LUDVIKA MINES PRELIMINARY ECONOMIC ASSESSMENT

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Nordic Iron Ore

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1. Executive summary

Introduction

Nordic Iron Ore commissioned Ramböll Sweden AB ("Ramböll") and their side-consultants to prepare a Preliminary Economic Assessment for the Ludvika Mines Project, which is located in south central Sweden. This Preliminary Economic Assessment (PEA) is intended to be used by Nordic Iron Ore to further develop the Ludvika Mines Project.

Ramböll's opinion contained herein is based on information provided to Ramböll by Nordic Iron Ore. This report builds on the resource estimate prepared by Geovista in September 2011. Side-consultants in the Study are ProIng AB who prepared the Processing chapter, Vectura Consulting AB who prepared the Logistic chapter and Vattenfall Power Consultant who completed parts of the mine planning chapter. The Client have finally made the economical evaluation in chapter 8, and chapter 7 have been compiled by the Raw Materials Group (RGM).

The Ludvika Mines Project consists of the two historical iron ore mines Håksberg Mine and Blötberget Mine located north and south respectively of the town of Ludvika and approximately 215 km northwest of Stockholm, Sweden. The property lies within Ludvika Municipality in the county of Dalarna. Existing data indicate that there is sufficient land area available within the properties to construct all necessary facilities required for production.

Mining and exploration of the iron ore fields surrounding Ludvika has been carried out since the 16^{th} century. During the 1960 and 70's several iron ore mines operated in the Bergslagen region in south central Sweden. However, due to unfavorable market conditions many were closed down by the end of the 1970s. Blötberget mine was closed in June 1979 and Håksberg in December 1979.

However, during recent years the iron ore prices have increased significantly; mainly due to high demand of steel in China as an example, causing a strong market demand for iron. The vast majority of analysts believe that the iron ore prices may well decline from the current recent highs, but will remain at a level that is historically still high, allowing for the development of new iron ore resources. Significantly those resources which are existing brownfield sites and located near existing services and logistics have significant advantages over many greenfield site developments.

The brownfield sites of Blötberget and Håksberg mines are now subject for re-opening. The concept for this is presented in this report.

Location and access

The mineral deposits of Ludvika Mines are located close to the town of Ludvika, and are well connected to all major centers with road and railway (see overview map in appendix 1). The area is served from the adjacent airport Borlänge by regular air service to the capital Stockholm and to other major cities in Sweden, which in turn are accessible through numerous international airlines. Several shipping harbor alternatives have been investigated, and the alternative presented in this report, Gävle, is situated at 180 km distance from the mine site and is connected by existing railway.

Property tenure and Land Use

The property has only a few owners, the main owner being the forest company Bergviks Skog. For the mines two separate Exploitation Concessions are applied for to The Mining Inspectorate of Sweden. The Blötberget Exploitation Concession was granted August 30, 2011, and it is expected that notification on the Håksberg Exploitation Concession will arrive in the end of 2011.

To enable the reopening of the iron ore mines in Blötberget and Håksberg some further technical developments are required. The two most important aspects are to develop an efficient transport solution for the iron ore and to be able to use the present infrastructure both in and adjacent the mine. Another important aspect is the minimization of impact for residents in the area. During an early localization study eight different areas were reviewed and the conclusion was that the best location for the concentration plant is at Blötberget (Skeppmora) close to the present railway, see overview in appendix 1.

Geology and Mineralization

The iron ore field of Blötberget consists of magnetite lava flows with a minor content of dolerite horizon, in the footwall, surrounded by terrestrial and near shore sediments. The large thickness of the magnetite lava indicates that the ore is deposited near its eruption zone or pipe. Both the terrestrial and the marine magnetite lava are superimposed by a thick zone with bands of detrital magnetite lava as granules and grains in both terrestrial and marine sediments. In the lower levels of Blötberget iron ore deposit, the detrital magnetite lava zone is divided from the main magnetite lava zone (the main ore zone) by an up to 25 m thick zone with marine argillitic greywacke.

The geology of Håksberg mine field differs significantly from that of Blötberget. Håksberg is also a magnetite lava flow deposit but it is deposited and interlayered with marine sediments such as mica-schists and argillitic greywacke. In Håksberg there is no significant oxidation of the magnetite lava and it is very fine grained <1mm. The massive magnetite lava horizons are also interlayered with pillow lava horizons. In the mine field of Håksberg there is also an increasing content of exhalatively deposited magnetite alternating with thin chert layers (i.e. banded iron formation, BIF). This magnetite formation was formerly called quartz banded iron ore.

Resources

The current mineral resources at Blötberget and Håksberg, in compliance with JORC, reported using an assumed cut-off of 30 % Fe.

Mineral resources at Blötberget as of August, 2011.

Category	Tonnage [Mt]	Grade Fe [%]
Indicated	13.9	42.6
Inferred	10.2	42.9

Mineral resources at Håksberg as of August, 2011.

Category	Tonnage [Mt]	Grade Fe [%]
Indicated	25.4	36.4
Inferred	11.6	36.0

This will combined give a tonnage for the Preliminary Economical Assessment, including the Indicated and Inferred tonnage to the following total:

Tonnage at Håksberg and Blötberget as of August, 2011.

Mining Area	Category	Tonnage [Mt]	Grade Fe [%]
Håksberg	Indicated+Inferred	37.0	36.2
Blötberget	Indicated+Inferred	24.1	42.7
Both	**As above**	**61.1**	**38.7**

Mining strategy

The plan proposed is to upgrade the existing declines to the old mines to gain access to surface. In the case of Blötberget a new decline is required from surface, whereas in Håksberg the old decline will be upgraded and will be finished down to the 300 m level. Parts of the old mine infrastructure such as ventilation, old ramps and drifts will be upgraded for the use of more modern equipment operating at a higher production rates than was the case historically. The mining method utilized is a modernized version of the previously used sublevel caving and open stoping methods. The mining is carried out in all ore bodies in order to obtain several working faces but also to get an even mill feed.

The mined ore will be crushed and transported to surface in vertical and inclined shafts at both mines. At Blötberget mine the ore is fed directly to the adjacent

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concentration plant, while at Håksberg the ore is loaded via an ore silo into rail cars at a new terminal, for shipment to the concentration plant in Skeppmora.

At a total production rate of 5.5 Mt (2.5 Mt at Blötberget and 3 Mt at Håksberg) the lifespan of the production time is approximately about 12 year for the mines, based on the Indicated + Inferred mineral resource.

Processing

It is planned that the new beneficiation plant will be mainly producing a pellet-feed concentrate, but also a sinter-feed fines (-4 mm) product. The beneficiation plant will have two production lines, one for Blötberget type ore and one for Håksberg type of ore, with a common flotation and dewatering circuit. The estimated weight recovery of Fe-products will be about 40% producing 265 kt/y of fines with a nominal size of -4 mm with 62 % Fe and 1918 kt/y concentrate with 67 % Fe and <0.05 % P.

Pre-production capital costs

The pre-production investments are given in Table A. Full production is planned to be reached Q2 year 4, however the mining is proposed to commence early at about Q2 year 2 along with the already developed areas in Blötberget and Håksberg mines. Pre-production costs are therefore summarized as the capital costs that are required before production starts at Q2 year 2. Capital costs required for reaching full production at Q2 year 4 are also shown in Table A. Pre-production capital costs are summarized to 2 115 MSEK excluding project costs of 12%. Capital costs to reach full production are summarized to 2 700 MSEK excluding project costs of 12%.

Table A. Estimate of pre-production capital costs and costs to reach full production

Capital Costs Pre production	Blötberget (BB)	Håksberget (HB)	Total pre-production	Full prod BB	Full prod HB	Full prod total
	[MSEK]	[MSEK]	[MSEK]	[MSEK]	[MSEK]	[MSEK]
Mining	136	470	606	340	767	1 107
Ore beneficiation	1 000	240	1 240	1 037	240	1 277
Transport	83	62	145	83	62	145
Infrastructure	93	31	124	103	68	171
Total			**2 115**			**2 700**
Project costs 12%			254			324
Total			**2 369**			**3 024**

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Capital Cost Estimate

The capital costs estimates for the project are summarized in Table B.. Capital investment costs are estimated based on 2011 prices and no inflation is added.

The total Life of Mine (LoM) capital costs for sustaining capital are estimated at 3 165 MSEK excluding project costs of 12% (based on leasing/contracting of mining equipment) as summarized in Table B.

Table B. Estimate of capital costs over the Life of Mine (LoM)

Capital Costs LoM			
	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]
Mining	568	825	1 393
Ore Beneficiation	1 187	240	1 427
Load out/Rail terminal	83	62	145
Infrastructure	124	76	200
Total	1 962	1 203	3 165
Project costs 12%			380
Total			3 545

Operation costs estimate

Opex is based on a yearly production of 5.5 Mt ore and 2.35[1] Mt products (sinter and pellets feed), as well as on contracting out of the Mine drifting and production parts. Operation costs estimate are summarized in Table C.

Table C. Estimate of Operation costs at full production

Operational cost estimate	SEK per ton ore	SEK per ton product
Mining	80	200
Rail/ROM Haulage	3.9	9.8
Crushing/hoisting	6.6	16.4
Ore Beneficiation	26.8	66.9
Rail transport	16	40
Harbor fee (Gävle)	8	20
Contingency (2.5%)	3.5	9
Average Operating Cost per ton	144.8 SEK	362.1 SEK

Product Quality

Using available metallurgical data available an estimate of a typical pellet feed product is shown in Table D below. This is an estimate based on available data and is subject to confirmation testwork; planned in the coming months.

[1] Note: DW 2.18 Mt + a water content of ~8%

Table D – Estimate of Typical Product Quality

Fet Total Iron %	SiO2 Silica %	Al2O3 Alumina %	CaO Lime %	MgO Magnesia %	P Phosphorous %	V Vanadium %	Na20 Sodium %	K20 Potassium %
>67.0	<1.3	<1.3	<0.4	<0.3	<0.03	<0.15	<0.05	<0.05

Market

It is the view of Nordic Iron Ore that this is a conservative estimate of the product quality achievable. The product is anticipated to contain significant proportions of magnetite which will bring significant advantages to the pellet maker. Metallurgical data to date indicate that other products may be possible, which may suite the European steel industries and possibly the non-metallurgical applications.

As a project NIO has significant advantages with the existing infrastructure and services available, primarily with existing high quality rail virtually to the mine and access to existing deep water ports that are used to handling dry bulk cargos. This will ensure that the investment costs are minimised and that NIO has competitive advantage to significant markets. The project is financially attractive and allied to the technical report

Economical evaluation

The economic analysis for the project, based on the indicated and inferred mineral resources of 61 Mt, the capital expenditures of 3 545 MSEK over LoM and operational cash cost of SEK 362 per dry metric ton (dmt) generates a $NPV_{(8\%)}$ of 2 907 MSEK (415,3 MUSD), IRR of 24 % and a payback time of 6,0 years, which are calculated from the date of the investment decision. These figures demonstrate that the project is financially attractive and allied to the technical report, which concludes that the Project is feasible and has a great deal of potential up-side, make for an attractive development prospect.

Environmental

Parallel to the work with the PEA study the environmental application is under preparation and will be submitted in November/December 2011. As a part of the Environmental Impact Assessment (EIA) a consultation with the County Administration was held in June 2011 and a public consultation in October 2011. Other work performed as part of the environmental application includes nature surveys, inventories of watercourses, noise and vibration surveys.

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Conclusions

The Ludvika Mines Project has a number of significant positive factors that can be recommended.

- Nordic Iron Ore has gained considerable technical expertise in the area and has assembled an experienced development team capable of implementing an iron ore mining project.
- It is favorable to implement a project in a brownfield area with existing overground, as well as underground infrastructure and services.
- Experience from previous mining operations suggests that high quality products are feasible and that the products will be attractive to the nearby European markets.
- Operating costs to FOB are competitive when compared with other developments.
- Ludvika is a junction point for railway traffic on high specification Swedish mainline railway network. This provides access to advanced logistics to not only get the product to market through several Swedish ports in the East and West, but also to bring in construction and operating raw materials.
- Competitive access to European markets.

Based on the Indicated+Inferred mineral resource of totally 61.1 Mt the estimated mine project is given a life span of about 12 years. However, due to the amount of exploration targets both in direct connection to the ore bodies in Blötberget and Håksberg, as well as the adjacent old mining areas in Fredmundsberg, Gonäs mines, Våghalsen and Finnäset and the Väsman area, further mining is clearly probable due to that mineable resources likely can be added, giving a longer lifespan to the mine.

The proposed base case with simultaneous dewatering and mining start in the two mines gives an investment level of about 2 115 MSEK (excluding project costs) as pre-production costs. During this period of time the mining commences early with mining of about 1 Mt ore year 2 and 2.75 Mt ore year 3 before full production rate of 5.5 Mt is reached early year 4. In order to reach full production an investment level of 2 700 MSEK (excluding project costs) is required.

The base case with simultaneous development of Blötberget and Håksberg mines is to be considered a "worst case scenario" with regard to investments and construction activities. A detailed optimization of the proposed mining and process layout with the proposed production level is recommended with the aim of reducing the investments cost as well as plan the geological work in order to transfer the mineral resource to an up-to-date standard. Several options are at hand and are proposed below:

- Geological investigations and re-essays are carried out to confirm the ore reserve prior to the mine development decision.

- Divide the development of the two old mines; with mining commencing in Blötberget with one line in the concentration plant and then later development of a second line in the concentration plant to accommodate the Håksberg production, and conclude the development for full production of 5.5 Mt/y.

- Mining commences initially in Blötberget and a development drift to Håksberg is made and then scaled up to a new haulage level to Håksberg. Only one hoisting installation is required adjacent Skeppmora, and may be used for both mines. Final production capacity 5.5 Mt/y.

2. Project Background

2.1 Property Description and Location

The Blötberget and Håksberg/Väsman projects are situated in the vicinity of the town Ludvika, within a radius of only 10 km from the town center and approximately 230 km northwest of Stockholm. This region is known as the Bergslagen district, famous for its very long mining and steelmaking history. Ludvika is located at the southern shore of the lake Väsman at an elevation of around 157 m above sea level (masl). The deposits of this project constitute the middle and northern parts of a 25 km long and 500 m wide iron ore belt stretching from Ställberg - Grängesberg in the southwest to Gräsberg in the northeast. The defined project is more closely located within this ore field centered around Ludvika and consists of the two mining concessions Blötberget south and Håksberg north of the town.

The terrain at the ore field is gently hilly, except for the area around Blötberget, which is rather flat and is covered by swamps and forest. The area southeast of the town Ludvika is situated around elevation 188 masl and the mine´s “0”-level corresponds to three meter below the foundation of the concrete head frame (BS-shaft), equal to 186.26 masl (RH70) The elevation of the nearby passing main railroad line at Klenshyttan (about 2 km east) is around 210 masl.

The highest area is in the northern part of the Håksberg ore field, where the old mine´s “0”-level is equal to 225.95 masl (RH70), while the nearest lakes Väsman and Hillen are on 155 and 137 masl respectively.

A modern infrastructure is available in the town of Ludvika for most general services and includes medical care, telecommunications, banking, housing, hotels, vehicle repair and schooling. Nearest airport with domestic flights to/from Arlanda International Airport is Dala Airport at the neighbouring town Borlänge, ca 35 km northeast of Ludvika.

A main railroad trunk line passes through Ludvika and the ore field, which have connections to three alternative export harbours; Gävle (180 km) and Oxelösund (270 km) at the Baltic Sea and Lysekil (410 km) at the West-coast. In Oxelösund one potential customer (SSAB) is located having two blast furnaces in operation.

Electrical power for the project is available from the local power grid operated by VB-kraft. A 50 kV line passes the planned location for the concentrator and a switchyard in Ludvika is situated conveniently close.

A major national highway (Rv 50) running south-north also passes Ludvika and the ore field.

2.2 Study Purpose

The overall aim of the defined project is to resume the iron-ore production in the two old, Blötberget and Håksberg underground mines, which have been closed since 1979, and to upgrade the ore in a centrally located ore concentration plant. The long term goal is to develop also the Väsman deposit (defined as an exploration target), located in between the two old mines, and to eventually connect them into one single mining operation, with a common production infrastructure haulage levels, hoisting shafts and a concentration plant.

2.3 Data Acquisition – Gathered information

The mineral/ore related material in the following PEA-study is mainly based on historical data from previous investigations and production. The information has been collected primarily from the archives of the Mining Directorate in Falun, but also from several official and private historical archives. This information has been supplemented by new data, produced from different research and investigations initiated by NIO; for example core mapping and re-assaying, bench-scale mineral investigations and metallurgical testing.

2.4 History

Mining and exploration in the ore fields surrounding Ludvika has been carried out in different periods since the 16th century. Most of the mining has been focused on iron, except for two periods, 1701-1711 and 1885-1889, when copper was recovered at Iviken, in the most southern part of the Håksberg ore field. In the 18th and 19th century comparable small amounts of ore were produced. Not until the beginning of the 20th century, when the Thomas-process was introduced in the steel-making plants, the high-phosphorus ore at Blötberget could be mined in a larger scale. During the same period foreign interests started to control the mines in the Håksberg ore field, first by English and Austrian companies and later by Germans. After the war the mines went back to Swedish ownership and continued production but with different companies, until the closure in 1979. When the German companies took over in 1937 all the different mines within the Håksberg ore field were merged into one operating unit and a central hoisting- and concentration plant was erected at Håksberg. Now the ore bodies could be mined more effectively, the transportation optimized and the facilities at the Central shaft utilized while operating at its full capacity. At Blötberget only two mines with separate shafts were in operation simultaneously between 1950 and 1966: the Vulcanus "original" mine and the Blötberget "new" mine, which started operation in 1944 by sinking the new shaft to 300m level and building the new central plant.

Some highlights in the history of Blötberget and Håksberg ore fields are presented below:

Blötberget:

- In 1900 Mining Co Vulcanus started large-scale mining.

- In 1944 Stora Kopparberg Bergslags AB started mining in an adjacent claim and sunk a new shaft (BS-shaft) together with complete new surface structures, head frame, concentrator, storage/loading facilities.
- In 1949 Stora Kopparberg bought Vulcanus.
- 1950 to 1966 both mining areas were mined simultaneously, using both shafts. The production rate was ca 400 kt/year of ore and 220 kt of products.
- 1968 to 1975 the BS-shaft was further sunk to 570m depth. The hoisting facility was modernized and upgraded to 600 kt/year production capacity. The new plant commenced operation in December 1975.
- In 1977 Swedish Steel (SSAB) was founded and the mines (Blötberget and Håksberg) were sold to SSAB the same year.
- The operation ceased in June 1979.

