the plant to 350 ktpd.

LOM 140 assumes that there is an increased in plant throughput productivity of 5.0% per year for five years and that the Hugo North Lift 1 development is followed by production from Hugo North Lift 2, Hugo South and Heruga. The average throughput rate is approximately 140 ktpd or 51 Mtpa and potential processing schedule for LOM 140 is shown in Figure 24.3.

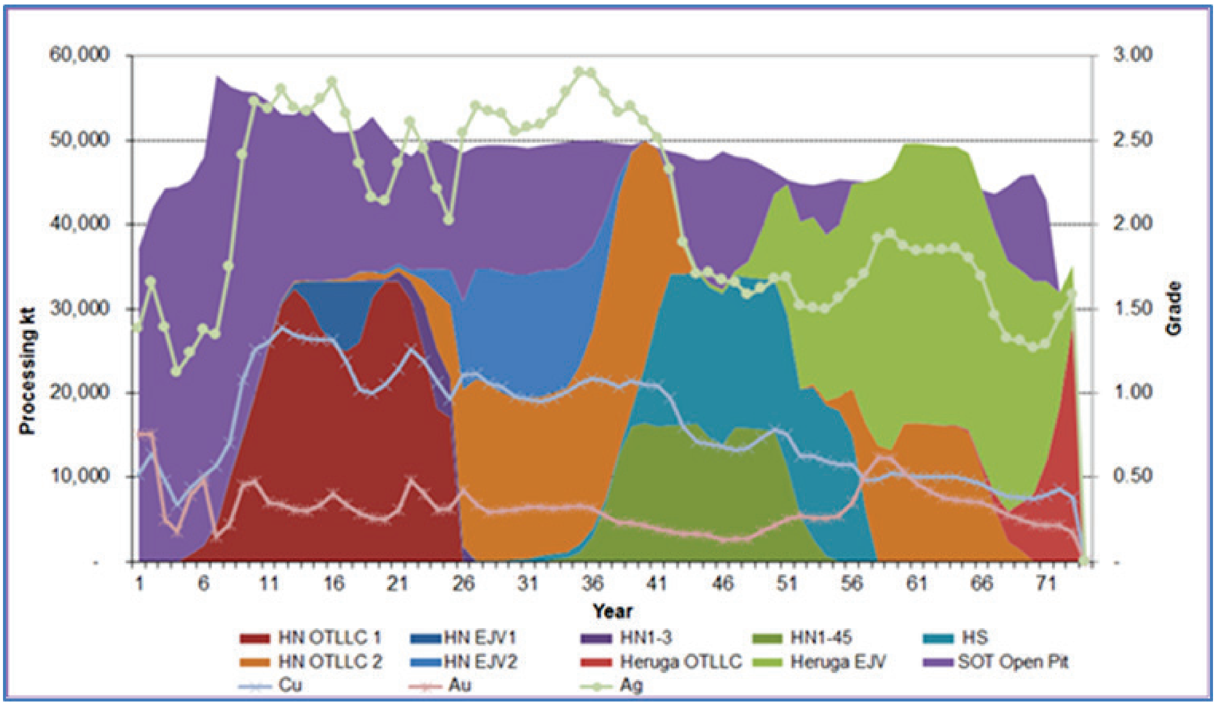
LOM 260 (see Figure 24.4) is an extension of LOM 140 and assumes that the plant capacity is doubled after approximately 20 years to an average throughput rate of 260 ktpd or 95 Mtpa.

LOM 350 assumes that there are progressive plant expansion to a rate of 350 ktpd or 128 Mtpa. With each successive expansion case there is a reduction of the mine life that would necessitate the success of further exploration to continue production. In LOM 350 (Figure 24.5) this would be required to bring the exploration potential to production in approximately 30 years.

The work on the Alternative Production Cases is not yet at feasibility study stage, in particular the definition of the expansion sizes and costing of the cases. It is recommended that the options be studied further and that the timing of the new mines be defined in more detail.

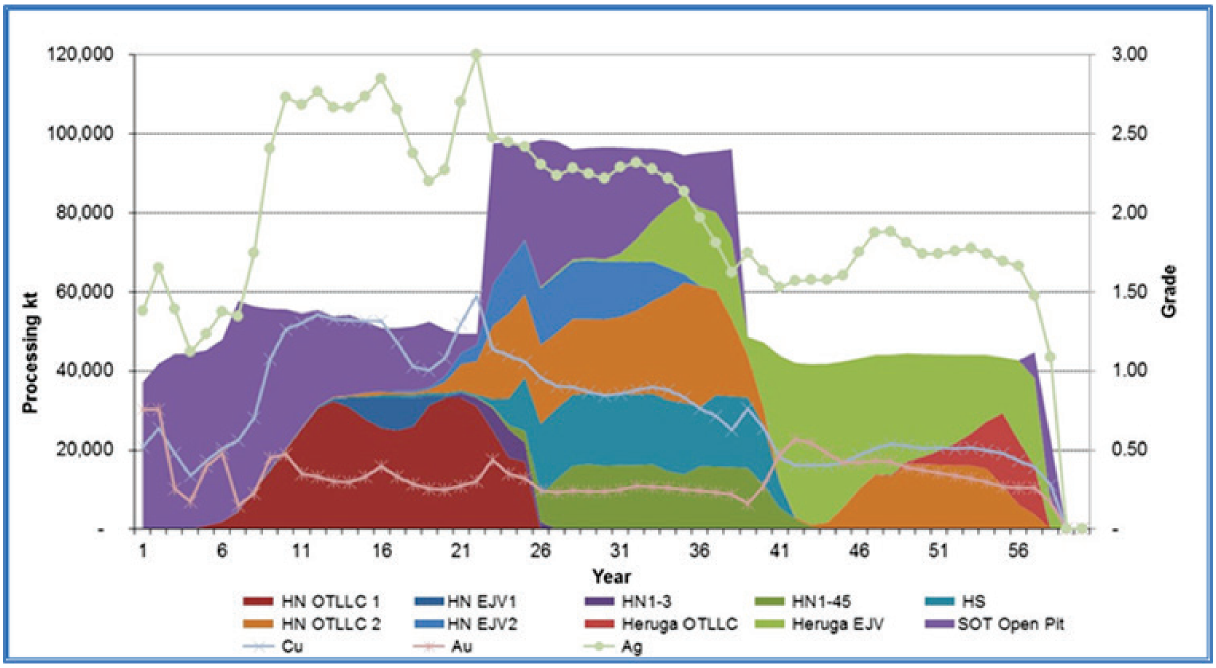
Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised.

Figure 24.3 Alternative Production LOM 140



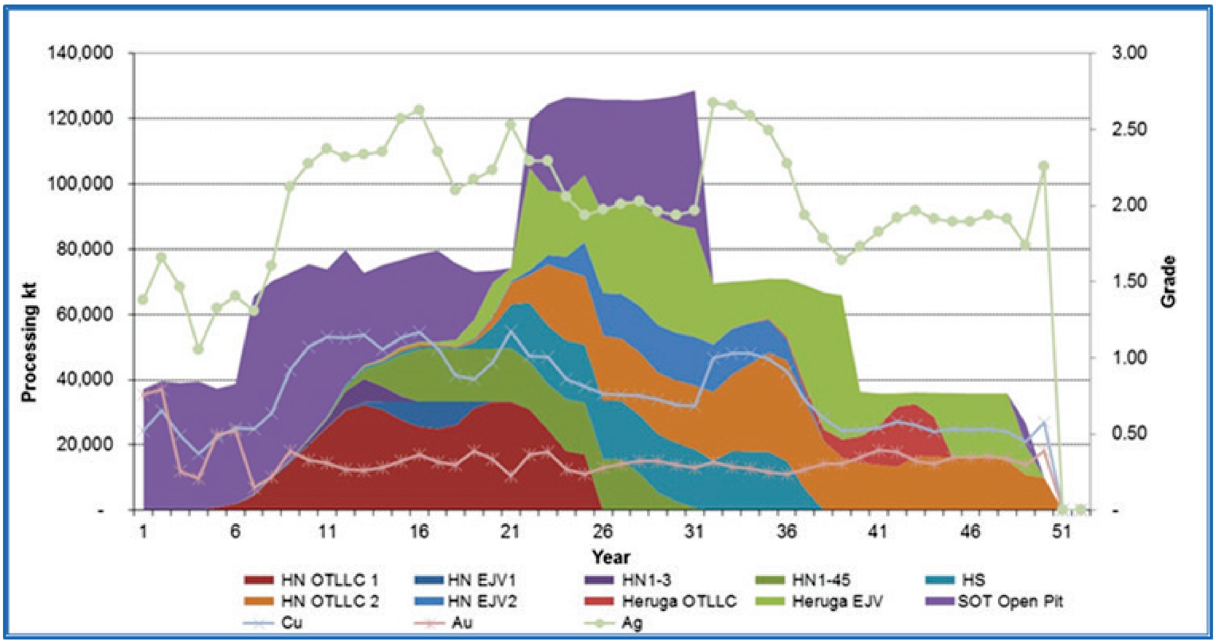
Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

Figure 24.4 Alternative Production LOM 260



Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

Figure 24.5 Alternative Production LOM 350



Under the NI 43-101 guidelines, Inferred Mineral Resources are considered too speculative geologically to have the economic considerations applied to them that would allow them to be categorised as Mineral Reserves. There is no certainty that the Alternative Production Cases will be realised. Entrée has a 20% interest in ore extracted from HN EJV1, HN EJV2 and Heruga EJV.