Håksberg:

- In 1937 a German consortium of steel making companies bought all mines in the Håksberg ore field and centralised the operations to Håksberg. The new concentrator commenced production in 1939.
- In 1957 a large expansion of the concentrator in Håksberg was made. Flotation of hematite-ore was introduced.
- in 1960 the new skip-loading station together with a new primary crusher at 400m level started to operate in the Central shaft.
- In 1962 the 300 m level footwall haulage drift was completed, which means that there exists a drift-connection through the whole ore field from Iviken to Källbotten.
- In 1965 spiral-separation was introduced in the mill instead of flotation and a new tailings pond was built west of the central plant at Håksberg.
- In 1973 the development of a decline from the surface to 300 m level was started. It was completed down to approx. 260 m level before the mine was closed.
- In 1977 Swedish Steel (SSAB) was founded and the mines (Blötberget and Håksberg) were sold to SSAB the same year.
- 1979, Dec 21 the operation at Håksberg ceases.
- In 1981 the pumps are stopped and the mine starts to be flooded.

Surrounding areas

Within a couple of km northeast of Blötberget ore field there are three smaller abandoned underground mines located:

- Fredmundsberg mined up to 1944
- Gonäs mined up to 1919
- Våghalsen/Finnäset, mined up to 1919

Further to the east, in the southern continuation of the Håksberg-Väsman ore field parallel mineralization zone to Blötberget, several smaller old workings can be found, as Våghalsen and Finnäset. The latter became the investigation center for the Väsman deposit, with a sunked shaft to 280 m elevation.

Adjacent the Våghalsen/Finnäset area and under the lake Väsman towards Håksberg the Väsman exploration target is situated, previously investigated partly from an exploration drift at 300 m level made from a separate shaft at Finnäset.

2.5 Concession areas

The area that contains the deposits of Blötberget and Håksberg, as well as the Väsman anomaly and many other iron occurrences, is covered by nine different claims ("investigation-permit") and two "mining permits". All but one of the mining permits, Håksberg Knr1, are approved by the Swedish mining authority "Bergsstaten". Blötberget Knr1, has been approved 2011-08-30, Håksberg is still pending for approval. The five claims covering the Håksberg-Väsman mineralisation are Håksberg no. 100, 200, 300 and 400 and Väsman nr 1. The four remaining claims covering the Blötberget ore-field are Blötberget nr 1, 2 and 3 and Främundsberg nr 1. The attached map shows the location of the concession areas as well as the expiring dates (Figure 1).

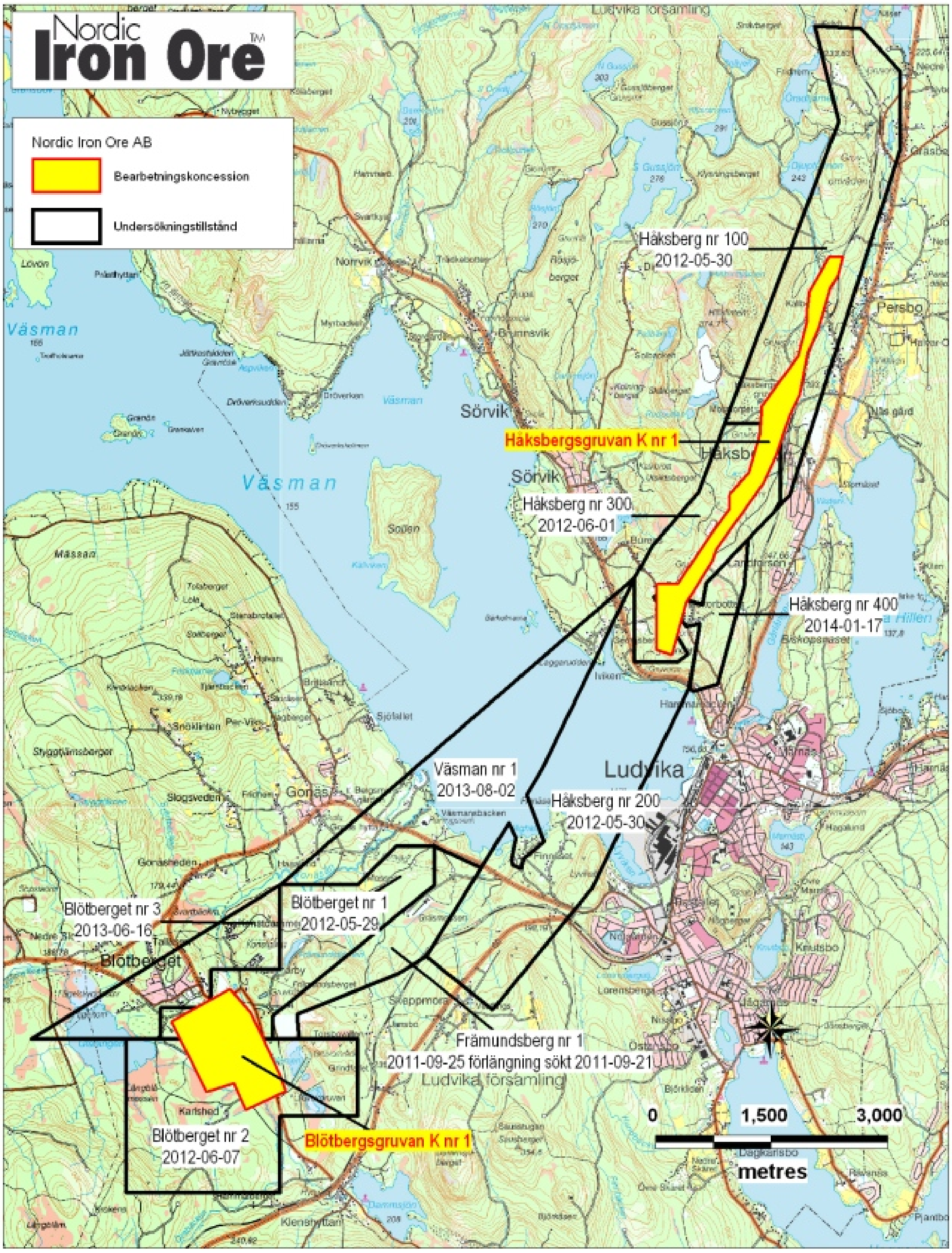


Figure 1. Map over location of concession areas as well as the expiration dates.

3. Mineable ore

3.1 Geology

3.1.1 Regional geology

Within Ludvika district (Bergslag) there are three sediment dominated synclines containing schist and greywackes; the syncline of Hällsjö (S of Ludvika), the syncline of Stollberg (NE of Ludvika) and the syncline of Grangärde (NW of Ludvika). Mn-rich iron ores occur close to these synclines (see Figure 2).

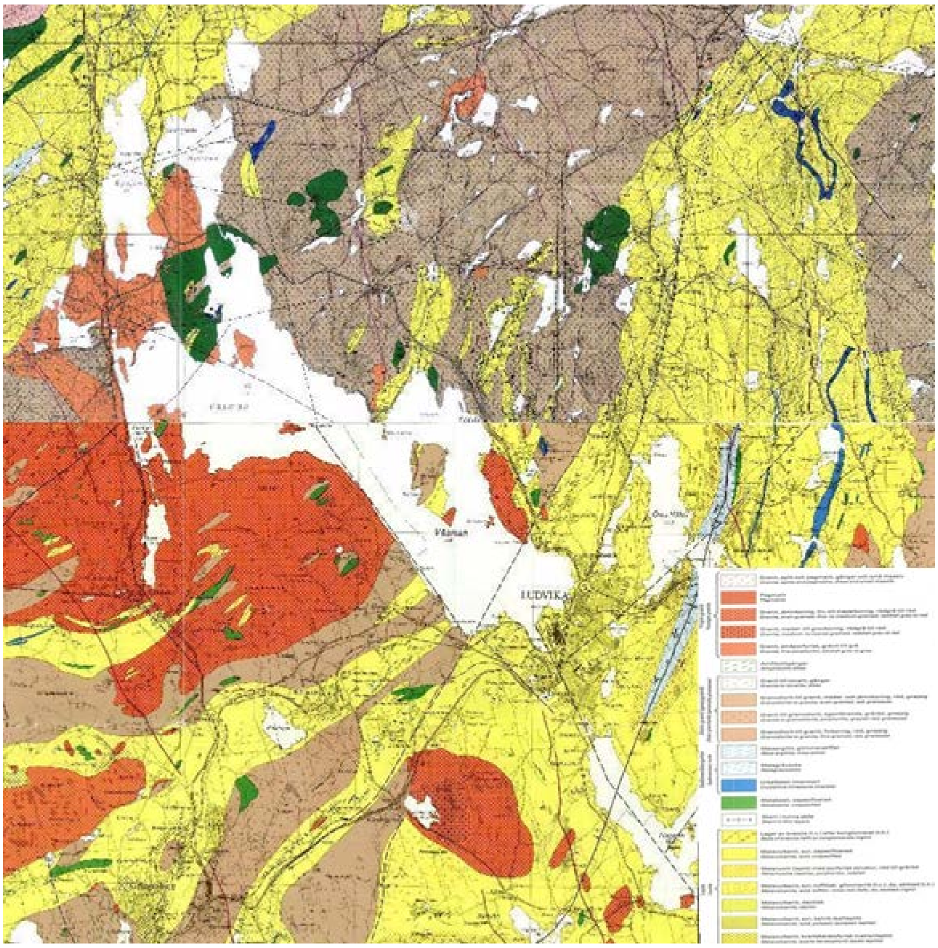


Figure 2. Regional Geology of Ludvika, Bergslag

An altered zone reaches out over a distance of almost 30 km with mostly quartz banded iron ore or banded iron formation (BIF) in the northern part and apatite-iron ore deposits in the southern part (Blötberget). Under the Mn-rich and quartz banded formations, quartz skarn ores and skarn ores occur, and further down the apatite-rich ores occur associated with impregnation ore-types (ref *Malm i Sverige 1 Mellersta och södra Sverige,* Nils H Magnusson, 1973).

There are several deposits in the area; the ores of Gräsberg in the northern part, the Håksberg field and Finnäset in the central part and the ores of Blötberget in the southern part. A few kilometers south of Blötberget the Grängesberg iron ore field is situated.

3.1.2 Local Geology of Håksberg

The Håksberg Field is a mineralized zone reaching from south to north; from Iviken in the south to Källbotten in the north. The field is a syncline fold with a flat lying fold axis striking N-NE. The limbs of the fold are dipping towards E. The bedrock in the area consists of alkali-rich metavolcanites, which are part of the `Leptitformation of the middle of Sweden`, see Figure 3. The deformation in the area has altered the metavolcanites into schist-rich rock types. Together with the volcanites pegmatites and dolerites occur.

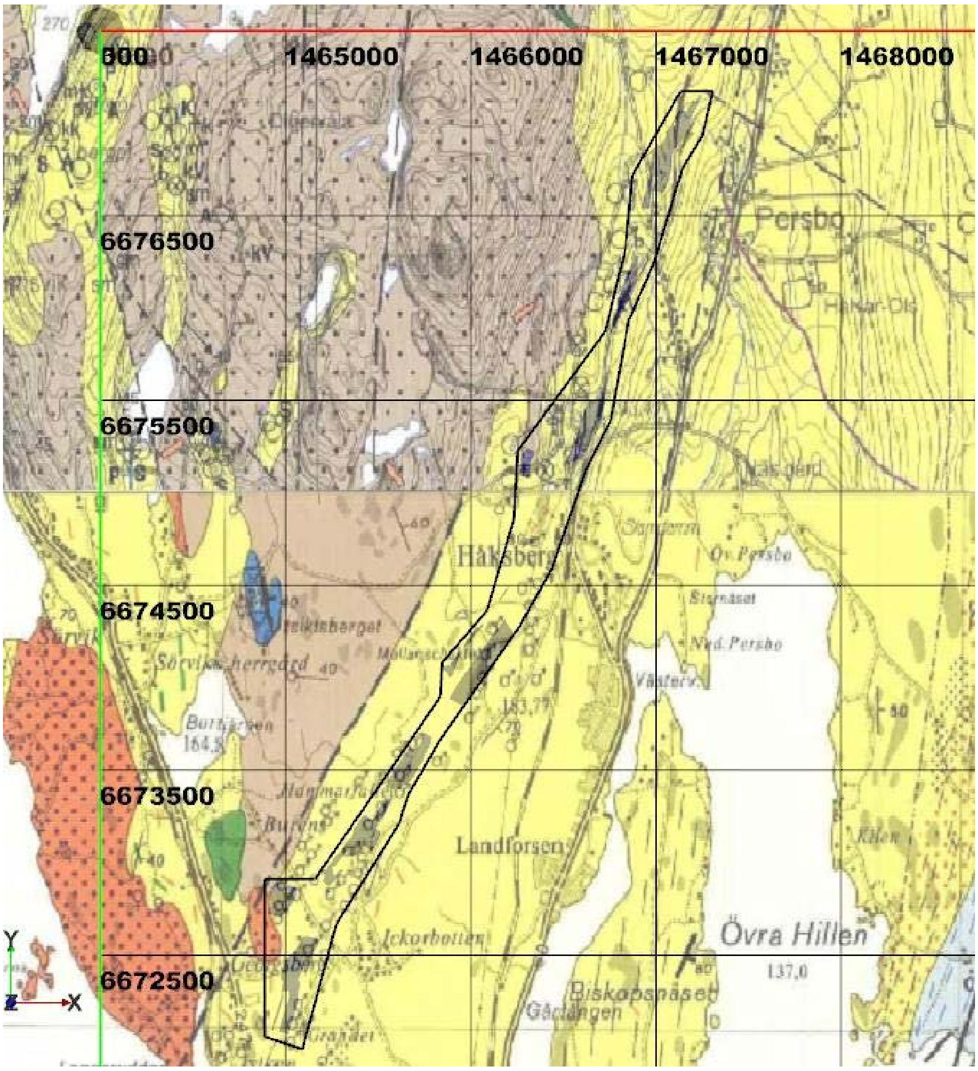


Figure 3. Local Geology of Håksberg, together with the applied concession area (black line).

The Håksberg ores are fine grained quartz and skarn banded phosphorus-poor deposits situated in a large regional synform. The ore bodies dip 60°- 85° towards E. The plunge is S and the strike N-NO. The mineralized ore bodies vary between 50 to 800m in length, and 5 to 35m width. Their approximate iron content is 36.4 %. The ores are strongly folded especially towards the hanging wall. The rocks in the stratigraphic footwall consist almost exclusively of schists (biotite, chlorite and muscovite) and argillitic greywacke. Rocks in the stratigraphic hanging wall consist almost exclusively of sericite- chlorite mica schist, partly with cordierite.

3.1.3 **Local Geology of Blötberget**

The iron ore of Blötberget is a part of a large regional synform, with ENE trend. The ore is in the northern limb of the synform *(Report: Geological Logging and Sampling of Archive Cores at the Central Core Archive in Malå, Mats Larsson, 2011) (see* Figure 4*).*

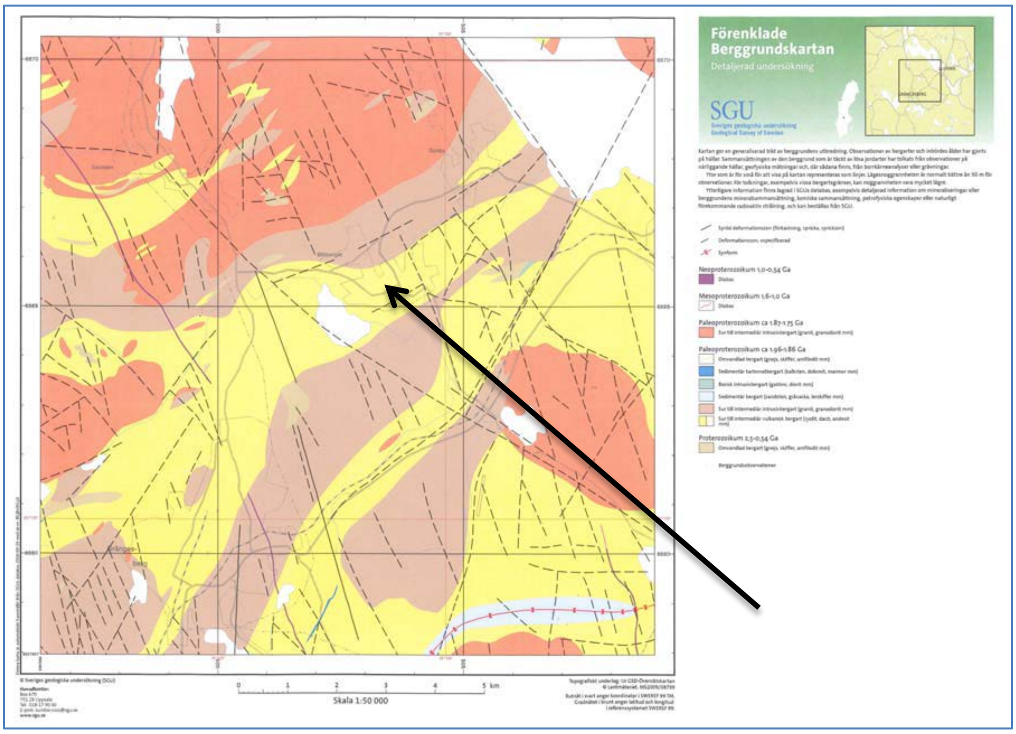


Figure 4. Local Geology of Blötberget (ref SGU). *The existing industrial area is shown with a black arrow.*

The iron ore field of Blötberget is dominated of metamorphosed granite bedrock with interbedded metavolcanics, with a slight enrichment of CaO. In the footwall closest to the ore zone, the metavolcanics are grey to dark grey in color, often rich in biotite but have a low quartz content. In the hanging wall the metavolcan-ics are rich in potassium; the color is greyish with low biotite enrichment.

The main strike for both the host rock and the upper parts of the ore is SW-NE, dipping about 55° towards SE. Exploration towards deeper part of the mine shows that the dip of the ore tends to flatten with depth, about 25°-30° at 820m depth.