25 INTERPRETATIONS AND CONCLUSIONS

25.1 Interpretations and Conclusions – EJV Property

Oyu Tolgoi is a very large, long-term project that includes four separate deposits. The deposits are grouped into three areas: Heruga, SOT and Hugo Dummett (Hugo North, including Hugo North Extension, and Hugo South). The EJV (Hugo North Extrension and Heruga) is a significant part of the Mineral Resources. The geology of the EJV is well understood and the EJV deposits are considered to be examples of a very large copper–gold porphyry system and related high-sulphidation types of deposits.

The Mineral Resources and Mineral Reserves were classified using logic consistent with the CIM definitions referred to in NI 43-101. The mineralisation of the project satisfies sufficient criteria to be classified into Measured, Indicated, and Inferred Mineral Resource categories.

The Mineral Reserves are based on feasibility study level work carried out by OT LLC. The study work has been used to support project financing and meets requirements for Mineral Reserve reporting under the NI 43-101 Standards of Disclosure for Mineral Projects and those of US Industry Guide 7.

The present geological interpretations are acceptable for the geological and resource models at the levels of confidence stated. The geological interpretations and models are likely to change as the project proceeds to detailed mine design and construction.

The Hugo North Extension Mineral Resergve is only a small part of the underground Mineral Reserves at Oyu Tolgoi. There has only been a small change in the Mineral Reserve between LHTR13 and LHTR16 and this indicates that the Mineral Reserve on Lift 1 is unlikely to be changed significantly by additional studies. Significantly more Mineral Resources are available on the EJV if a Hugo North Lift 2 were developed below Lift 1.

The Heruga deposit, which lies within the Javhlant ML, contains a large zone of porphyry copper–gold–molybdenum mineralisation that has been subject to systematic drilling by OT LLC. No additional work has been completed on Heruga since the LHTR13

The long-term development of Oyu Tolgoi would involve the development of the resources on all deposits. Alternative Production Cases have been developed to provide early-stage analysis of the development flexibility that exists with respect to later phases of the Oyu Tolgoi deposits (Heruga, Hugo South, and Hugo North Lift 2). Development of these deposits will require separate development decisions in the future based on then prevailing conditions and the development experience obtained from developing and operating the initial phases of Oyu Tolgoi.

The extensive resources within several deposits at Oyu Tolgoi provide the opportunity to continually evaluate investment decisions as the mine progresses, deposit knowledge increases and economic conditions change.

OT LLC plans to undertake engineering studies of expansion options in the continuing study of Oyu Tolgoi. This will include examining all production scenarios and associated expansion options. OT LLC plans a focused and structured review of the study work to be used in the capital approvals process as the operation developments. OreWin believes that further design work could identify opportunities to improve project economics via cost reductions and mine plan optimisation. This may result in further positive changes to the EJV development schedule that could bring forward development of EJV Mineral Reserves forward relative to the current plan.

OT LLC maintains a risk management plan for Oyu Tolgoi including the EJV Property. OT LLC. OT LLC undertakes both regular ad continuos reviews of the risks at all levels included under the following areas:

- Approvals
- Resources
- Marketing
- Development Schedule
- Commercial / Project Management
- Engineering / Design
- Implementation
- Operations Readiness
- Operations
- Closure.

25.1.1 Interpretations and Conclusions – Ulaan Khud (Airport North)

Ulaan Khud was explored during 2006 and early-2007 with 35 diamond drillholes totalling approximately 16,700 m. One additional hole was drilled in 2008 to test the up-dip extension of mineralisation seen in hole EGD127.

Drilling in 2006 and 2007 defined a shallow but narrow, steeply dipping zone 30–50 m wide with a north–south strike length of approximately 900 m, and a vertical extent of up to 600 m. The zone averages <0.3% Cu but contains narrow, patchy, high-grade copper and gold intervals. No significant mineralisation was intercepted in the 2008 drill test and the zone was not expanded.

25.2 Interpretations and Conclusions – Shivee West

The Argo mineralization occurs in CS3 rhyolitic volcanics, probably massive flows with coarse flow breccias and fine hyaloclastites, with subtle development of quartz veinlet stockwork(s). To date, silicification in the form of quartz veining is the only alteration recognized. Pyrite was the only sulphide recognized during RC chip logging in 2011, up to several percent locally but usually on the order of 0.5 - 2%. Its presence is not a reliable guide to gold grade.