Typical in the Blötberg field is that the ore bodies occur in the felsic metavolcanics more or less like lenses. The main iron ore bodies here often have a high Fe-content, hematite-magnetite, slightly enriched in P due to occurrence of apatite.

3.2 Mineral resources

To ensure compliance with the requirements of JORC, an attempt to verify the mineral resources at Blötberget and Håksberg has been made through re-logging and re-assaying of historical core stored at the National Drill Core Archive of the Swedish Geological Survey in Malå.

A total of 13 drill cores from Blötberget and 21 from Håksberg are available in Malå, of these 8 from Blötberget and 11 from Håksberg have been logged and sections for assays have been sampled. In addition, all assayed sections as well as a number of waste sections have been subject to density determinations.

The use of historical data in the reporting of current mineral resources is accepted, provided that the competent person has confirmed their usability for this purpose through independent verificatory work. Such work includes, but is not limited to, re-logging and re-assaying of drill core, verification of collar locations, drilling of twin holes etc. Parts of this have been initiated with the work reported in the Geo-Vista report (appendix 2).

To a large part, the results of the verificatory work concur with the conclusions of NIO regarding the classifications. The data density is high for this type of deposits and plenty of underground workings such as drifts and stopes as well as historical production records support the interpretation. The lack of information regarding the distribution of deleterious elements is, however, a shortcoming. More confirmatory work, mostly in comparing original assays to the grades assigned to the ore blocks, is also needed.

The re-assays of old sample sections show that historical assays are of good quality with results very similar to the recent assays. It also indicates that the old cut-off grade for iron, which appears to have been set to 30% Fe, probably was set too high, especially seen in the light of today’s iron ore prices, the mineable width may probably be increased in many instances by reducing cut-off grades and still achieving an acceptable ROM grade.

The use of an average density of 4.0 t/m^3 in the re-constructed mineral resource models by NIO is considered to have caused biased estimates. The average grade for Blötberget, 42.8% Fe, would correspond to a density of 3.8 t/m^3 rather than the 4.0 used in the model. This indicates that the overall tonnage is overestimated with approximately 5%. Similarly, the average grade for Håksberg, 36.4% Fe, would correspond to a density of 3.6 t/m^3 rather than the 4.0 used in the model. This indicates that the overall tonnage is overestimated with approximately 11%.

The mineral resources previously presented by NIO are therefore considered to be slightly overestimated, in view of the density-bias. The reported categories are considered too high in view of the need for more verificatory work to confirm the historical information.

The author has considered the technical and economic criteria used to calculate a reasonable mineral resource cut-off grade for reporting mineral resources. The JORC Code definition of a mineral resource requires that "there are reasonable prospects for eventual economic extraction."

The current mineral resources at Blötberget and Håksberg, in compliance with JORC, reported at an assumed cut-off of 30 % Fe, can thus be stated to be, after correction for the bias caused by the used density, and in consideration of the classification criteria as presented in Table 1 and Table 2.

Table 1. Mineral resources at Blötberget as of August, 2011

Category	Tonnage [Mt]	Grade Fe [%]
Indicated	13.9	42.6
Inferred	10.2	42.9

Table 2. Mineral resources at Håksberg as of August, 2011.

Category	Tonnage [Mt]	Grade Fe [%]
Indicated	25.4	36.4
Inferred	11.6	36.0

A reasonable cut-off grade for modeling and reporting the Blötberget and Håksberg resources would probably be closer to 20% Fe than the 30% Fe used in the historical work, as discussed earlier, the market price for iron ore has increased 15-fold since closure of the mines in 1979. A direct comparison with similar projects being developed also indicates that a 20 % Fe is a more reasonable cut-off. A check on 7 holes from Blötberget shows that lowering the cut-off to 20% Fe will increase the width of the intercept by an average of 71%, while the grade will drop by 16 % relative to the original measured grade.

The re-assays indicate that phosphorous grades of < 0.5 % and sulfur grades of < 0.01 % are typical for Blötberget. For Håksberg the corresponding assays are even better, P < 0.1% and S < 0.01%. However, there are several instances with elevated levels of molybdenum and tungsten throughout the occurrence of up to 0.2 % of the mineral Powellite ($Ca(MoO_4)$- $Ca(WO_4)$), that is potentially deleterious. These results should, however, be seen as highly indicative since they only cover parts of the deposits.

The iron ore deposits at Blötberget and Håksberg are, at least to an extent, in need of more confirmatory work in order for them to merit to be classified as Measured, however, in the authors' opinion, the classification of indicated is reasonable, principally based on the fairly high density of drilling, the good verificatory results and the production records, and they may thus be included in economic evaluations.

In order to resolve the remaining uncertainties a set of confirmatory drill holes as well as a re-survey of the collar locations are needed, both requiring that the mines are pumped dry in order to be feasible. While waiting for this to happen, the following is recommended;

To start with, a second round of re-logging and assaying of the core that remains to be found in Malå is recommended. Secondly, the historical data entry needs to be completed as far as it is possible to recover data, requiring further archive studies.

A very tentative budget for this work would be in the order of 10 MSEK.

Potential ore resources

Exploration Potential: In addition to the mineral resources reported here, there are several known exploration targets within the existing concession areas controlled by NIO, which cover the ore zones in the Blötberget-Håksberg region. Besides previous mining, extensive investigative work has been conducted throughout the region by private mining companies as well as by SGU. All types of work are represented such as, geophysics (mag. surveys), drilling, drifting and shaft sinking, which has resulted in several interesting mineralization intercepts and anomalies/exploration targets:

- Väsman, located south of the Håksberg ore field as a direct continuation. Ground magnetic program twice, partly drilled from above as well as below ground. Considered to be the largest known Fe-deposit in Bergslagen district.
- Gräsberg is the northern continuation of Håksberg ore field. Investigated by shaft sinking, drifting and drilling down to 300 m elevation.
- Håksberg downdip, below 350m elev., along the whole ore field. A few scattered deep diamond holes drilled, as deepest down to approx. 900 m elev.
- Blötberget northern extension (Guldkannan, Fremundsberg, and Kärrgruvan) and parallel zones to the main ore field show strong magnetic anomalies, which are partly mined and drilled, but needs more investigation.

Nordic Iron Ore

- Blötberget central ore field, in between the former STORA and Vulcanus concession areas, there is a potential ore block that is neither mined nor drilled.

Up to this point only very rough estimations have been carried out to get a grip of the potential of this region, which could be summarized as “extensive” in quantity and “reasonable” in quality.

4. Production Plan

4.1 Mining

This chapter in the study deals with the planned underground mining for the Ludvika mine, comprising the old Blötberget and Håksberg mines. The geological and geotechnical setting for the mines is summarized, and a description of previous mining operations as well as the proposed new developments and mine plan. The new mining operation is planned to produce about 5-6 times as much ore annually as was previously mined, which requires both up-sizing of existing ramps and drifts as well as a new infrastructure underground. A summary of proposed developments are given in the end of the chapter. Details from this chapter are presented in appendix 3.

4.1.1 Geotechnical overview

In general no previous geotechnical data have been found in the historical material, other than notes made on the general mine maps. There are no notes on weak ground found in the documentation, and interviews with previous employees confirm that the ground conditions were generally good.

In order to assess the conditions in more detail a mapping of boreholes from Blötberget and a surface mapping program of the accessible rock surfaces above the water level was executed. The core and surface mapping from Blötberget rocks suggest rock mass quality to be good to very good; core mapping is showing Q values of ~100 and above. No major fault zones intersecting the ore bodies indicating weaker rock mass have been found.

In Håksberg no cores with large enough diameter for geotechnical testing were found. Therefore surface mapping was performed, where results suggest good to excellent rock mass conditions.

In order to assess risk of surface settlements during mining at depth, rock mechanics calculation models were made. Results show that by leaving about 20% of the ore as pillars, surface settlement areas can be kept within acceptable amounts.

4.1.2 Mining Concept

The overall mining strategy is to resume mining making maximum use of the existing mine developments. Common for all developments is that the mines were not entirely mechanized and larger drifts and tunnels are required for an upgraded production.

In Blötberget the present decline from 160 m level will be upgraded, as will the present ventilation raises. The BS shaft will be used for hoisting.

In Håksberg the previously partially finished decline from Iviken will be extended down to the 300 m level that stretches between Iviken and Källbotten. The 300 m level will be upgraded for modern transports. The Central shaft will be used for hoisting.

When full mining capacity is reached (2.5 Mt for the Blötberget mine and 3.0 Mt for the Håksberg mine), it is required that a major part of the ore bodies are mined simultaneously.

In Blötberget a new decline will be made from surface adjacent the industrial area and connected to the existing decline in the mine at the 160 m level. The conveyor belt will be routed to the hoisting chamber and then connected to the concentrator by a separate conveyor tunnel.

The old BS shaft will be reused for hoisting the ore from the crusher and the decline at Blötberget will be sunk parallel to the mining. Transport levels will be made at intervals at depth such that they have a life time of about 3 years. The ore from the mining levels will be dumped in ore passes connecting to the transport levels.

In Håksberg the existing Iviken decline should be connected to the 300 m level, and this level widened and upgraded to allow for modern machinery. Transportation of the mined ore to the crusher will be from orepass (chutes) located adjacent the local mining ramps on the 300 m level. The crusher and hoisting is located in the re-used Central shaft.

For the Blötberget mine about four levels of sublevel caving were developed mainly in the Hugget/Betsta ore prior to the halt in production. Mining is planned to commence in this area as soon as connection to the ramp from surface is made to the 160 m level. During the continuation of mining at depth the ramp development is performed. The main ramp is driven down to facilitate crusher installations and at the same time open up mining areas for development. Mining of the Sandell ore in the hanging wall to the Hugget ore body is planned to be made at an early stage as well. As production is increased new ventilation arrangements are to be installed.

In the Håksberg mine new accesses (mining ramps) are proposed to be driven from 300 m level (alternatively 200 m level) in nine mining areas. The 300 m level will serve as the main haulage level and needs to be upgraded for this. Based on the mine maps an inventory of developed areas has been performed. The total amount of developed ore ready for early mining with only minor adjustments to drifts sizes and accessibility is shown in Appendix 3, table 2. The tonnage ready for early mining amounts to ~2.6 Mt distributed on four ore bodies with the major tonnage adjacent the Ikorrbotten mine.

The ore bodies around Ikorrbotten and Stora Högbotten as well as Karl-Anders Västra seem to be possible to access early from a “modern” ramp adjacent the Ikorrbotten shaft area.

4.1.3 Mining methods

The main mining method will be longitudinal sublevel caving for the Blötberget mine. The orebody width allows for one sublevel drift. The Kalv- and Flygruvan are wider ore bodies allowing for several drifts either transversal (as during previous mining) or longitudinal since these two ore bodies are wider. The Sandell ore body will be mined with an open stoping method.

In the area at Håksberg (mainly from Ikorrbotten up to and including the Mellanschakt area) the mining method will be longitudinal sublevel caving. The ore width is for most of the Håksberg area ores narrow; allowing for one sublevel drift.

Two areas in Håksberg; the Iviken area and the Central area, with possible impact on the surrounding surface structures are planned to be mined with stoping methods that leaves pillars to minimize influence. In the central area and also in Iviken and Ikorrbotten the waste rock filling that was done during previous production will continue of old open pits, thus adding to the overall stability over time.

Prior to the mine closure some development for sublevel caving was made in Blötberget and in Håksberg. Development exists for about 2 208 kt in the Blötberget mine (Appendix 3, table 1) and in Håksberg mine 2 688 kt (Appendix 3, table 2), mainly as sublevel drifts. The sublevel distance is 10 m.

4.1.4 Recovery and Dilution

For the different mining methods, different extraction ratios and dilution are estimated:

- sublevel caving (in Blötberget and in Håksberg) will have an extraction ratio of 80% and a dilution of 20%
- open stoping with backfill will have an extraction ratio of 90% and a dilution of 10%
- open stoping with pillars (as in Iviken and Central Håksberg) will have an extraction ratio of 85% and 15% dilution.

For more data about the extraction ratios and dilutions see appendix 3, chapter 3.1.1.

4.1.5 Estimated Mineable Ore

Based on the mineral resource estimate and its category Indicated+Inferred the minable ore estimate is developed. An estimate of the ROM grades is made based on regular sublevel caving dilutions as given in chapter 4.1.4. A substantial amount of the ore is transferred to the non-extractable category based on ore losses regular to the sublevel caving mining method and ore left as pillars in several ore bodies within the Håksberg mining area. The ore recovery is estimated to

80 % and 85 % respectively for Blötberget and Håksberg. Thus giving this estimate of minable tonnages:

Blötberget;	24.1 Mt (at 35.4% Fe)
Håksberget;	37.0 Mt (at 30.6% Fe)

4.1.6 **Mine development and Production schedule**

New mine accesses are required for both mines, why the old drifts will be enlarged to sizes suitable for modern transports and mining equipment and, in some cases, even new drifts will be required.

Development of renewed crusher installation adjacent or on the existing locations will be undertaken. The old hoisting shafts at BS and central Håksberg are planned to be reused. A new hoist chamber is to be excavated in the shaft below surface and below the hoist chamber a dumping bin with an adjoining belt conveyor gallery connecting the ore transport system to the surface for the two mines, to the concentrator at Blötberget and to the ore rail road terminal at Håksberg.

Other mine development required are ventilation raises, drifts and local ramps adjacent to the ore bodies to enable them to be accessed for production drilling, mucking and transport to the underground crushers. In Blötberget haulage will be carried out between ore passes and ore dump at the crusher station at the new transportation levels. In Håksberg the haulage between ore passes and the crusher station will be at the 300 m level.

The decline in Blötberget will be sunk parallel to the mining operations and a new decline from the industrial area is proposed for transport logistics. Ore is hoisted in the old BS shaft to a new underground skip station and from there on to an about 2 km long conveyor belt gallery to the concentrator. Ventilation will be from a new ventilation station between Vulcanus and BS.

The existing decline in Iviken will be upgraded and connected to the 300 m level. The old transport level at 300 m level will be upgraded and serve as main haulage level to the Central shaft area. The 300 m will also be from where the mining ramps are accessing the mining areas. The ore hoisting will take place in Central shaft at Håksberg. New ventilation stations will be located in Iviken and at Central Håksberg.

Both mines are water filled, Blötberget to about 16 m level and Håksberg to about 48 m level. Emptying of the mines by pumping is required prior to major mine development and the commencement of production mining. During operation it will be necessary for drainage pumping of the mines but at a more moderate volume per day.

The ventilation system for the two mines will be upgraded to a higher capacity (see also 4.1.8), but during the early years parts of the old system will be reused in Blötberget. New ventilations raises are to be developed in both mines, in Iviken and Central area at Håksberg and adjacent BS shaft at Blötberget. Underground connecting drifts and raises will be developed as well. During wintertime a propane heating system will generate preheating of the down cast ventilation air.

Geological work, in terms of infill drilling to establish a base for detailed mine planning, are envisaged following the drainage of the mines. About 1 drill crew for each mine is needed on a permanent basis and with drilling of about 10 000 m annually.

Production schedule

The higher production rates for the mines are expected following ramp and decline development and ventilation installations, which will allow for a larger machine fleet to operate.

Year 1 Dewatering of the old mines

Year 2 Production rate corresponding to the old tonnage, mining is made in old previously developed ore. Production rate is 400 000 and 600 000 ton respectively for Blötberget and Håksberg. The start of the first production is estimated at Q2 year 2.

Year 3 Comprises upgrading of the production to about 50% of final production following development of ventilation raises and transport routes.

Year 4 Upgrading of the production to full production of 2.5 Mt in Blötberget and 3.0 Mt in Håksberg is made. Estimated start of full production in Q2 year 4.

Mining will commence in previously developed sublevels at the Blötberget mine and at Håksberg close to the ore bodies adjacent to the decline. Hence the early production at Håksberg may be transported to surface and on to the crusher either in Iviken or adjacent the Central area, and further by train to the new concentrator at Skeppmora.

The time schedule for starting up the mine production is estimated to be 36 months before full production is reached. However, in existing areas that have been developed, production may start 15 months after commencement of drainage of the mine. An estimate of annual production is about 400 kt (at Blötberget) and 600 kt (at Håksberg) during the first year (corresponding to the production capacity before mine closure) and then a gradual increase in production as development proceeds. Both mines will require almost the same overall preproduction time since the Blötberget development may start before mine dewatering, but Håksberg needs dewatering to gain access to the Iviken decline (see Table 3 and Table 4).

Table 3. Time schedule for mine start in Blötberget mine.

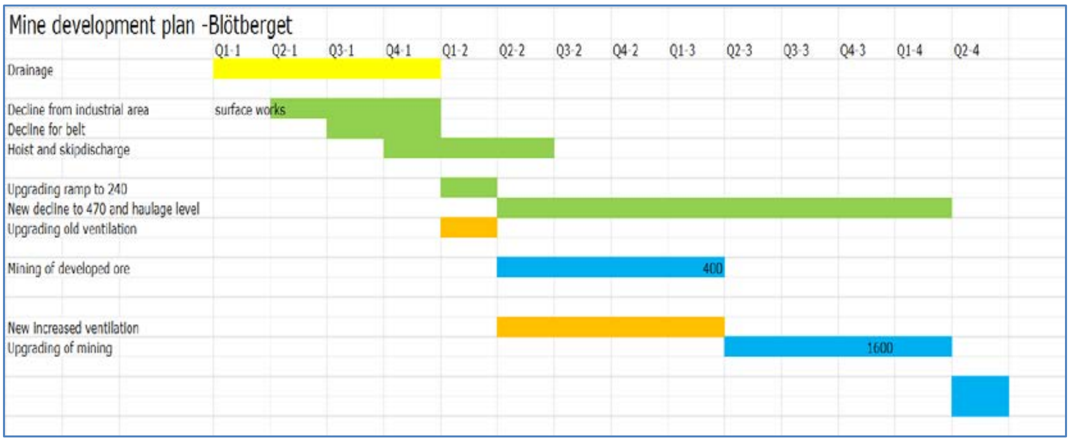
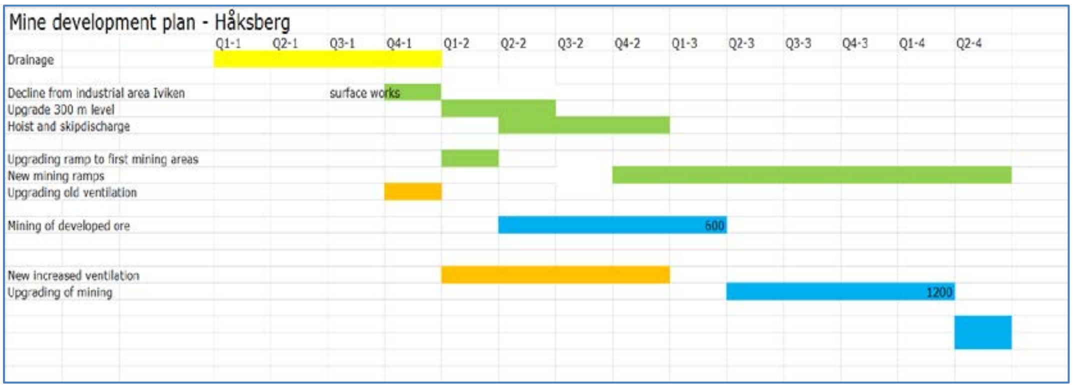


Table 4. Time schedule for mine start in Håksberg mine.