Both Argo and Zone III lie within a well-defined, northerly-trending magnetic-low (), which extends for at least 2.5 kilometres along strike. A gradient Titan IP survey done in 2005 went over the area of Argo and Zone III, but was designed to look for deep mineralization. A broad chargeability feature was defined (), coincident with the magnetic low. The chargeability is likely related to weakly elevated sulphide content in the CS3 rhyolitic volcanics. However, based on the RC drilling, sulphide content in the presence of gold mineralization is very low.

Mineralization at Argo and Zone III may have a relationship to the bedrock geology lying east of the gold targets. The highest gold grades in both drilling and surface sampling have come from the north end of Argo, along the western flank of a significant accumulation of flow-laminated dacite (Unit CS8). Previous sampling and geochemical surveys by Entrée over the CS8 dacite do not indicate any gold anomalies within the unit. Moving south to Zone III, where the lithology immediately to the east is the flow-banded dacite of Unit CS4, the grade of gold mineralization on surface and in drillholes has decreased, and at least on surface, is spread over a greater width. The strike extension of Zone III to the south, which does not show any gold mineralization, also lies on the flank of CS4 dacites. This suggests that the gold mineralization of both Argo and Zone III may have an unknown structural control that is related to their position relative to Unit CS8. The stratigraphic relationships among the three units are not clear, although CS4 dacites may be structurally emplaced above CS3 rhyolites. CS8 may be time-equivalent with CS3. It undergoes a facies change from flow-laminated dacite to dacite flow breccia, in which clasts of flow-laminated dacite can be recognized. Its contact with CS3 rhyolites is difficult to determine, due to the fragmental nature of both units.

Exploration in 2012 on the Argo Zone continued to confirm the moderate to high gold grades obtained by sampling done in 2011. Three chip samples collected from the discovery outcrop returned 0.75 g/tonne Au over 2.4 metres, 0.330 g/tonne Au over 2.3 metres, and 8.67 g/tonne Au over 3.3 metres. Subsequent excavator-assisted trenching also had high gold intervals, including an average of 81.4 g/tonne Au over 3 metres, 2.24 g/tonne Au over 6 metres, 3.10 g/tonne Au over 3 metres, and 3.76 g/tonne Au over 6 metres. Although not consistently mineralized throughout, Argo has now been traced over a strike length of 400 metres, and has a width of 130 metres where high grade mineralization can occur over at least several narrow intervals.

The sampling at Altan Khulan did not return any significant gold values to suggest the presence of structures parallel to the direction of drilling undertaken in 2008.

The Khoyor Mod North target comprises a broad 250 by 300 metre area with subtle quartz veining in Devonian age rocks. One 50-metre trench was excavated in 2012: 20 continuous chip samples from the trench returned gold values from trace to 0.58 g/t Au (over 2 metres) and anomalous copper values up to 505 parts per million. The copper-gold geochemical signature and the quartz stockwork indicate a porphyry-style target, at depth within the Devonian sedimentary rocks, in particular where these are associated with monzodiorite intrusions. The age of the intrusions is unknown; nonetheless the geological setting of the target has some similarities to that at Oyu Tolgoi.

26 RECOMMENDATIONS

Exploration and development of the Entrée OT LLC EJV Property is under the control of project operator OT LLC. The future work recommendations in 2014 OTTR although focused on the OT project will be of benefit to Entrée as they will include examination of the EJV Property.

Recommendations have been stated throughout the text of the report. OT LLC has commenced production from the open pit and the concentrator, and is working with all the stakeholders with the aim of restarting the underground mine at Hugo North. OT LLC intends to use this experience and apply it to the continued study and operation of the project. OreWin concurs with the OT LLC plan. The key recommendations for further work are:

26.1 Oyu Tolgoi Project Development

Oyu Tolgoi's large Mineral Resource base represents significant opportunities, not only as an exceptionally long-life project but also for production expansion. Ongoing planning work using Inferred resources has identified the potential for further expansions. The LHTR16 demonstrates the potential of the Inferred and shows that the EJV resources are an integral part of the long-term development plans.

OT LLC continues engineering studies for the Oyu Tolgoi project, including the EJV Property. These will include examining all production scenarios and associated expansion options. OT LLC plans a focused and structured review of the study work to be used in the capital approvals process as the operation develops. OreWin believes that further design work could identify opportunities to improve project economics via cost reductions and mine plan optimisation. This may result in further positive changes to the EJV development schedule that could bring potential development of EJV mineral resources forward.

Separate development decisions will need to be made based on future prevailing conditions and the experience obtained from developing and operating the initial phases of the project.

Exploration and development of the EJV Property is under the control of the project manager, Rio Tinto. The future work recommendations in the 2014 OTTR although focused on the Oyu Tolgoi project will be of benefit to Entrée as they will include examination of the EJV Property.

Continuing the study of the Hugo North deposit and options for development will be of benefit to the EJV portion of the deposit. In particular, making use of the additional haulage capacity that is planned to be installed underground could allow for improved performance to accelerate Hugo North Lift 1 production and so bring Hugo North Lift 2 development forward. The commencement of mining on Hugo North Lift 1 will provide valuable 'real life' data for mining, processing and other disciplines for improved modelling of Hugo North Lift 2 development and production.

The work on the Alternative Production Cases is not complete, in particular the definition of the expansion sizes and costing of the cases. It is recommended that Entrée work with TRQ and OT LLC to study the options be studied further and that the timing of the new mines be defined in more detail.

26.2 Future Strategies

The geological aspects of mine design and construction are discussed below.

The present geological interpretations are acceptable for the geological and resource models at the levels of confidence stated. The geological interpretations and models are likely to change as the project proceeds to detailed mine design and construction.

From 2010–2015, OT LLC reviewed and re-evaluated much of the data collected in support of mine design and construction. These reviews included consideration of the additional drilling completed in the project area, incorporation of revised, and more detailed, structural and lithological interpretations, consideration of changes in interpretation of the evolution and genesis of Oyu Tolgoi deposits, and the results of geotechnical reviews. A number of areas were identified that could benefit from targeted work programmes, particularly in the areas of structure and rock mechanics.

The result was development of proposed work for 2015 and beyond that addressed geological issues that could directly affect the mine design and construction. The OT LLC work programme is likely to include the following:

- Continuing to incorporate reconciliation data to assess performance of resource models, especially for the SOT deposit.
- Continuing with underground and open pit face mapping to improve geological and structural understanding and validate the structural and geological models.
- Undertaking drill testing of structural discontinuities identified in the structural and geotechnical reviews. The results of such test work would be incorporated into the block model.
- Reviewing the updated block models to pinpoint areas where there are gaps in knowledge concerning lithology, alteration, structure, and mineralisation that require targeted drill testing. Such gaps are considered to be more likely on the deposit margins or in areas where high-grade mineralisation is in direct contact with areas interpolated as waste.
- Building a 3D district geological and structural model that will assist in further exploration and in the definition of additional drill targets in the near-mine environment.
- Evaluating future work in the Hugo South and Hugo North Lift 2 areas to further enhance the understanding of the overall resource development strategy.
- Completing the quantification of the mineralised inventory within Heruga North.
- Continuing with exploration programmes scaled to business needs to investigate opportunities to expand the project resource base and improve the mine development sequence.
- Drilling at Ulaan Khud in 2006 and 2007 defined a shallow but narrow, steeply dipping zone 30–50 m wide with a north–south strike length of approximately 900 m, and a vertical extent of up to 600 m. The zone averages <0.3% Cu but contains narrow, patchy, high-grade copper and gold intervals. No further work is recommended in this area;

however, the poorly explored area between the south end of the Ulaan Khud and Hugo North Extension could still be considered prospective.

26.3 Plant and Infrastructure

26.3.1 Concentrator

The concentrator progressed from commissioning into production and many unit operations within the concentrator are being progressively optimised for throughput and recovery.

It would be anticipated that improvements in throughput and recovery will be achieved to reach and surpass design assumptions together with reduction in unit operating costs. This could be achieved by:

- Optimisation of grinding control through improved power splits between SAG and Ball milling;
- Optimisation of grind size to achieve the optimum recovery / throughput economic outcome;
- Optimisation of reagent control / type for flotation and thickener unit operations;
- Optimisation of regrind recycle and sizing for cleaner flotation;
- Improved availability of equipment through gaining of operating experience and implementation of preventative maintenance practices; and
- Improved operator and technical experience with the concentrator equipment and ore characteristics.

This optimisation would include ongoing circuit surveys and modelling, metallurgical test work and support from reagent and equipment suppliers.

Additional work is required in the following areas to advance the design of the process plant:

- Phase 2 detailed engineering.
- Ongoing metallurgical testing programme for Hugo North and Central zone ores.
- Concentrator conversion feasibility study update.
- Prefeasibility programme for additional resources (Heruga, Hugo South).
- Smelter studies.
- Heap leach studies.
- Magnetite recovery.
- Gravity or magnetic separation of gold from the regrind circuit.

- Other improvements to gold recovery.
- Enhanced tailings treatment to reduce water retention.

26.3.2 Tailings Storage Facility

OT LLC has a programme of studies to optimise the TSF design. These include bringing forward the Cell 2 operation to create larger tailings deposition areas will result in higher in-place tailing densities and greater storage capacity. Optimisation of the TSF is also expected to improve tailings solids content at deposition, which is currently is lower than the design assumptions but it is expected that this can be brought up to the design assumption through optimisation of the operation of the TSF. This optimisation of the TSF will potentially provide cost savings over the assumptions in OTFS14.