Mining at full production

Mining at full production is 2.5 Mt ore for the Blötberget mine and 3.0 Mt ore for the Håksberg mine and is expected during Q2 year 4. Mining at full production requires that declines and mining ramps are fully developed and that the ventilation raises and stations are in operation. See Table 3 and Table 4 above for the major steps in mine development over time.

Waste rock production

Waste rock will be produced from the development works within the two mines.

Early mine development and waste rock production

During the start-up phase of the mine the waste work production will give the following amounts of waste rock from developments of drifts and raises.

In the early mine developments the waste rock production is estimated to:

Year 1 About 891 000 ton
Year 2 About 1 080 000 ton
Year 3 About 680 000 ton

Waste rock production at full production

At the Blötberget mine about 250 kt waste rock will be produced annually. The waste rock will be moved within the mining areas, either to a local rock handling area and crusher if used for road material or transported to surface to the old open workings to enhance stability of the openings. Transport distances from the decline above ground to the dumping area are about 1-2 km. The main opening to fill is the old openings at Betsta-Hugget.

At the Håksberg mine about 450 kt waste rock will be produced annually. The waste rock will be moved within the mining areas, either to a local rock handling area and crusher if used for road material or transported to surface to the old open workings to enhance stability of the openings. Transport distances from the decline above ground to the dumping areas are about 1-4 km. The main opening to fill is the old opening at Iviken, Ikorrbotten and Central Håksberg.

4.1.7 **Mine Operation**

The ore flow from the mining face to the concentrator consists of the following steps:

- Drilling – blasting on sublevels
- Load-haul-dump on sublevels to ore passes feeding to haulage levels
- Haulage to Crushing station
- Crushing
- Vertical hoisting in skips
- Inclined hoisting (belt conveyor) to processing and train loading (ore feed)

Major mining equipment

The major mining equipment is estimated to consist of some 30 units for each mine. In this report major mining equipment is assumed to be rented by contractors, hence their capital costs are not included in the Capital Cost Estimates, but instead major mining equipment are included in the operating costs (see Table 9 and Table 14). In appendix 3 (chapters 6, 7.3 and 9.1) these figures are described in more detail, including level of capital costs if major mining equipment instead was to be purchased.

Major mining equipment will be designed to minimize emissions into the atmosphere within the mine to assist minimizing the mine ventilation system costs and air cleaning requirements (see below). This will include particulates from exhaust and the handling/crushing of ore and developmental waste materials.

4.1.8 **Mine services**

Installations for mine services mainly consist of ventilation, electricity and water installations. The lists of required installation are given in appendices 4, 9 and 12.

In the mining process particles and gases are generated that are harmful and toxic. The major sources are diesel powered vehicles, gases from the blasts, and dust generated from the mining and crushing of the ore. Access to good ventilation that supplies fresh air to the various work areas is a prerequisite for the mining. Details on mine ventilation are presented in appendix 4.

The mine ventilation will be constructed such that energy consumption and operational costs are minimized. The largest energy saving is achieved by control of the air flow to the areas where personnel is working and therefore necessary to keep with air quality below the threshold limits. The ventilation plant is therefore controlled by a network of sensors that regulates the air flow to areas where production is ongoing. At standstill the ventilation flow is regulated down to a low flow.

The preheater unit for the fresh air used during winter season should also be able to keep up with rapid flow changes without any time delays. This is achieved and with biggest benefit when using a propane heating system. When required the intake air is heated to +2°C to avoid ice forming in the down cast shafts.

New ventilation fan stations are constructed at surface to blow down preheated air into the ventilation raises. The intake air distribution to the ventilation drifts is performed by intake fans and flexible ducts.

Exhaust fans are located in the mine. The air is blown through old workings and shafts connecting the mine to surface. The exhaust from raises above surface are made through a steel outlet duct at about 3 m above ground level.

Blötberget

The intake air fan station will supply both the previous used ventilation raise and a new raise in the footwall between the Vulcanus and Betsta ores. The maximum air flow is 600 m^3/s. The average flow is 350-450 m^3/s. The heating requirement is about 19 MW (-24°C to +2°C).

The outlet air is evacuated through the decline, through the old Vulcanus shaft and by a new exhaust shaft, close to the BS shaft.

Håksberg

Two intake air fan stations are constructed for the mine with new raises. They are located in Iviken and at Håksberg. Nine mining areas will be fed by this system.

At Iviken the intake fan station supplies 350 m^3/s and in Håksberg 480 m^3/s. The preheating power is 11 MW respective 15 MW (-24°C to +2°C). At the main level (300 m) a horizontal ventilation duct is installed to transport the air to the stopes.

Two alternatives for the ventilation distribution have been evaluated. The alternatives were a separate ventilation drift parallel the haulage drift and a significant larger haulage drift with ventilation ducts. The alternatives showed a similar cost picture when including rock excavation and ventilations equipment installations costs. The ventilation proposed with a separate ventilation drift is shown in this study. Subsequent design steps will further refine the ventilation solution with aim to minimize rock excavation works, and ventilation installations. Such refinements may result in a combination of drifts and ventilation ducts to a larger extent that is shown at this stage.

The exhaust air is evacuated with fans to old openings to surface at Grandgruvan, Stora Högbotten, Karl-Anders Västra, Kärrgruvan and Barabaragruvan and an old exhaust raise at Ikorrbotten and shafts Mellanschakt and Källbotten.

4.1.9 Electricity installations

In Blötberget a 50 kV transformer substation will be installed and connected to the 50 kV power lines that passes through the industrial area (see also 4.4.4 and appendix 9). The owner of the power line (VB-energi) delivers the 50 kV transformer substation and connects it to the power line.

In Iviken and Central shaft, Håksberg, 12kV substations will be installed, which will be connected from VB-Energi's transformer substations at Hyttbacken. The substations are designed for 10 MW each. In the mine redundant power supply on 12kV substations will be installed.

Underground secondary transformer substations will be installed; in Blötberget at 330 m, 360 m, 480 m and 530 m levels and in Håksberg at the 300 m level. These secondary transformer substations will support ventilation, lightning, pumps and general power. The lists of required installations are given mainly in appendix 9. Reserve power installation for water pumping is presented in appendices 12a and 12b.

4.1.10 Water installations

The lists of required installation are given in appendices 4, 9 and 12.

Underground fire posts will be supplied with water from the drilling water net. The fire department do not object to using the same water for firefighting as for drilling.

Fire posts equipped with fire hose will be needed at certain locations. The water will be supplied by the drilling water network, which will be distributed from water storages situated about 100 meters above areas where mining is being conducted. For details on fire water supply see appendix 12 (PM Fire Water).

Vehicles underground will be fueled by diesel and 7 + 8 filling stations are planned. Vehicles, machines and filling stations shall be equipped with fire extinguishers.

Rescue chambers

The new ventilation shaft in Håksberg may serve as emergency exit. In Blötberget one of the two planned main declines may serve as emergency exit.

Rescue chambers pose an alternative to emergency exits. The chamber may be stationary or mobile and shall be equipped with oxygen for at least 4 hours and communication device. In Håksberg one chamber will be placed in each of the nine mining areas. In Blötberget there will be a total of five chambers situated.

4.2 Ore Beneficiation

4.2.1 Basic Design data

Blötberget ROM production			2.50 Mt/year
-,,-	-,,-	Fe-grade	35.40 % Fe
-,,-	-,,-	P-grade	<1.50 % P
-,,-	-,,-	solid density	3.43 t/m^3
Håksberg ROM production			3.00 Mt/y
-,,-	-,,-	Fe-grade	30.60 % Fe
-,,-	-,,-	P-grade	<0.06 % P
-,,-	-,,-	solid density	3.29 t/m^3
ROM lump size			-150 mm
Operating time			365 d/y
Availability crushing, hoisting			87 %
Availability ore beneficiation plant			90 %
Storage capacity concentrate			4000 t
Storage capacity -4 mm fines			4000 t
Energy price			0.70 SEK/kWh
Workers costs			500 kSEK/y

4.2.2 Process- and Product Development

Drill core material from the two deposits, Blötberget and Håksberg, has been subject to laboratory testing at Minpro AB. The test material originates from earlier exploration drilling. The material consisted of 85 individual samples, with analytic data provided. The individual samples have been grouped into 16 "metallurgical samples" by the geologist. The main consideration when selecting the samples was the iron content; close to what is expected in the future mining. Material from these were selected and combined into three test samples, representing Blötberget and Håksberg (see Table 5).

Table 5: laboratory testing of three test samples, representing Blötberget (BB) and Håksberg (HB)

Assays of test samples:	Fe	FeO	P	SiO2	Al2O3	CaO	MgO	Na2O	K2O	V
BB Composite	34.5	14.7	0.9	32.3	5.8	3.9	2.8	0.9	1.9	0.1
BB Hematite	36.0	6.9	0.1	37.9	5.4	0.8	0.6	1.1	2.9	<0.2
HB Composite	30.5	12.8	0.1	39.3	7.1	3.0	1.3	1.5	<0.1	<0.1

A series of bench-scale test programs comprising of fine grinding and separation in a Davis Tube magnetic separator were undertaken. The purpose was to conduct a preliminary evaluation of the potential for production of pellet concentrate from the ores. In addition, two further tests using dry magnetic separation of fine crushed -4 mm material took place to find out if sinter fines concentrates could be extracted from the ores. The results from these tests show that the ore from Håksberg is potentially the most suitable for the production of some sinter fines suitable for the steel industry.

The samples were ground to two different sizes, about 45 %-45 um and 75 %-45 um. The ground products were subject to traditional low intensity wet magnetic separation (to capture the magnetite): whilst the non-magnetic products were also tested using a Jones WHIMs separator to see if further amounts of hematite were present and recoverable.

There appear to be no difficulties to obtain saleable pellet feed concentrates from the ore test samples at a grind size of about 45-50 %-45 um. The test work indicated a low hematite iron grade after WHIM separation, which was largely due to recovery of mica together with hematite. The mica, in reality, can usually be easily removed using gravimetric processing. Higher than desired phosphorus levels in the concentrate could be due to a liberation issue as hematite may be harder to grind than magnetite, but equally it is possible that the phosphorus could be linked with some of the micaceous materials.

The proposed flow sheet (see Figure 5) for a future concentrator involves separate grinding circuits, wet mechanical cleaning and flotation. By these means it is probably possible to reach acceptable metallurgical results also for the hematite. However, further metallurgical testing, in step-by-step manner is needed to establish a suitable process design. Then the process flow sheet needs to be proved on a larger bench or pilot scale on a semi continuous basis in order to prove the process and to establish all the data to allow plant design and provide operating costs for the economic models.

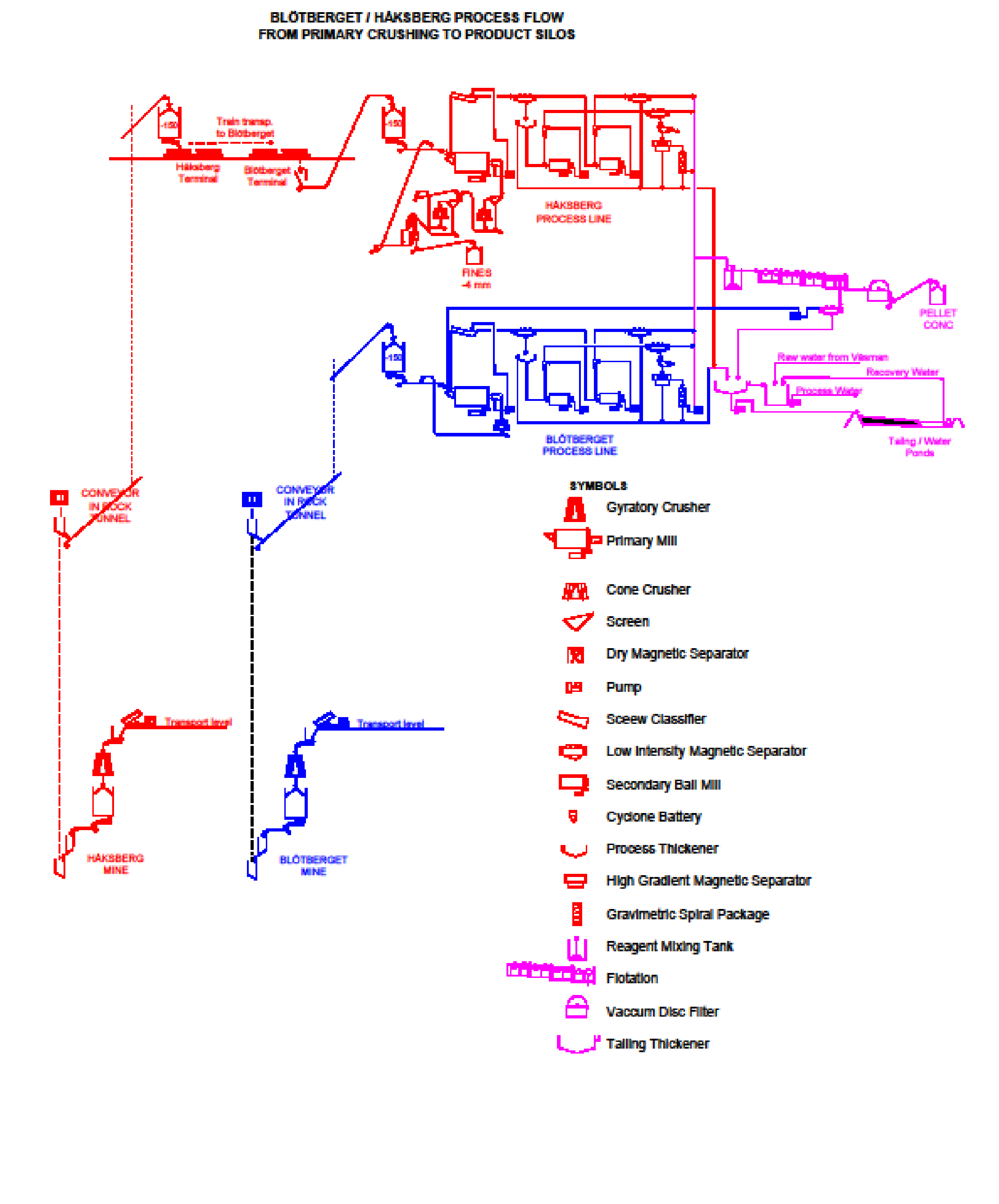


Figure 5. Flow sheet over process flow from primary crushing to product silos

4.2.3 Primary Crushing Blötberget

The crude ore is delivered by trucks to an ore bin on level 470. The subsequent crusher is fed by a vibration feeder. The crusher is of type Gyratory with a feed intake of 1100x1350 mm with an output product of -150 mm. The instant capacity is 1000-2000 t/h depending on feed size distribution. Crushed ore -150 mm. Storage capacity beneath the crusher is 6000 ton.

4.2.4 Primary Crushing Håksberg

The crude ore is delivered by trucks to an ore bin on level 300. The subsequent crusher is fed by a vibration feeder. The crusher is of type Gyratory with a feed intake 1100x1350 mm with an output product of -150 mm. The instant capacity is 1000-2000 t/h depending on feed size distribution. Crushed ore -150 mm. Storage capacity beneath the crusher is 6000 ton.

4.2.5 Ore Hoisting and Conveying Blötberget

The hoist unit is installed on level 200, in existing shaft. The ore hoisting is done by double skip. The skip loading station is located on level 530 and shaft bottom on 570. The skip unloading station is located on level 215. The hoisting capacity is based on 2.50 Mt/y with an availability of 87 %. From the skip unloading level 215 the crude ore -150 mm is conveyed through an inclined rock tunnel to the concentrator crude ore 4 000 ton capacity feed.

4.2.6 Ore Hoisting and Conveying Håksberg

The hoist unit is installed on level 23, in existing shaft. The ore hoisting is done by double skip. The skip loading station is located on level 380 and shaft bottom on 420. The skip unloading station is located on level 28. The hoisting capacity is based on 3.00 Mt/y with an availability of 87 %. From the skip unloading level 28 the crude ore -150 mm is conveyed through an inclined rock tunnel to the crude ore train loading silo. The crude ore will be transported to Blötberget train terminal, where it is unloaded and conveyed to a separate crude ore 4 000 t capacity concentrator feed silo.

4.2.7 Beneficiation BB-line

The -150 mm feed ore is grinded in three stages, primary autogenous, secondary and third with ball mills. In order to avoid critical size problem in the primary mill, about 25 % pebble (6-40 mm) is extracted and crushed to -10 mm and recycled to the mill. The Fe-recovery in between these stages is done by wet magnetic separators for magnetite and high gradient magnetic separators followed by gravimetric spirals for the hematite part. The high phosphorous (<1.50 %) content in Blötberget crude ore will be finally reduced in the common subsequent flotation circuit.

4.2.8 Beneficiation HÅ-line

The beneficiation of Håksberg crude ore follow the same process design. However, the extracted pebble (6-40 mm) is crushed to -4 mm and passed over a 2-stage dry separator circuit, producing a -4 mm fines concentrate. The -4 mm fines concentrate is conveyed to the train terminal and stored in a 4 000 ton capacity silo. The magnetite, hematite low phosphorous grade concentrate from Håksberg process line will be combined with Blötberget concentrate in order to reduce the flotation P-head grade.