The following items are planned to be addressed by OT LLC as future work based on the current TSF design for Oyu Tolgoi:

- The current design needs to be optimised given the operating conditions and lower tailings solids content at deposition.
- It may be more cost effective overall to implement Cell 2 earlier than Year-5, in terms of the amount of embankment material required to store the tailings. Larger tailings deposition areas will result in higher in-place tailing densities (faster drainage and drying time) and greater storage capacity. This approach is to be evaluated for potential cost savings.
- Currently the density of concentrator thickened tailings is 1.26 t/m^3 this is lower than the design assumption of 1.45 t/m^3, and this is having a potential adverse effect on the project water balance, higher water usage, and capacity of the tailings facility, less capacity of existing design. The test work undertaken during the project design indicated a tailings density of 1.45 t/m^3 can be achieved from the tailings thickeners. As the concentrator has only recently progressed from commissioning into production and many aspects of the concentrator have not been optimised, optimisation of thickener control and flocculant additions, are expected to achieve the design thickener underflow density. At a revised target density of 1.35 t/m^3, the KCB 2011 feasibility design for the TSF provides for storage of 670 Mt of tailings produced over the first 18 years of mine life. Once operating conditions are understood, the facility will need to be expanded to support continued mining beyond that capacity. Designs for the three additional cells required to store the total 1.5 bt of tailings will be based on the deposition and construction experience gained in optimising the current design.
- Embankment slopes should be optimised based on observations from test fills and conditions during the construction period. The design is currently based on assumptions of pore pressure response that could be conservative. The instrumentation and monitoring programme should be expanded to improve understanding of foundation performance.
- Observations made during operations with regard to beach formation and water recovery are being evaluated to optimise the number of sub-cells in the TSF design. Alternately, the sub-cells may be eliminated entirely and an expanded spigot discharge system used to manage tailings deposition.

Achieving the design tailings density to the tailings dam will assist in:

- Improvements in water return, from the tailings dam and thickener, tailings beach angles
- Steeper beach angles in the tailings dam further improving ultimate settled density in the dam, and
- Providing improved storage capacity towards design values.

These improvements from current assumptions will achieve reduced costs for the TSF sustaining capital over the life of the project.

26.4 Shivee West

Additional exploration is recommended on Shivee West to further test Zone III / Argo Zone and to continue porphyry copper exploration. Estimated cost for the following work is approximately $6.6 M.

26.4.1 Precious Metal Exploration – Argo Zone / Zone III

Continued exploration of the near surface gold mineralisation at Argo is recommended, to look for and subsequently to define mineralisation amenable to open pit mining. The work programme would encompass additional geochemical and geophysical surveys, and drilling.

Compared to conventional soil sampling done by Entrée from 2003 to 2007, MMI sampling has been more successful in outlining and locating gold anomalies. Expansion and infill of the existing MMI soil sampling over the Argo Zone is recommended, to cover in greater detail the magnetic low that is associated with the mineralisation.

Although the overall sulphide content of the Argo mineralisation is very low, dipole–dipole IP surveying is recommended, to define near-surface chargeability and resistivity features, and is not sufficiently detailed to guide continued drilling. Dipole–dipole IP surveying is recommended, using n=1–10 and a=100 m, on lines spaced 100 m apart, to cover the magnetic and Titan IP anomaly.

Two phases of drilling are recommended. Core drilling (3,000 m of HQ core) is recommended to gain additional geologic knowledge of the Argo mineralisation across the zone and along strike to the north, in particular to determine the stratigraphic and structural controls on mineralisation. This would be followed by 3,000 m of RC drilling, to infill the core hole pattern, and to drill any additional targets resulting from the geophysical and MMI sampling surveys.

26.4.2 Porphyry Copper Exploration

The Khoyor Mod area has sporadic copper showings in a monzodiorite intrusion hosted by Devonian DA4s sedimentary units. An attempt to date this intrusion was unsuccessful (Panteleyev, 2006); however, whole rock sampling of core and outcrop is recommended, to determine if it has a geochemical signature similar to the Devonian Qmd at Oyu Tolgoi. Establishing a Devonian age would enhance the prospectivity of this area.

The MMI–Au anomalies north of the Khoyor Mod area require additional detailed mapping, sampling, and excavator-assisted trenching to define a drilling target for several relatively shallow HQ core holes totalling 1,000 m.

5,000 m of HQ core drilling is recommended to continue deep exploration of the strong magnetite and potassic hydrothermal alteration system encountered in EG-10-140 during Entrée's 2010 drilling campaign.

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Volume	Title
1.0	Executive Summary
2.0	Country And Regional Settings
3.0	Ownership And Legal
4.0	Government And Community Relations
5.0	Human Resources And Capability Development
6.0	Occupational Health, Hygiene, And Safety
7.0	Environment
8.0	Water Management
9.0	Geology And Mineral Resource Estimates
10.0	Underground Mining
11.0	Open Pit Mining
12.0	Metallurgical Process And Process Plant
13.0	Tailings Storage Facility
14.0	Infrastructure
15.0	Project Execution Plan
16.0	Operational Readiness
17.0	Marketing
18.0	Capital Costs
19.0	Operating Costs
20.0	Summary Of Financial Results
21.0	Risk Assessment
22.0	Next Study Stage And Restart Planning
23.0	Life Of Mine Case (Plan)

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27.3 Glossary of Symbols and Units

Table 27.1 Table of Symbols and Units

Symbol / Unit	Meaning
°	Degrees (decimal)
′	Minutes (latitude / longitude)
″	Seconds (latitude / longitude)
%	Percent
<	Less than
>	Greater than
°C	Degrees Celsius
µm	Micrometre (micron)
a	Annum (year)
bt	Billion tonnes

Symbol / Unit	Meaning
b	Billion
cm	Centimetre
cm^2	Square centimetre
cm^3	Cubic centimetre
d	Day
d/wk	Days per week
dmt	Dry metric tonne
g	Gram
g/t	Grams per tonne
h	Hour
ha	Hectare (10,000 m^2)
kg	Kilogram
kg/m^3	Kilograms per cubic metre
kg/t	Kilograms per tonne
kh	Thousand hours
km	Kilometre
km/h	Kilometre per hour
km^2	Square kilometre
koz	Thousand Troy ounces
kPa	Kilopascal
kt	Thousand tonnes
ktpd	Thousand tonnes per day
ktph	Thousand tonnes per hour
L	Litre
lb	Pound
m	Metre
M	Million
m/s	Metres per second
m^2	Square metre
m^3	Cubic metre
masl	Metres above (mean) sea level
mg	Milligram
Mlb	Million pounds
mm	Millimetre

Symbol / Unit	Meaning
mmpa	Millimetres per annum
mmph	Millimetres per hour
mo	Month
Moz	Million ounces
MPa	Megapascal
Mt	Million tonnes
mV	Millivolt (one thousandth of one volt)
oz	Ounce
ppb	Parts per billion
ppm	Parts per million
t	Metric tonne (1,000 kg)
t/a	Tonnes per annum
tpd	Tonnes per day
tph	Tonnes per hour
t/m^3	Tonnes per cubic metre
W/m^2	Watts per m^2
wk	Week (seven days)
wmt	Wet metric tonnes

27.4 Glossary of Abbreviations and Terms

Abbreviation / Term	Description
AAS	Atomic Absorption Spectroscopy
AB	Multiple Current Electrode IP
ABA	Acid Base Accounting
ACS	Access control system
AC-Tek	Advanced Conveyor Technologies
AFS	Aminpro-Flot Simplex
AIF	Annual Information Form
Aminpro	Amelunxen Mineral Processing Ltd.
ANFO	Ammonium nitrate fuel oil
ARD	Acid rock drainage
ARG	Argillic alteration (intermediate)
ATV	Acoustic televiewer
BCF	Proprietary software

Abbreviation / Term	Description
BiGd	Biotite granodiorite dyke
BWI	Bond Ball Mill Work Index
CATV	Cable television
CCTV	Closed-circuit television
CEET	Comminution Economic Evaluation Tool
CHL	Chlorite alteration
CHR	Critical hydraulic radius
Ci	Minnovex Crushing Index
CIM	Canadian Institute of Mining
CuEq	Copper equivalent
DCS	Distributed Control System
DDH	Diamond drillhole
DEIA	Detailed Environmental Impact Assessments
DEM	Discrete element modelling
DFN	Discrete fracture networks
DIDOP	Detailed Integrated Development Operations Plan
DTR	Digital trunk radio system
EBRD	European Bank for Reconstruction and Development
EFNARC	European Federation of National Associations Representing producers and applicators of specialist building products for Concrete
EIA	Environmental Impact Assessment
EJV	Entrée–OT LLC Joint Venture
EMS	Environmental Management System
EMSys	Electrical monitoring system
Entrée LLC	Subsidiary of Entrée-Gold Inc.
EP	Equivalent people
EPCM	Engineering, Procurement, and Construction Management
ESIA	Environmental and Social Impact Assessment
FAS	Fire alarm system
FEL	Front-end loader
FIFO	Fly-in-fly-out
FLEET	Flotation Economic Evaluation Tool
FRS	Fibre-reinforced shotcrete
FS	Feasibility study
G&A	General and administration