4.2.9 Flotation

The flotation circuit operation principal is to produce a P-grade <0.05 % using as little as possible collecting agents. The process is controlled by automatic chemical analysis and controlled addition of collecting agents, froth modifying agent, blowing air and flotation cell levels. The flotation froth product is passed over a magnetic separator for recovery of any misplaced magnetite.
Reagents used: water glass, NaOH, ATRAC, MIBC.

4.2.10 Dewatering

The flotation concentrate (bottom product) is thickened and pumped to a vacuum disc filter for dewatering. Dewatered (<7 % water content) concentrate is conveyed to the train terminal and stored in a 4 000 t silo capacity.

4.2.11 Summary of Products

Total crude feed ore 5.500 Mt/y with 32.4 % Fe and 0.70 % P
Product of -4 mm fines 0.265 Mt/y with 62 % Fe and <0.07 % P
Product of concentrate 1.918 Mt/y with 67 % Fe and <0.05 % P
Rest product to tailing pond 3.317 Mt/y with 10 % Fe and 1.15 % P

4.2.12 Tailings disposal

High diluted underflow products from wet magnetic separators and tailings from spirals will gravimetrical flow to a tailing thickener. About 95 % of the water content will be recovered to overflow and reused for process water, together with overflow water from process thickeners. The tailing thickener will be located near the process plant with a large process water tank inside the plant. The thickener underflow will be pumped to the tailing dam and tailing water content recovered from the clarification pond and pumped back to the process water tank. There is also a possibility for raw water supply (<360 m^3/h) from Väsman if required.

The tailings dam will be situated southwest of the industrial area. The three main reasons for choosing this area for the tailings dams are:

- The short distance to the industrial area
- The area is already affected by mining activity
- The area will hold 10 years production of tailings

The water content in the deposited slurry results in a surplus of water in the tailings dam. Since the process demands water it is important that water can be recycled to the process. This is made possible through decanting the surplus water in the tailings dam to a water dam; the clarification pond. The clarification pond will be built in connection to the tailings dam. In the clarification pond a pumping station will be built and water will be recycled to the process by a pipeline.

The studied option has been titled *Area 2 East of the road* and furthermore includes the area around and above the former tailing dam (Area 1). Initially the clarification pond and tailings dam in area 2 will be built, which contains the first 6-7 years production of tailings. This is what has been cost estimated and for what consumption of material has been calculated (for details see appendix 6.)

Conditions

A terrain model has been created in Autocad using a digital map with contour lines with an equal distance of 5 m. This model is sufficient for an estimate of the amount of material needed for the tailings dam and clarification pond.

Water requirements for processing of ore

The design capacity of the clarification pond has been set to 1 million m^3.

Estimated amount of tailings produced

The estimated total volume of ore is 61 million tons, of which about 60% will remain as tailings, i.e. 36.6 million tons.

<u>Properties of the tailings:</u>
Compact density: 3.04 t/m^3
Bulk density: 1.7 t/m^3 (when deposited in the tailings dam)
36 600 000 /1.7 = 21 500 000 m^3

Required volumes for deposition

The tailing dams will contain approximately 21.5 million m^3 during the estimated lifetime of the mine. Initially water to the process will be pumped from surface water supply (Väsman). The clarification pond will, with time, be filled with rainwater, inflowing surface water and recycled water from the tailings dam and will contain 1 million m^3.

Deposition techniques

Up to October 2011, two techniques for deposition of the tailings have been studied:

- Traditional deposition with slurry
- Partially thickened tailings deposition

With traditional deposition, the tailings will be mixed with a large amount of water and then pumped to the deposition area with a pipeline with outfalls at several positions along the dike. The surface of the tailings will, with this deposition technique, set to a natural angle of repose equal to 1:120.

Thickened tailings, as the name suggests, involves the mechanical process of dewatering low solids concentrated slurry that originates from the mill. The surplus water will be recycled to the mining process. The surface of the partly thickened tailing will, due to earlier experience, set to a natural angle of repose equal to 1:30.

Due to the great width of the proposed tailings area, deposition has to take place from all of the dikes. Deposition from only one point, i.e. the east part of Gravgruvan, would result in a low usage efficiency of the available volume. As a consequence, should partially thickened tailing disposal be used, a method for depositing the material to all parts of the area must be further studied.

The deposition should preferentially be conducted from the center part of the area prior to shutdown, thus creating an inclination downwards to the outer parts of the tailings and hereby increase the volume of deposited material.

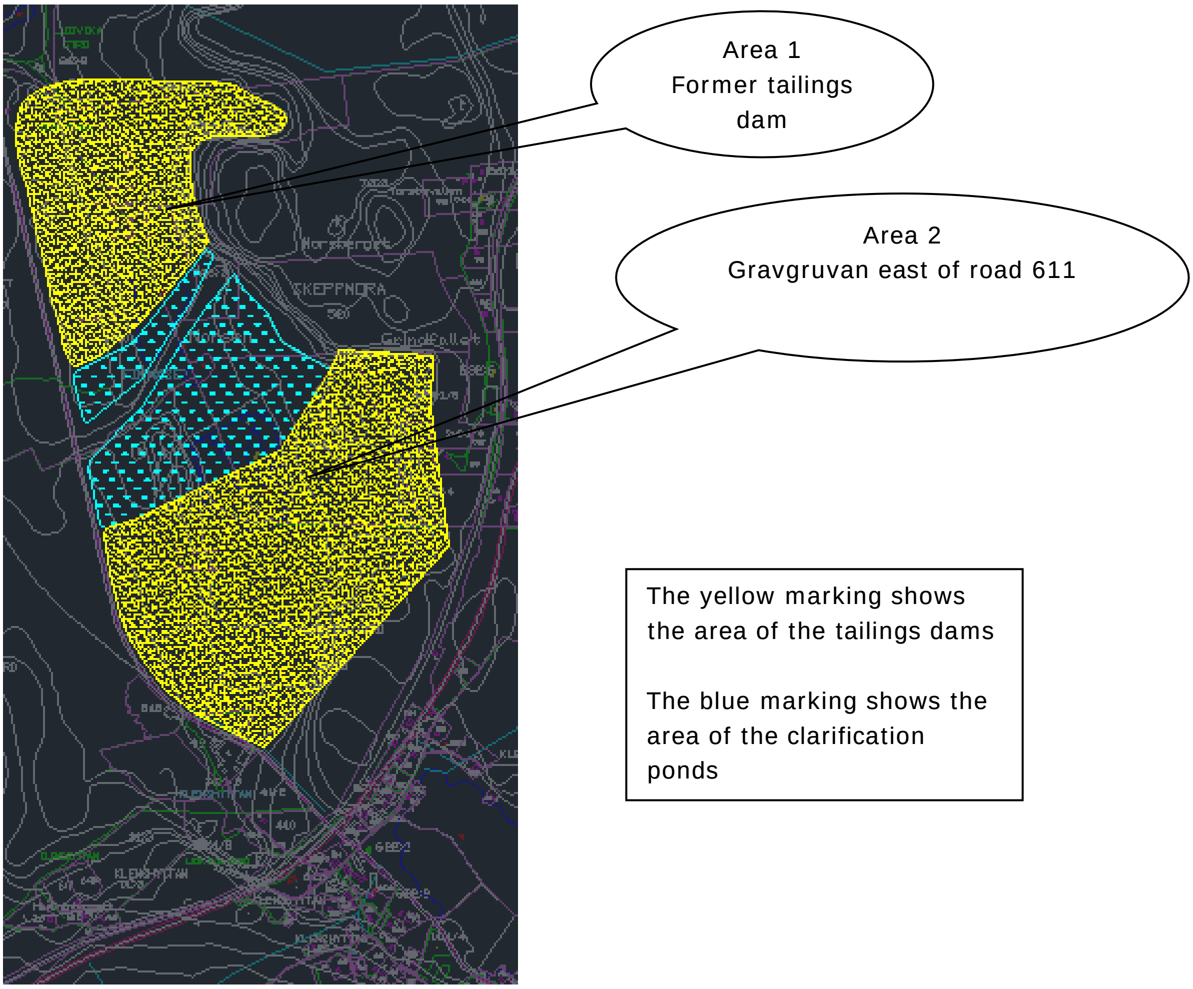


Figure 6. Overview area 2 (Gravgruvan) east of road 611 and former tailings dam.

The proposed construction of the tailings dam allows that both traditional wet disposal as well as partly thickened tailings disposal can be used.

Design of the dams - tailings dam

The tailings dams will be designed as drained dams, where the coarser fractions of the tailings will be used to construct the dams (as opposed to a dam with an impervious core).

Clarification pond

The clarification pond will only contain water and therefore will be designed as traditional rock fill dams with an impervious core of till.

Storage volumes for water and tailings

The clarification pond in Area 2 (Gravgruvan, south of the channel) will contain 1 million cubic meter of water. The clarification pond in Area 1 (the existing deposition, north of the channel), will at construction contain about 0.2 million cubic meter of water.

Table 6 Calculated storage volume

Tailings dam	[million m^3]
Area 2 Gravgruvan east of the road at altitude +210, traditional wet deposition	12.0
Elevation of altitude to +215, traditional wet deposition	15.3
Elevation of altitude to+220, traditional wet deposition	18.1
A deposition with Partly Thickened tailings at shutdown gives an addition to area 2, Gravgruvan	+3.5
Area 1, existing tailings at altitude +210, traditional wet deposition	4.9

To accommodate a minimum of 21.5 million m^3 of tailings in the dams, there are several options, such as one example:

- Fill Area 2, Gravgruvan, to an altitude of +215 and then fill with Partly Thickened tailings and use Area 1 to an altitude of +210 hereby enabling deposition of about 22.8 million m^3 (15.3 +3.5 + 4.9)
- etc.

Sequence of construction

The south clarification pond will be constructed as the first measure in the area since it will contain water for the milling process. Furthermore, deposition will take place against the south dike of the clarification pond. Initially, deposition of the tailings is possible in Area 2 without any starter dike. This could be achieved with only minor preparations of the existing dike by using the area that previously has been prepared for deposition.

The new starter dike in Area 2 along the road in the east and the highlands in the south will be completed in the summer season before the tailings level has reached the existing dikes.

In the initial phase, measures have to be taken to get the process water from the tailings dam to the clarification pond. This can be achieved by different methods, i.e. trenches in the tailings and pumping of water from the tailings to the clarification pond.

In the longer term, Area 1 that also includes the existing deposition area will be used for the tailings. The first measure will be the construction of the north clarification pond and to determine the solution for transport of the water to the south clarification pond, thus meet the demand for a constant volume of 1 million m^3 of water available for the mining process. That can be fulfilled by either pumping the water or constructing an aqueduct across the channel.

Deposition of tailings in Area 1 will be started south of the existing tailings and continued on the west side of the existing tailings. This is to give adequate support to the existing tailings which have very steep slopes and cannot support deposition to the altitude of +210 as they look today.

Pros

- The area consists partly of the existing tailings (Area 1) and is already affected by previous mining operation.
- The short distance to the industrial area.
- Construction work has started of dikes for tailings deposition in area 2 during the previous mining operation.
- The tailings in area 2 can be put into operation with very small effort.
- The terrain in the east is very suitable for tailing dams and clarification ponds considering the amount of construction material needed.
- There are no known special environment protection areas.

Cons

- A relatively large amount of tailings needs to be deposited around the existing tailings at the startup phase in order to provide sufficient support for the existing dikes. Subsequently, deposition can be performed at higher altitudes on top of the existing tailings.
- The channel used for drainage of the mine will be located in-between the two areas 1 and 2.
- Continued deposition on top of existing tailings will result in expensive costs given any future demands for environment remediation.
- Proximity to development in the south direction in Klenshyttan. (Possibly small industries).
- The maximum altitude of the tailings at completion will be about +210 m (height 30 m) and at altitude +220 (height 40 m compared to the altitude of the road in the west).

Consequence classification

A preliminary classification of the proposed dams at Blötberget has been performed according to the Swedish dam safety guidelines of the hydropower and mining industry.

Dams are classified based on the consequences that follow a failure of the dam. The classification is based on the marginal consequence, i.e. the additional damage following the failure itself, not damages due to extremely high water flows and such. The consequences are evaluated based on the probability for:

- Loss of human lives or serious injuries
- Damages to the environment, critical civic functions and other economical damage

The tailings dams in Area 1 and 2, Gravgruvan will preliminary be classified as consequence class 2. This means the following:

The probability is not negligible for:

notable damage to	# civic functions
	# ecosystem components
or	# economic impact

The clarification pond in Area 2, Gravgruvan will preliminary be classified as consequence class 1B. This means the following:

The probability for loss of lives or serious injuries is not negligible

or notable probability for:

serious damage to	# critical civic functions
	# valued ecosystem components
or high probability for:	# large economic impact

4.3 Mine Terminal

A number of factor influence the placement of the terminal and the rail yard. A number of these are not directly connected to the railway logistics, one such factor clearly being the placement of the mineral processing plant in Blötberget. A early design is presented in Figure 7.

A raw ore terminal (see Figure 8) will be needed in Håksberg for transportation to Blötberget and the geographical location of the terminal and rail yard is considered most advantageous if placed at Skeppmora in direct connection with the main line, where costs are minimized because long lines to the yard will not be necessary.

The iron ore product will be transported from Skeppmora with 3-4 train sets per day to the harbor in Gävle to the customer. Details regarding transport and terminals are presented in appendix 7a and 7b.

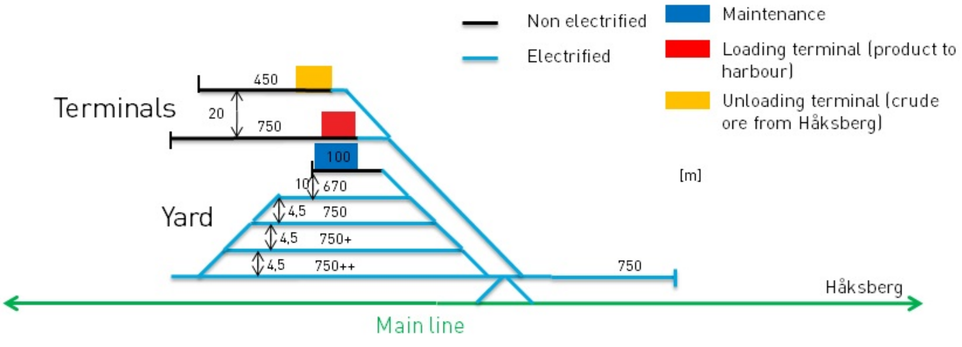


Figure 7. Railway design (functional) in Blötberget (Skeppmora)

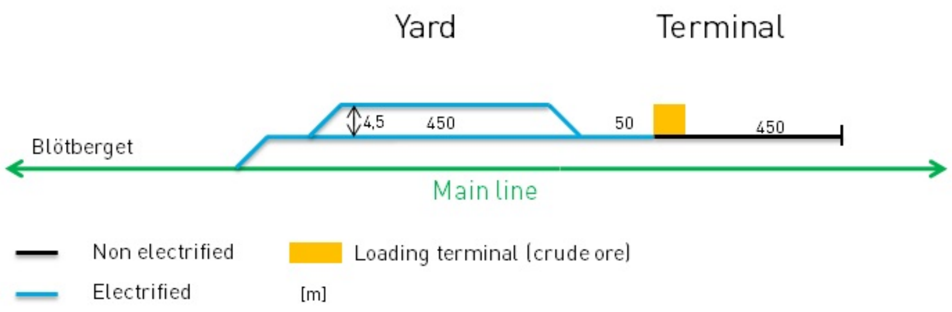


Figure 8. Railway design (functional) in Håksberg

4.4 Infrastructure

Overviews of the planned infrastructure are presented in Appendix 1b (Blötberget) and Appendix 1c (Håksberg). The planned establishments consists of the industrial area itself, roads within and between these areas, buildings housing concentration plant, offices etc., fire water facilities, electric power installations including re-routing of an electrical cable in Blötberget as well as the distribution of power and distribution within the industrial area and the communication network. Water management also constitutes parts of the infrastructure, with re-direction of Gonäsån and pumping of groundwater from the mine.

The industrial areas in Blötberget and Håksberg will consist of gravel except for parts surrounding office buildings and adjacent parking space which will be paved. All facilities belonging to the industrial areas will be surrounded by industrial fencing. The industrial areas are planned to be frequented by dumpers as well as trucks with trailers, and all buildings are therefore placed with consideration of the space requirements these vehicles have.

Industrial area Blötberget

At Blötberget the industrial area will be divided into two parts:

- Concentration plant, office, stores, incoming transformer, switchgear and goods reception. These facilities are placed close to the terminal area and railway tracks.
- Vehicle service stations and fuel station are placed next to the start of the portal decline.

Close to the BS shaft there will be a fresh air fan station and an adjacent Propane station.

Industrial area Håksberg

The industrial area at Håksberg will be located at Iviken, near the existing start of the decline. This location will house an office building, vehicle service stations, fueling station and a transformer station. A new fresh air fan station will be constructed along with an adjacent propane station.

Close to the Central shaft at Håksberg there will be a new transformer station, fresh air station and propane station.

4.4.1 Roads

Roads to be used for transport are planned with a 7 m width. Remaining roads are planned with a 5 m width with meeting slots. The required roads are illustrated in appendix 8, drawings T0201 (Blötberget) and T0211 (Håksberg).

In Blötberget the existing road entering the area will be reinforced (road 1). A new road with a bridge over the channel will be constructed between the two industrial areas in Blötberget and a Propane station adjoining the road (road 3). The existing road between industrial area part 2 and the BS shaft will be reinforced (road 4, 6). If ore transports are to be conducted in an initial stage between industrial area part 2 and the BS shaft the road will be reconstructed and will then replace road 4 (road 5). The road leading to the intake air fan station and Propane station near the BS shaft will be reinforced and straightened (road 7).

In Håksberg a new road will be constructed to supply the Propane station (road 8). The road leading to the industrial area Iviken will be reinforced (road 9). The road between Iviken and excavation area Håksberg will partially be reinforced and partially redrawn (roads 9, 10, 11 and 12). The road leading to the intake air fan station and Propane station at excavation area Håksberg will partially be reinforced and partially redrawn (roads 13 and 14).

4.4.2 Buildings

Buildings that are required for the mining operation include concentration plant, vehicle workshops, reagent storage, office/locker-room, welding and mechanical workshop, ventilation stations and cold storage. Buildings are planned with foundations made of concrete and prefabricated concrete base elements. Their exterior walls are planned with sandwich-panels. Details of the buildings are presented on drawings in appendix 11.

Nordic Iron Ore

4.4.3 Fire water on surface

Ludvika fire department and Statoil has been contacted in the matter of fire water supply.

Håksberg:

Ludvika fire department does not make any demands concerning fire water access in Håksberg. Water may be taken from the clarification pond in case of fire.

One Propane tank with volume 100 m^3 will be placed in Håksberg. No combustible material is allowed within the security zone. No water in addition to the water supplied from the fire trucks will be needed.

Blötberget:

Fire water will be supplied by the water pipe delivering water from Lake Väsman. A number of strategically located fire water posts will be located along the pipe. In case of power failure, fire water may also be pumped from the process water tank in the concentrating plant which holds a volume of 1 130 m^3. A pressure booster pump shall be held available.

The pumping station at Lake Väsman should have two pumps, one operating and one stand by. Normally the station is supplied with electricity from the electricity grid and in case of power failure a diesel generator will serve as back up.

Two Propane tanks are to be placed at different locations. One will have a volume of 100 m^3 and the other will be somewhat smaller. No combustible material is allowed within the security zone. No water except from the water supplied from the fire trucks will be needed.

Iviken:

At least three fire posts with a capacity of 1200 liters per minute and fire post. Location will be decided after consulting the fire department. A fire water tank is required to provide the requested amounts. The tank will be filled using the public water net.

One Propane tank containing a volume of 100 m^3 will be located at Iviken. No combustible material is allowed within the security zone. No water except from the water supplied from the fire trucks is needed.

4.4.4 Electric power

In Blötberget the 50 kV transformer substation will be installed and connected to the 50 kV power lines that passes through the industrial area (see also 4.1.9). The owner of the power line (VB-Energi) will deliver the substation and will handle the connection. However, the power line needs to be re-routed, the cost of which is included in this section (see chapter 6.3.4). The transformer substation transforms the power from 50kV to 12kV and distributes 12kV to the industrial area and the mine in both Blötberget and Håksberg. For details on electric power supply see appendix 9.

4.4.5 Communication
Backbone will acts as a common network for technology and administrative networks. The backbone is also used for communication between Blötberget and Håksberg. In Blötberget there will be backbone of optical fiber from the server room in the office building at the industrial area to the concentration plant, BS-shaft, decline and ends in the server room in the office building at the industrial area, in order to maintain security through redundant communication. In Håksberg there will be a backbone from the server room in office building at the industrial area Iviken to the decline and it will end in the Central shaft in Håksberg. In order to maintain security through redundant communication, optical cable is running in the mine drifts from the Central shaft in Håksberg to the decline industrial area Iviken.

The technology network is used in production, environmental monitoring system, alarms, radio communication, security systems, etc.

Between offices and workshops in the industrial areas there will be optical fiber to serve as administrative network.

A fire alarm system will be installed in workshops underground, offices, workshop spaces and concentration plant. The fire alarm system will activate an audible emergency alarm on the surface. The fire alarm system underground will activate emergency alarm acoustically, and lighting fixtures pulsation. In the event of power loss the underground emergency alarm will be activated.

A digital radio system will be installed on the surface and underground, communication between the nodes for wireless system will be via the optical fiber network. The system is based on digital base stations located underground and any radio receiver will act as "repeater" that will link the radio traffic on to the next radio receiver. The radio system may also be integrated with a 3G cellphone system for mobile telephone networks on the surface. The system will be common for Blötberget and Håksberg.

Access control systems within the office, workshop spaces and concentration plant in the industrial fields. Wireless tags for the access control system are common with the tagging and tracking system. This system will be common for Blötberget and Håksberg.

A tagging and tracking system will be installed in the decline and in the mine. Persons and vehicles fitted with tags are detected via wireless receivers up and down the haulage road. The system will be common for Blötberget and Håksberg. Capital costs for communication are presented in chapter 5. For details on communication see appendix 10.

4.4.6 Water management
Before the reopening the mines have to be emptied from about 4-5 million m^3 of water each. With a flow of 300 l/s from each mine this will take about a year. The

mine water will be pumped to sedimentation ponds at each mine. For details regarding dewatering and sedimentation ponds see appendix 12 (PM Dewatering and PM Water management and water balance).

At present the river Gonäsån runs through the mining area in Blötberget and must therefore be rerouted before the mine is emptied from water. The river Gonäsån has been rerouted once before, during the former mining operations in the area and in broad terms this same route will be reopened. For details see appendix 12 (PM Re-routing of Gonäsån).

The ground water leakage during the operation of the mine each of the mines has been calculated to 40 l/s for each mine. Some of this water will be used for drilling and the rest will be led to the sedimentation ponds. As the flow rate is much smaller only one pond will be used. For details see appendix 12 (PM Water management and water balance).

The concentration process requires 6 581 m^3 water at full operation (see chapter 4.2), most of which is recycled within the process. The tailings are mixed with 288 m^3/h water to form slurry that is pumped to the tailings dam. The product contains 17 m^3/h of water. Therefore, 305 m^3 water per hour needs to be replaced. As far as possible this water will be pumped from the tailings dam. In order to keep enough water during to winter period the tailings dam will be constructed to keep 1 million m^3. This corresponds to 4.5 month water consumption. During short periods of time when the water consumption of the process is not covered by water recycled from the tailing pond, water will be pumped from Lake Väsman. For details see appendix 12 (PM Water management and water balance).

4.5 Mine waste rock

4.5.1 Waste rock from development works

Blötberget

Development works in term of drifts and raises will generate waste rock. For the Blötberget area the waste rock will mainly be transported in the decline with truck. The waste rock will be used in the dam construction for the mine tailings mainly but also used as backfill the caving area for the Beststa –Hugget ores to increase the stability in the area. Moreover, the waste rock will be needed to establish local industrial areas and plans. Further treatment of the material such as crushing will be carried out within the industrial areas.

The amounts available as development waste are shown in Figure 9. The utilized roads for the waste rock transports (road 3 to 7) are shown in Appendix 8 T0201.

Håksberg

Development works in term of drifts and raises will generate waste rock. For the Håksberg area some backfilling of stopes may take place from underground, a maximum of about 20% is estimated of being able to deposit underground, the rest of the development waste will be transported above ground. The decline in Iviken is used for that. The development waste will mainly be used for backfilling of the failing areas in Iviken , Ikorrbotten and Central Håksberg. The amount of development waste produced in Håksberg will be strongly dependent on chosen mining method.

The amount of developments waste is shown in Figure 9. The roads that will be used for waste rock transports (roads 9-13) are shown in Appendix 8 T0211.

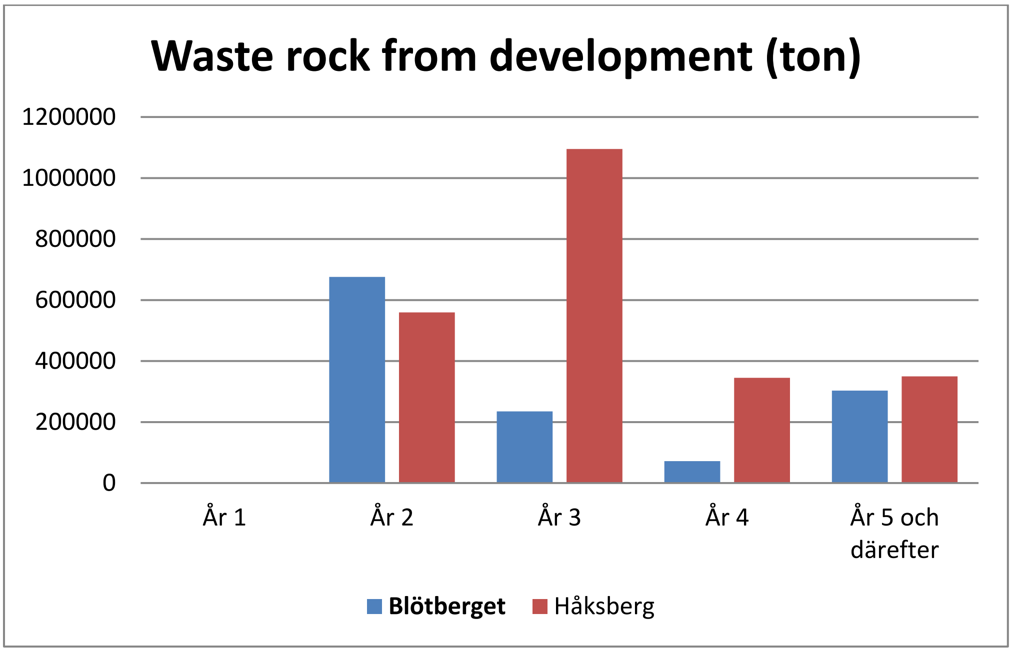


Figure 9 Mine development waste

4.5.2 Mass balance waste rock

Blötberget

Moraine and rock masses will be produced with developing the industrial areas at Blötberget. Initially this material together with waste rock will be used for the terminal works at Skeppmora, and later this material will mainly be used for dam construction purposes. The material will be transported with dumpers and trucks. The utilized roads for transports (road 3 to 5) are shown in Appendix 8 T0201.

In addition to the material from the terminal and industrial area developments, the mine development waste will be produced as described above. In Table 7, an overview of the need and the available waste rock for Blötberget is shown.

Table 7. Tentative mass balance sheet for the waste rock in the Blötberget area

Mass balance	Mt
Soil and rock from roads and industrial area	0.4
Mine development waste	3.2
Demand dam construction	-3.0
Demand mine terminal	-0.7

Håksberg
Initially waste rock will be produced above ground about waste rock (0.3 Mt) and Soil (0.2 Mt) as the terminal in Håksberg is constructed. This waste material will mainly be used as backfill material in old mine openings in Iviken, Ikorrbotten and Central Håksberg. The roads that are utilized for the transports are shown in Appendix 8 (road 9 to 13). In addition the material from the terminal construction, mine development waste will be produced. An estimated 4.3 Mt mine development waste is estimated over the Life of Mine.

4.6 Possible mine development

As a part of the next phase, the Feasability study, in developing Ludvika Gruvor to a profitable sustainable mine operation a number of areas have to be investigated and studied more in detail. Some of the most important issues are listed here below (without being complete):

- Resource exploration – improving quality and quantity of the mineral resources starting with Blötberget and Väsman areas, above 300 m elev.
- Mining plan and layout – optimizing and selecting mining methods and ore haulage- and hoisting system
- Process optimization and Product development – selecting best possible process flowsheet for the mined ore, by sampling and testing stepwise in different scales (bench to pilot)
- Product marketing – secure longterm supply agreements with the steel market
- Mine development and production plan – optimization
- Logistics - selection and optimization of ore loading/discharging terminals as well as rail-cars

This measures should result in:

- Reduced environmental footprint
- Reduced capex by good utilization of existing infrastructure and centralized ore handling- and beneficiation-systems, as well as media
- Reduced opex by maximized output, productivity and grade.

5. Logistics

5.1 Introduction

This part of the study constitutes a first analysis of transport and logistic solutions for Nordic Iron Ore. The analysis includes a variety of parameters constituting a complex relationship. The purpose has been to use a single method to identify and quantify the strengths and weaknesses of every option relating to the port of shipment and associated rail transportation. The analysis has not been optimized at all stages, but nevertheless provides an important first indication of the interrelationships between the various options/solutions that have been studied. As the study carried out for this project is the first of its kind, there is further need for additional studies in all areas.

The final report (attached as Appendix 7a) consists of a total of three PMs, each of which aim to:

- Define the functional requirements for yards and terminals located in the vicinity of the mines so that the railway facilities are designed rationally and efficiently (PM1).
- Study the transport chain for concentrated ore from the mineral processing plant in Ludvika to the unloading facility in the port and associated boat transportation for potential markets in Europe (Rotterdam's Port) and Asia (Qingdao's Port) (PM2).
- Describe the different port terminals and how the unloading facilities should be designed. Three ports have been investigated; Oxelösund (option A), Gävle (option B) and Lysekil (option C) (PM3).

All PMs include overall cost estimates.

5.2 Mine Terminal

A number of factor influence the placement of the terminal and the rail yard. A number of these are not directly connected to the railway logistics, one such factor clearly being the placement of the mineral processing plant. The results of the location study carried out for the mill is that this should be placed in Blötberget. A raw ore terminal will be needed in Håksberg for transportation to Blötberget. The geographical location of the terminal and rail yard is considered most advantageous if placed at Skeppmora in direct connection with the main line, where costs are minimized because long lines to the yard will not be necessary.

At the level of Skeppmora, there is a straight rail section on the main line of about 1000 meters. The area is also relatively flat and is considered good for the placement of the yard. However, the main line inclines 9-10 ‰ to the north. The rail yard is expected to connect to the main line at the southern end. The terminals for crude ore and loading are located west of the yard. The unloading terminal should be placed as close to the mill as possible. It is proposed that the terminal and rail yard be placed next to each other, side by side.

The crude ore terminal is located in Håksberg given that previously there was a sidetrack in the area that is required for the rail yard and terminal. Unlike Blötberget, it is only necessary to connect the rail yard to the main line in the south end, as no trains will be approaching Håksberg from the north.

In conclusion, it can be seen that the entire yard does not need to be built in one step. An initial solution is possible: consisting of three rail yard tracks, a loading terminal and a raw ore terminal in Blötberget and a raw ore terminal in Håksberg. If a smaller terminal is to be built initially, the tracks could theoretically be shorter, as they would then be electrified. Should the latter be desirable in order to expand the yard with more tracks, the contact poles and switches for example would then be incorrectly placed and easy expansion would be more complicated. Against this background it is recommended that the rail yard be built with track lengths designed for fully capacity already at the beginning. The constructed solution consists of four rail yard tracks and extraction tracks and a loading terminal and a raw ore terminal in Blötberget and a raw ore terminal in Håksberg, at a cost of about 140 MSEK.

5.3 Railway transportation

The port specific conditions have been studied overall for the following three ports: Oxelösund, Gävle and Lysekil. To get to these three ports, three different railway lines are used, with different features and different advantages and disadvantages. These are summarized in the table below.

	Oxelösund	Gävle	Lysekil
Maximum Permissible Axle Load (axle load)	25 ton	25 tons, with the exception of Ludvika – Fagersta C, which is 22.5 tons	25 tons, with the exception of Öxnered – Lysekil, which is 22.5 tons
Stvm (meter weight)	8 ton/m	8 ton/m, with the exception of Ludvika – Fagersta C, which is 6.4 tons/m	8 ton/m, with the exception of Öxnered – Lysekil which is 6.4 tons/m
Sth* (speed)	80-160 km/h	60-120 km/h	60-150 km/h, with some point reduction to 40 (Bredsjö moss)
Distance	299 km	181 km	409 km
Train weight (except)	3000	3000 (49 km, 27 % of the route)	3000 (48 km, 12 % of the route)
Inclination (varies along the route)	10-14 per mill	10-14 per mill	10-22.5 per mill
Train Length	604	563	505
*Highest permitted speed with Maximum Permissible Axle Load E (25 tons axle pressure) is 80 km/hour regardless of whether or not the line permits higher speeds for other trains.			

In order to assess the logistic and financial effects of the choice of shipping port, the solutions for all components of the logistic chain from the mine to the shipping port were studied. Based on this we were able to establish that that there is currently suitable wagon designs, mainly due to the properties of the material. If the material can be handled in a wagon with side or bottom discharge this would be advantageous given that this is common in Europe, there are a number of manufacturers in place and the unloading facility would be relatively simple. In the case of locomotives, for example Rc or Traxx, the infrastructure currently in existence will work. For train weights of 6000 tons and train lengths of 750 m, a more specialized locomotive is necessary. Our calculations are based on a developed Taimn wagon, covered and with side discharge.

As regards the choice of destination for the railway transportation, it can be established that the port of Lysekil is the most advantageous for sea transport given that the port reaches the desired markets (Europe, Asia), has the deepest port, is ice-free the whole year round, and is located on nationally designated freight-routes. The disadvantage of Lysekil as a shipping port is the geographic distance to the mining area in Ludvika, which entails long and costly train transportation (around 203 million SEK per year). Likewise, the technical performance of the railway infrastructure has significant weaknesses, particularly on the route from Munkedal to Lysekil.

The port of Oxelösund is the second most favorable port for sea transport with good port depth, ice-free all the year round while remaining a traditionally well-used bulk port. The technical performance of the railway infrastructure between the mining area in Ludvika and Oxelösund is considered good, and cost of rail transport is estimated at approximately 116 million SEK per year. A weakness is that reloading is probably necessary to reach the Asian market and ownership consists of other companies' interests rather than it being an entirely municipal owned port.

The port of Gävle has less favorable conditions for shipping given that the port is shallower, the entry is narrower in scope, there is ice four months a year and it is highly likely that it requires piloting upon approach. Gävle is the port that has the most favorable rail infrastructure leading to the mining area in Ludvika while the need for investment to handle trains in the port is limited. The cost of rail transport is estimated at approximately SEK 100 million per year, which is the lowest transportation cost for the three port options.

5.4 Port Terminal

As regards an unloading terminal, Gävle and Lysekil have for the large part, a completely newly established port and rail facilities. For the port of Oxelösund, it is a case of using the existing port and rail facilities, with some adaptations.

It is proposed that a new unloading pocket be built in one of the tracks close to the wharf on the so-called Höjdbangården for ore shipments from the Ludvika mining area to the port of Oxelösund. Other facilities to get the ore from the bulk storage and even from the storage to the boat have been established in principle. It is possible that the port will also invest in a larger ore loader if it transpires that larger vessels start arriving at the port. The investment cost, estimated by the harbor itself, amounts to about 20 million SEK. The port has also indicated an intermediate price of 27-45 SEK per ton (based on goods handling from the wagon to the boat).

The port of Gävle has suggested that the ore unloading be relocated to Granudden where expansion of the harbor is proposed, including the extension of the wharf with an additional surface for ore storage. The port has verbally given an indication of investment costs amounting to 160-180 million SEK. The goods handling price is estimated at 17-22 SEK per ton (this sum includes the handling of the ore arriving by train until the time that it is placed on the ship and also the cost of investment capital).