Abbreviation / Term	Description
Gbit	Gigabit (10^9 bits)
GDP	Gross domestic product
GIS	Geographic information system
GOM	GOM
GSI	Geological Strength Index
H&S MS	Health and Safety Management System
HEPA	High-efficiency particulate air
HI	Hollow inclusion
HME	Heavy mobile equipment
HNL1	Hugo North block cave Lift 1
HNL2	Hugo North block cave Lift 2
HSE MS	Health, Safety, and Environment Management System
HWS	Hanging wall sequence of rocks
IA	Investment Agreement with the GOM, effective October 2009
ICP-OES / MS	Inductively-Coupled Plasma Optical Emission Spectroscopy / Mass Spectrometry
ICT	Information and Communications Technology
IDOP	Integrated Development Operations Plan
IDOPTR	IDOP Technical Report, 2012
IDP05	Integrated Development Plan 2005
IDP10	Integrated Development Plan 2010
IDZ	Isolated Draw Zone
IFC	International Finance Corporation
IFC-PS1	IFC Performance Standard 1 (Social and Environmental Assessment and Management Systems)
IMMI	Ivanhoe Mines Mongolia Incorporated
IMMI EIA	IMMI Environmental Impact Assessment
IP	Induced Polarisation
IRMR	In-situ Rock Mass Ratings
IRR	Internal rate of return
ISBL	Outside battery limits
JV	Joint venture agreement
LAN	Local Area Network
LCT	Locked cycle test work
LHD	Load-haul-dump

Abbreviation / Term	Description
LIBOR	London Interbank Offered Rate
LOM	Life-of-mine
MagTell	Magnetotellurics
MBI	Modified Bond Index
MCE	Maximum Credible Earthquake
MEL	Mineral exploration license
MFT	Modified flotation tests
MEGDT	Mongolian Ministry of Environment, Green Development and Tourism
MRAM	Mineral Resources Authority of Mongolia
MRMR	Mining Rock Mass Ratings
MRS	Mesh-reinforced shotcrete
MS	Mass Spectrometry
NAF	Non-acid forming
NGI	Norwegian Geotechnical Institute
NI 43-101	Canadian National Instrument 43-101 Standards of Disclosure for Mineral Projects
NN	Nearest neighbour estimation method
NPV	Net Present Value
NPV8	NPV at an 8% discount rate
NSR	Net Smelter Return
OSBL	Outside battery limits
OCDB	Oracle Content Database
OEL	Occupational exposure limits
OK	Ordinary kriging estimation method
OT LLC	Oyu Tolgoi LLC
P_{80}	The 80% passing size of grinding circuit product
PAF	Potentially acid forming
PCBC	Block cave modelling proprietary software
PEP	Project Execution Plan
PFS	Prefeasibility study
PIMA	Portable Infrared Mineral Analyser
PLC	Programmable Logic Controller
PMF	Probable maximum flood
PPA	Power Purchase Agreement
QA/QC	Quality assurance and quality control

Abbreviation / Term	Description
Qmd	Porphyritic quartz monzodiorite
QP	Qualified Person
RC	Reverse circulation
RCAG	Research Centre of Astronomy and Geophysics
RDP	Round Determinate Panel
ROM	Run of mine
RQD	Rock quality designation
RSP	Review and Strategic Plan
RTCP	Rio Tinto Copper Projects
SAG	Semi-autogenous grinding (mill)
SBR	Sequencing Batch Reactor
SGSPA	Small Gobi Strictly Protected Area
Shut-off grade	The grade used to determine the point at which each drawpoint is closed
SIA	Social Impact Assessment
SLC	Sub-level cave
SMU	Selective mining unit
SOM	Stockpiled in an oxide material
SPI	SAG Mill Power Index
SRG	North seeking Gyro
SRM	Synthetic Rock Mass Modelling
SWIR	Short-wave infrared
T&I	Rio Tinto Technology and Innovation
TDR	Time Domain Reflectometers
TEC	Trace elements composites
TEM	Telluric electromagnetic
TPUT	Throughput
TR	Technical Report
TRQ	Turquoise Hill Resources Ltd.
TSF	Tailings storage facility
UCS	Unconfined Compressive Strength
UG FS	Underground feasibility study
US CPI	United States Consumer Price Index
US SEC	United States Securities and Exchange Commission
UTS	Unconfined Tensile Strength

Abbreviation / Term	Description
VAT	Value Added Tax
VFR	Visual flight rules
VoIP	Voice over Internet Protocol
WRD	Waste rock dump