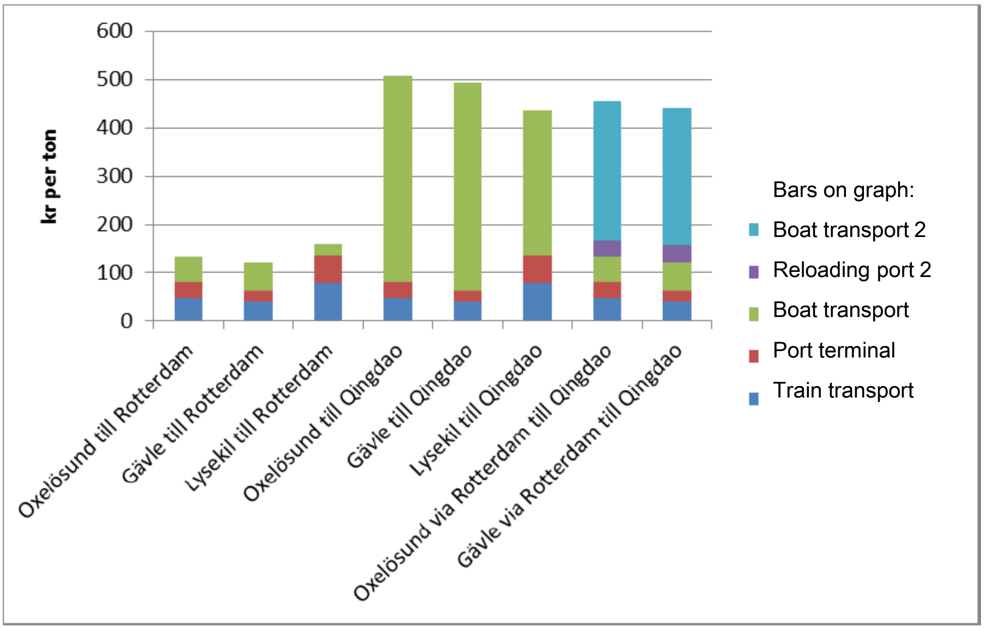
The port of Lysekil does not intend to use the present port for ore shipments from Ludvika, rather there is a proposal for a new location for such a port. The ore port has been proposed to be located in Brofjorden, indeed, two alternative locations have also been suggested (Option 1a - b and 2). The investment cost is estimated at 950 million SEK and the handling cost is estimated at 55 SEK per ton.

It can be stated that all three ports in general meet the functional requirements that may arise and that there are advantages and disadvantages of all three ports in Oxelösund, Gävle and Lysekil. The unloading facility cannot be selected however until the ore wagon has been chosen.

5.5 Conclusions

The figure below summarizes the costs for different transport arrangements. Both rail and boat have been included. Depending on the destination, the outcome will be different. Oxelösund and Gävle have similar costs for the complete transport chain in all scenarios. Furthermore, it appears that Lysekil is advantageous for long transport distances, which is natural given that the scale impact of large vessels can be utilized effectively. The choice of port is clearly related to the destination port that needs to be reached. It should be noted that for long distances it may be better to transfer goods to larger ships in Rotterdam for Oxelösund and Gävle.

In addition to the costs for transportation, there are the costs for the infrastructure. Lysekil is at the top of the list, because a new port and railway connection must be built. The costs of the railway facilities in Ludvika are equivalent for each option. The terminal and rail tracks in Håksberg are estimated at around 60 million SEK and terminals and rail tracks in Blötberget is estimated at around 170 million SEK. The costs for all three ports have been submitted: Oxelösund has indicated costs in the region of about 20 million SEK, Gävle approximately 160-180 million SEK and Lysekil about 950 million SEK.



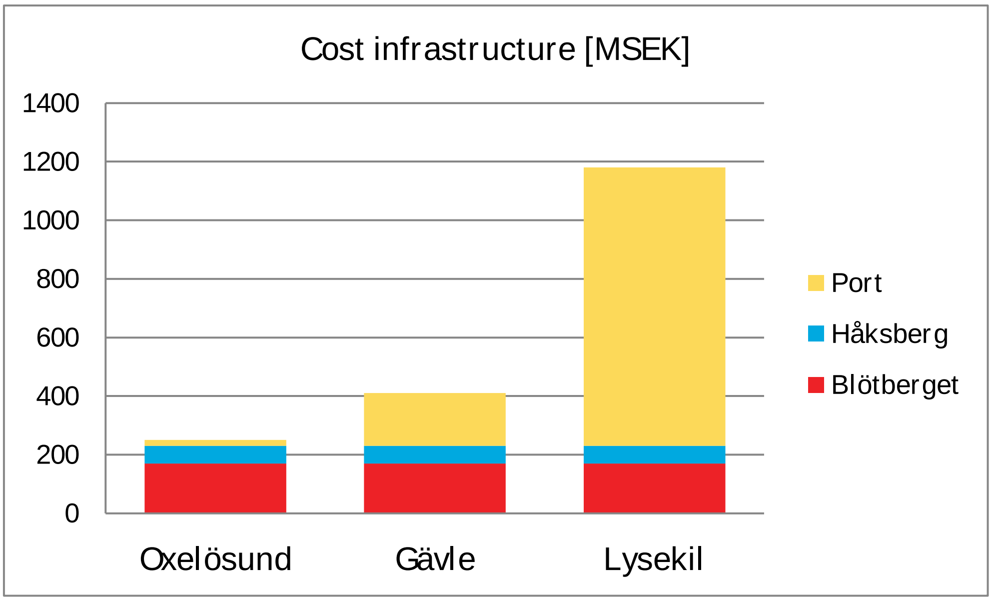


Figure 10 and 11. Cost estimates for different transport options and infrastructure

It is at this point difficult to make a clear recommendation regarding which port or which transport arrangements should be selected. A summary of the strengths and weaknesses, including a whole host of different parameters, can be found in the table below based on current knowledge of the transport costs, infrastructure costs and conditions of each port.

	Port of Gävle	Port of Oxelösund	Port of Lysekil
Strengths	+ Diversion facilities for railway transport + Technical performance of the infrastructure between Ludvika and the port + Limited need for investment in the harbor to handle trains + Much space in the harbor + Expansion opportunities for NIO + Handling price + Feasibility + Permission (MKB) + Customization	+ Harbor depth + Entering conditions (piloting not required) + Ice conditions + Well-used bulk port + Technical performance of the infrastructure between Ludvika and the port + Small investments + Feasibility + Permission (MKB)	+ Harbor depth + Entering conditions (piloting not required) + Ice conditions + All popular markets reached (Europe, Asia) + Politically correct as the port is located in a nationally designated freight route + Non-differentiated speed on tracks + Expansion opportunities for NIO
Weaknesses	- Entering (narrow entrance, which gives rise to time loss) - Ice conditions - Depth of port - Sulfur directive	- Sulfur directive - Possible transfer to reach Asian market - Ownership (other companies' interests) - Diversion facilities for railway transport - Capacity limitations at the unlading yard	- Geographic distance between the mine area and the port - Technical performance of the infrastructure, route Munkedal-Lysekil. - Unused bulk port - Diversion facilities for railway transport - Very large investments - Handling price - Permission (MKB) - Feasibility - Dependence upon third parties

6. Costs

6.1 General

Following presented cost estimations, both capex and opex, are based on preliminary quotations from suppliers/contractors as well as benchmarked costs from similar mining projects according to industry standard. The accuracy of the estimations in this Preliminary Economic Assessment (PEA) is considered to be +/- 25%. "Other costs", or "Contingency costs", are not specified here as an own cost item, though included in the overall cost estimations by 15% of capex. However, this "uncertainty-factor" are covered/treated in the capex/opex sensitivity analysis of the Economical model (see Chapter 8). Regarding "overhead costs", as project mgt and supervision during construction, commissioning and procurement, those are summarized as "Project cost" and added to the overall capex (by 12%).

Both capex and opex estimations are based on year 2011 cost-level and no escalation has been added for inflation.

6.2 Capex pre-production

The pre-production investments are given in Table 8. Full production is planned to be reached Q2 year 4. The mining is however proposed to commence at about Q2 year 2 with the already developed areas in Blötberget and Håksberg mines. Pre-production costs are therefore summarized as the capital costs that are required before production starts at Q2 year 2 as shown in Table 8. Capital costs required for reaching full production at Q2 year 4 are also shown in Table 8. Pre-production capital costs are summarized to 2 115 MSEK excluding project costs of 12%. Capital costs to reach full production are summarized to 2 700 MSEK excluding project costs of 12%.

6.3 Capex – Life of Mine

6.3.1 Mining

Capital costs related to mining (see Table 9) include costs for rock works for mine access and ramps as well as mine ventilation shafts and drifts. It also includes equipment for ventilation of the mine as well as ventilation control systems. The electrical installations include a 50 kV substation which will be connected to the 50 kV power line which passes the industrial area. Costs also include an estimate for the emptying of the mines from 4-5 million m^3 of water at each mine, here presented as "Mine pumping" costs. *Mining equipment is presented in the table but is omitted from the summarized cost since the mining and development works may be made by contractors (see section 6.4)*. Details of costs are presented in appendices 3, 4, 9, 10 and 12).

6.3.2 Ore Beneficiation

Capital costs related to ore beneficiation (see Table 10) include costs related to the crushing and hoisting of ore as well as costs related to the process. Process costs include primary crushing, ore hoisting and conveying from Håksberg to the concentrator in Blötberget. In the concentrator beneficiation is executed in two separate lines (one for Blötberget ores and one for Håksberg ores), flotation, dewatering and finally disposal of tailings in the tailings dam. Costs include civil works for both concentrator building and tailings dam and water pond, as well as construction costs for the concentrator, as well as all mechanical equipment, costs for ventilation in the concentrator building and systems for dealing with heat and dust. Details of costs are presented in appendix 5, 9, 11 and 12, see more detailed reference in Table 10.

Table 8. Estimate of pre-production capital costs and the capital cost to reach full production.

Capital Costs Pre production	Pre-prod Blötberget (BB)	Pre-prod Håksberget (HB)	Total pre-production	Full prod BB	Full prod HB	Full prod total
	[MSEK]	[MSEK]	[MSEK]	[MSEK]	[MSEK]	[MSEK]
Mining						
Mine[2]	136	470	606	340	767	1107
Ore beneficiation						
Crushing/hoisting	150	240	390	150	240	390
Concentrator-process	840		840	840		840
Tailings disposal	10		10	47		47
Transport						
Terminal Skeppmora	80		80	80		80
Rail yard		60	60		60	60
Electric power to terminals	3	2	5	3	2	5
Infrastructure						
Electric power[3]	24	22	46	24	22	46
Re-routing of Gonäsån	2		2	2		2
Electric cable re-routing	3		3	3		3
Roads/surfaces	26	9	35	26	9	35
Additional buildings	38		38	48	37	85
Total			**2 115**			**2 700**
Project costs 12%			254			324
Total			2 369			3 024

6.3.3 **Rail Terminals**

Capital costs related to rail terminals (see Table 11) includes the terminal in Skeppmora (Blötberget) and the rail yard in Håksberg, as well as capital costs for installation of electric power at both terminals. Details of costs are presented in appendices 7 and 9).

[2] including dewatering, mine access and ramps, mine ventiation shafts and drifts, ventilation and control, electrical installations including substation 50 kV
[3] connection to grid and distribution in the industrial area

Table 9. Estimate of Capital costs – Mining – over Life of Mine (LoM)

Capital costs related to mining	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]	Reference
Mine pumping	22	16	38	Appendix 12.1.1 and 12.1.2
Mine access and ramps	381	369	750	Appendix 3, chapter 7.2 and Appendix 3 "Indicative prices from Contractors"
Mine ventilation shafts and drifts	76	306	382	Appendix 3, chapter 7.2 and Appendix 3 "Indicative prices from Contractors"
*Mining equipment**	*120*	*140*	*260*	*Appendix 3 chapter 6 and 7.3*
Ventilation and control	67	98	165	Appendix 4 (attachments 3.1 and 3.2) + 10.1, 10.2 + 11
Electrical installations including substation 50 kV	22	36	58	Appendix 9.1 and 9.2
Total (with no own equipment)	568	825	1 393	

**Mining equipment = 0 if contractors are used for development works, why this is instead added in the operating costs. Numbers are here only for comparison and are not summarized in the total sum.*

Table 10. Estimate of Capital costs – Ore Beneficiation – over Life of Mine (LoM)

Capital costs related to ore beneficiation	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]	Ref.
Crushing/ hoisting	300	240	540	Summary of costs: Appendix 5, chapter 5
Concentrator – Process	840		840	Summary of costs: Appendix 5, chapter 5 Details process: Appendix 5, chapter 5 Details concentrator building: Appendix 11 chapter 2 Details electric power: Appendix 9.1 Details water management: Appendix 12.1.1
Tailings disposal	47		47	Appendix 5, chapter 5
Total Process and Crushing/ hoisting	1187	240	1427	

Table 11. Estimate of Capital costs – Transport – over Life of Mine (LoM)

Capital costs related to transport	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]	Reference
Rail terminals	80	60	140	Appendix 7a
Electric power in terminals	3	2	5	Appendix 9.1 and 9.2
Total	83	62	145	

6.3.4 **Infrastructure**

Capital costs related to infrastructure (see table 12) include costs related to construction of the industrial area. This includes the re-routing of the electric cable in Blötberget and the connection of power and distribution within the industrial area (as described in chapter 4.4.4). It also includes the re-routing of Gonäsån (chapter 4.4.6) and civil work for surfaces and costs for road construction (chapter 4.4.1). Buildings are also included; e.g. vehicle workshops, welding and mechanical workshops and ventilation stations. (The concentrator building is included in 0). Details of capital costs related to infrastructure are presented in appendices 8, 9, 11 and 12.

Table 12. Estimate of Capital costs – Infrastructure – over Life of Mine (LoM)

Capital costs related to Infrastructure	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]	Reference
Electric power (connection to grid and distribution in the industrial area, electric cable re-routing)	24	22	46	Appendix 9.1 and 9.2
Re-routing of Gonäsån	2		2	Appendix 12.1.1
Roads/surfaces	26	9	35	Appendix 8.1
Additional buildings (vehicle workshops, welding/mechanical workshops and heating)	72	45	117	Appendix 11, chapter 2
Total	124	76	200	

6.3.5 **Closure costs**

A decommissioning plan and cost estimate for the closure will be produced for the EIA, and may then be added into the project costs, tentatively at a cost of 1 SEK/ton.

6.3.6 **Summary of capital costs**

The capital costs estimates for the project are summarized on the following tables. Capital investment costs are estimated for the year of 2011 and no inflation is added on the investment costs.

The total LoM capital costs for sustaining capital are estimated at 3 1 65 SEK million excluding project costs of 12% as summarized in Table 13.

Table 13 Estimate of capital costs over the LoM - Summary

Capital Costs LoM			
	Blötberget [MSEK]	Håksberg [MSEK]	Both mines [MSEK]
Mining	568	825	1 393
Ore Beneficiation	1 187	240	1 427
Rail terminals	83	62	145
Infrastructure	124	76	200
Total			3 165
Project costs 12%			380
Total			3 545

6.4 Opex

The mining costs are costs directly related to mining of ore underground; drilling and blasting, mucking and transport to the crusher, ventilation costs (electric power and heating). The average direct mining cost for the ore is estimated to 68 SEK/ton ore if major mining equipment is purchased[4]. To the operational cost will be added the mine geology related to direct mine planning of about 2 SEK/ton and the 10 SEK/ton in machine depreciation. This gives an estimate of the direct mining costs to 68+2+10 = 80 SEK/ton. The mining costs are at this level of detail assumed to be similar in the two mines.

The handling of ROM between Håksberg and Skeppmora is estimated to result in a cost of approximately 3.9 SEK/ton ore. The operation costs for crushing and hoisting (6.1 SEK/ton ore) are the costs from the primary crushing to concentrator feed silos and include energy, maintenance and workers and a 10% contingency. Operating costs for concentrator (62.1 SEK/ton product) includes feed silo concentrator to product silos and include energy, maintenance and workers and a 10% contingency. The rail transport operating costs are estimated to be 40 SEK/ton product. Operating costs for harbor includes operating costs estimated for the case Gävle Harbor (20 SEK/ton product). Operation costs are summarized in Table 14.

Table 14. Operation cost estimate

Operational cost estimate	SEK per ton ore	SEK per ton product
Mining	80	200
Rail/ROM Haulage	3.9	9.8
Crushing/hoisting	6.6	16.4
Ore Beneficiation	26.8	66.9
Rail transport	16	40
Harbor fee (Gävle)	8	20
Contingency (2.5%)	3.5	9
Average Operating Cost per ton	144.8 SEK	362.1 SEK

Note: Ratio ore/product = 0,4

[4] The costs per tons of mined ore where 80% of the ore is out of mining and 20% from drifting is estimated to about 65.3×0.8 + 81,6×0.2 = 52+16 = 68 SEK/ton.

7. Marketing and Pricing

An iron ore market report was compiled by the Raw Materials Group (RMG) for Nordic Iron Ore AB on the basis that the Ludvika mines will produce approximately 2.2 Mt of concentrate per year, and are attached as Appendix 13. RMG's report uses information provided by Nordic Iron Ore as well as information from its own resources to reach conclusions. However, it should be noted that in the future the Ludvika mines products could well consist of a mix of pellet feed, (which can be blended with sinter feeds for certain markets), fines and possibly pellets. This market review pulls together the views of RMG along with input from the company.

7.1 Summary

Iron ore is the raw material primarily used to make hot metal, direct reduced iron (DRI) or pig iron, all of which are the main raw materials used to make steel. 98% of global mined iron ore is eventually used for steel production. The iron itself is usually found in the form of magnetite (Fe_3O_4), hematite (Fe_2O_3). Pure magnetite and hematite contain 72.4% and 70% iron, respectively. The largest known iron ore reserves are found in Australia, Brazil, China, India, Kazakhstan, North America, Russia and the Ukraine.

Iron ore is supplied to the world's iron and steel industry in four main forms: (*i*) Lump ore added directly to the blast furnace, (*ii*) Sinter fines: used to make sinter, an agglomerated product, then added to the blast furnace, (*iii*) Pellet feed/Concentrates: used to make (*iv*) pellets, an agglomerated ball-shaped product charged to the blast furnace to produce pig iron or a direct reduction furnace to produce DRI. Pellets are generally higher in iron content and thus more productive than sinter or lump ore when used in a blast furnace, but they are also more expensive than the other products.

Metallurgical testing has suggests that the iron resources at the Ludvika mines will require fine grinding to liberate the valuable magnetite and hematite, though further metallurgical development will look at the possibilities of producing “fines” products that will require simpler processing. The RMG market report mainly assumes that the final product is a magnetite iron ore concentrate of a high quality and is primarily suitable for making into iron oxide pellets (8-16mm) which can then be used in the iron making processes (primarily blast furnaces (BF) or in direct reduction (DR) furnaces.

The global steel market, which determines iron ore demand, has, over the years, shifted considerably notably from the point that China overtook Japan to become the world's leading steel producing country in 1996. This led to a period of exceptionally robust growth with annual growth rate of 6% to 7%. World crude steel production grew from 750 Mt in 1996 to 1400 Mt in 2010. Crude steel production in China grew more than six-fold from 101 Mt to 626 Mt over the same fifteen-year period.

RMG's view is that for the foreseeable future growth in the world steel industry will continue to be robust, but down somewhat compared with previous years. They foresee over 3 % growth, on average, for the world until 2030, which will result in almost 3 billion tonnes steel per year (compared to 1.4 billion tonnes today). China will continue to be the greatest influence on the whole market place, as it is the largest iron ore producer as well as the largest steelmaker. China, it is assumed, will have an average growth in steel consumption of just over 4 %, which translates to an average growth in iron ore demand of just over 3 % or 1,950 Mt of iron ore in 2030 (as RMG assume an increase in the use of scrap for making steel later in the forecasting period). Other rapidly growing regions are India, where it has been assumed steel production will reach almost 350 Mt by 2030 (average growth 9%), the Emerging pacific rim (Indonesia, Thailand etc) producing approximately 110 Mt in 2030 (av. growth > 5 %), the MENA region including Turkey with 155 Mt in 2030 (av. growth > 5 %) and South America with 120 Mt or an average growth of more than 5 %. This amounts to an assumed world demand for iron ore of 3,210 Mt by 2025 and 3,630 Mt in 2030.

From direct evidence from China, it is predicted that iron ore production will fall in China during this period of time to 2030 and that many new iron ore projects will be delayed, hence we foresee an underbalanced market for a few years (until 2013/2014), followed by a market more or less in balance for a few years. During this time, from about 2015 to 2020, it is anticipated that there will be new projects entering production, which will account for a relatively large increase in supply. The resulting excess supply is, however, expected to be both small and then offset by closures of high cost capacity in China. The production cost in marginal Chinese mines will thus set a floor for the iron ore prices. From 2020, prices will be determined by production costs in new, relatively low grade deposits in remote locations.

Whilst it is anticipated that there will be an increase in the output of finer ground materials such as concentrate and pellet feed in the world, there will be an ever increasing demand for high quality concentrates to blend in with the ever decreasing quality of the average mined iron ores, especially those in China. This market will be supported by an increased requirement to pelletise iron ore in order to meet targets to improve steel quality, environmental and productivity targets. It is also assumed that there will continue to be growth in demand for sinter feed in the emerging markets in the Pacific Rim that are anticipated to open up in a few years' time; plus there will continue to be an increasing demand from China both in quality sinter feed as well as high quality pellet feeds (as the Chinese pellet output has increased significantly of late to some 110 Mt). But the most promising area for growth for sinter, pellets and pellet feed, both for blast furnace and DRI applications, is expected to be in the MENA region, including Turkey. The steel output in that region is anticipated to grow significantly, supported by the fact that there are presently several plants in the planning stage, making this region potentially see a major increase in iron ore demand.

Furthermore, India's influence on the market place for iron ore should not be ignored; there is strong evidence that one of the biggest players in the iron ore spot market will be looking to reduce exports of its' iron resources and use them domestically. Iron ore exports from India have fallen this year, partly due to regulatory difficulties, but also because of increasing domestic demand. Furthermore, India will look to improve steel quality and productivity, as well as use its' own resources more cost effectively; resulting in a requirement to beneficiate iron ore and then pelletise. There is already a significant increase in pelletising projects in India and for this to be successful many of these pelletisers will need high quality, magnetite rich concentrates to help them reduce pelletising process costs and improve the pellet quality.

RMG has taken a view that iron ore prices will be maintained at an historically high level for the coming 15-20 years and that level at which the index prices will bottom out are primarily dictated by the level at which the majority of Chinese iron ore mines can sustain production. Too low a price and the Chinese mines will close, increasing demand for imports. From the predicted prices for iron ore it is possible to make an estimation of the net-back FOB price that Nordic Iron Ore can reasonably expect to receive and that it is these figures that are used in the PEA economic model (see section 8).

There are some smaller markets volumes for iron ores that can be sold for non-metallurgical uses; for example as heavy media (predominantly coal industry) and as a heavy aggregate for pipe coating. These markets are quite small in global terms but could provide specific opportunities for NIO.

7.2 Product Quality.

From historic production data and metallurgical test work (past and recent) it is evident that Nordic Iron Ore is able to produce high quality high grade products, primarily suitable as pellet feed material. Using available metallurgical data available an estimate of a typical pellet feed product is shown in Table 15. This is an estimate only from available data and is subject to confirmation testwork planned in the coming months. However, it is the view of Nordic Iron Ore that this is a conservative estimate. The product is anticipated to contain significantly higher proportions of magnetite compared with hematite, and hence will bring significant advantages to the pellet maker highlighted below.

Table 15 – Estimate of Typical Product Quality

Fet Total Iron %	**SiO_2 Silica %**	**Al_2O_3 Alumina %**	**CaO Lime %**	**MgO Magnesia %**	**P Phosphorous %**	**V Vanadium %**	**Na_20 Sodium %**	**K_20 Potassium %**
>67.0	**<1.3**	**<1.3**	**<0.4**	**<0.3**	**<0.03**	**<0.15**	**<0.05**	**<0.05**

The high quality can be achieved primarily as a result of the requirement to fine grind the ROM material in order to liberate the valuable magnetite and hematite from the waste minerals. There may be some scope to produce some courser lower quality products should the process economics and the market warrant such a move. However the predominantly magnetite concentrate will provide a much wanted and needed product for the pelletising markets because of the following advantages:

- Significantly low total fuel requirements when compared with a hematite only feed to a pellet plant (up to 65% less energy required)
- Reduced carbon footprint to for the pellet maker
- Allows the pellet maker to blend in low quality cheap ores
- DR quality pellets can be made (with low SiO_2 + Al_2O_3 <2.5%)
- Not expected to be any penalties from the purchaser as the know deleterious content is below penalty thresholds
- Product can be ready ground to pellet feed size

7.3 Product Shipping Logistics

Nordic Iron ore has significant shipping logistics advantages over many iron ore developments because it is a brown-field development, where there was existing extensive mining carried out during the last century. The benefits of this are detailed elsewhere in Chapter 5; however it should be noted in this section of the report that the existing rail and port infrastructure connecting to the Ludvika mining region offers a networked system that requires little in the way of up-grading in order to be operable. The project has a number of options for exporting the product to the market place using existing facilities and could do so with minimum investment in the early years of production.

The ports offer the opportunity to ship in vessels up to Cape size (>180,000tdwt), but equally can load into smaller vessels where the customers are not capable of receiving the larger vessels. Access can be made economically to all the markets, whether they are local in Northern Europe, the Middle east of the far markets of Asia and China.

7.4 Market Overview

7.4.1 Iron Ore price Settlements

Until around 3 years ago over 90% of iron ore trades were conducted using what was referred to as the “benchmark” pricing, which were essentially negotiations settled between the big three iron ore producers and the largest regional purchasing areas, Europe, Japan and China. The price settlements were made using market demand for product types, expected shipping costs etc and these prices were set for the year. All other suppliers then followed the lead of the market makers and settled their prices accordingly. Since about 2005 there has been an increasingly active spot market system for pricing (stemming mainly from Indian trade to

China) which has influenced the introduction of internationally recognised Indices. During recent boom years the main suppliers of the iron ore have encouraged the use of these indices to start pricing quarterly and even monthly based upon recent historic indices and demand for products. These indices are published by Platts, TSI and Metal Bulletin. They all vary slightly in how they are compiled, but essentially they derived from recent trades and sentiment in the market at the time of publishing. These tools are now used by both buyers and producers to help them not only settle prices, but also to start hedging on the growing commodities futures market for iron ore.

These indices are largely based upon delivery to steelworks in China, and then they are used for calculating target pricing primarily by taking into account product quality variations and transport to market costs to calculate a FOB value at the port of lading. This method of trading based on a regularly changing contract either monthly or 3 monthly has not been readily accepted by many of the European steel companies as they argue that this calculation is not relevant to them as it is based on a distant market place. Consequently some suppliers to the European market have conceded to continue to supply on annual contract basis to them. However there is a general consensus in the market place that eventually the European purchasers will have to concede and that this currently accepted trading methods deployed to the Asian markets (or something similar) will be commonplace.

It should be noted that these indices generally reflect the market place for the lower quality end of iron ore products. This is slowly being addressed with some measures being introduced to differentiate between certain contaminant levels as well as the Fe content. There is a premium paid for higher grade ore. The premium for higher grade ore (i.e. ~66 % Fe or above) is not necessarily directly proportionate to the premiums achieved by medium grade above low grade.

Other iron ore products e.g. lump and pellets generally command a premium to sinter fines. The size of this premium is not constant and has varied from 25 to 150 $/tonne in recent years.

A comparison between the different indices is found in Figure 12 below.

Details of the effects of the deleterious elements can be found in more detail in the RMG Market report for Nordic Iron Ore.

Figure 12 – Comparison of Existing iron Ore Price Indices

	MBIO	TSI 58	TSI 62	Platts IODEX
Price	USD/dry metric tonne, CFR China	USD/ dry metric tonne, CFRFO China		USD/ dry metric tonne CFR main Chinese ports
Fe content	Base 62 %, range 56 – 68 %	58% range 55 – 60 %	62% range > 60 – 66 %	62% range 60 – 63.5 %
Silica	Base 3.5 %, Max. 6.0 %	4.00% Max. 8.0 %	4.00% Max. 6.0 %	4.50%
Alumina	Base 2.0 %, max. 4.0 %	3.50% Max. 5 %	3.50% max. 4 %	2.00%
Combined Si+Al	Max. 8.0 %	n.s.	n.s.	n.s.
Phosphorus	Base 0,05 %, max 0.1 %	0.07% max. 0.125 %		0.08%
Sulphur	Base 0.02 %, max 0.05 %	0.05% max. 0.07 %		0.02%
Loss on Ignition (% DW)	Base 4.7 %, max 9.8 %	n.s.	n.s.	n.s.
Moisture	Base 8.0 %, max 10.0 %	8.50% max. 10 %	8.00% max 10 %	8.00%
Granularity	> 90 %: < 6.3 mm, max size < 10 %: < 0.15 mm	90 % < 10 mm max size 40 %: < 0.15 mm		90 %< 10 mm
Trade size	Min. 30 000 tonnes, max 350 000 tonnes	Min. 20 000 tonnes		Min. 35 000 tonnes
Delivery Port	Base Qingdao-Rizhao-Lianyungang, norm. any Chinese sea port	Tianjin		Qingdao
Delivery Period	Within 8 weeks	Loading within 4 weeks of transaction		2 – 8 weeks from date of publication
Publications	Daily London mid-day	Daily		Assessment at 18.30 Singapore time daily
Payment	Not specified (n.s.)	At sight		100 % at sight
Normalisation	n.s.	USD 8 /% Fe, dmt	USD 5.5/% Fe, dmt	USD 4 / % Fe, dmt
n.s = not specified				

Sources: Metal Bulletin, The Steel Index, Platts, RMG

7.4.2 **Iron ore Demand Forecast**

Table 16 below shows the expected regional growth in the production of steel. Taking into account shifts in process types to produce the steel it can be predicted what the overall global and regional demand will be for the iron ore.

Table 16 - Growth of Steel Production 2000 to 2010 and Forecast to 2030

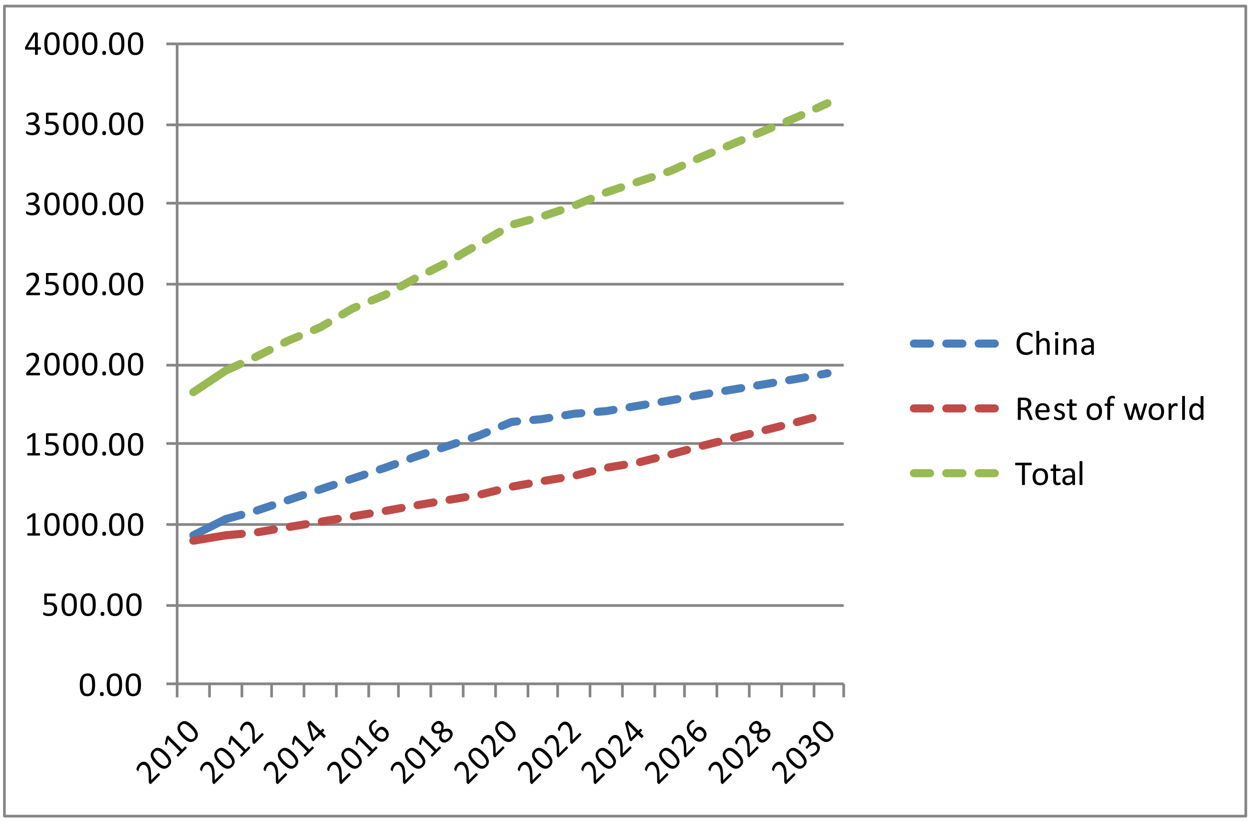
Country/Region	2000	2010	Av. Growth, % 2000 - 2010		2015	2020	2025	2030		av. Growth, % 2010 - 2030
China	127 236	625 658	17.51		902 671	1 152 062	1 322 640	1 518 473		4.1
India	26 924	66 848	9.96		102 854	158 254	243 493	374 644		9.0
Japan	106 444	109 600	1.02		121 007	121 007	121 007	121 007		0.5
South Korea	43 107	58 453	3.47		64 853	69 518	73 064	76 791		1.4
Emerging Pacific Rim	28 169	40 304	3.91		49 036	62 584	79 874	112 028		5.3
North America	135 353	111 798	-0.52		112 920	114 054	114 969	114 969		0.1
South America	39 110	43 775	1.59		53 259	67 973	86 753	121 676		5.3
Europe	184 925	176 982	-0.22		176 982	176 982	176 982	176 982		0.0
C.I.S	98 489	108 425	1.23		119 710	132 169	138 911	145 997		1.5
MENA incl. Turkey	30 074	57 413	6.65		79 020	100 851	127 489	155 109		5.1
					5.00	5.00	4.00	4.00		5.10
RoW (Africa & Oceania)	16 690	16 839	0.48		17 264	22 034	28 657	40 193		4.5
Total World	836 521	1 416 095	5.47		1 799 577	2 177 489	2 513 840	2 957 870		3.3

Sources: World Steel Association (2000, 2010); RMG forecast (2030)

The demand for iron ore is assumed to follow a similar trend as the increase in steel production, less a factor that reflects the more rapid increase in the use of scrap to make steel in China, in particular. Hence, in the case of China, RMG assumes that the annual increase in iron ore demand up to 2020 will be one percentage point higher than the growth rate predicted for steel. Beyond this year, growth in scrap supply is assumed to catch up with steel demand growth. Using 2011 as the starting point for RMGs forecast, accordingly, world iron ore demand will reach 2,340 Mt in 2015, 2,864 Mt in 2020, 3,210 Mt 2025 and 3,632 Mt in 2030. The average annual increase over the entire period is just over 3 per cent, which is below the rate of growth achieved in the early 2000s, but higher than the growth rates in the 1980s and 1990s. Figure 13 below illustrates the projection.

In RMGs projection, some 390 Mt of additional production would need to be added between years 2011 and 2015, a further 520 Mt until 2020 and about 350 Mt more from 2020 to 2025. These are impressively large figures, in spite of being derived from very conservative assumptions regarding overall world economic development. This is because although the percentage increases are not as high as in previous years, the actual total consumption figures are at unprecedented highs. From 2000 to 2007, output rose by 765 million tonnes, or slightly less than what we are projecting for the period 2011 to 2020. It deserves to be noted, however, that 260 of those 765 million tonnes that were added from 2000 to 2007 came from China. Because of the lack of near surface, high quality deposits near existing steel making or infrastructure it is very unlikely that the Chinese mining industry will be able to put up a similar performance during the next ten years. The additional production per year needed from the world, except China, during the period 2011 to 2020 is about the same as it delivered from 2000 to 2007. During that earlier period, the rate of expansion gave rise to severe bottlenecks in terms of infrastructure investment, equipment deliveries and trained personnel, which illustrates that such a rate of expansion is not something easily accomplished. The additional production needed from 2020 to 2030 is again of a similar order of magnitude, 70 Mt per year, and it is by no means certain that it can be brought on stream easily and without delays.

Figure 13. Actual and Projected World Iron Ore Demand, 2010-2030



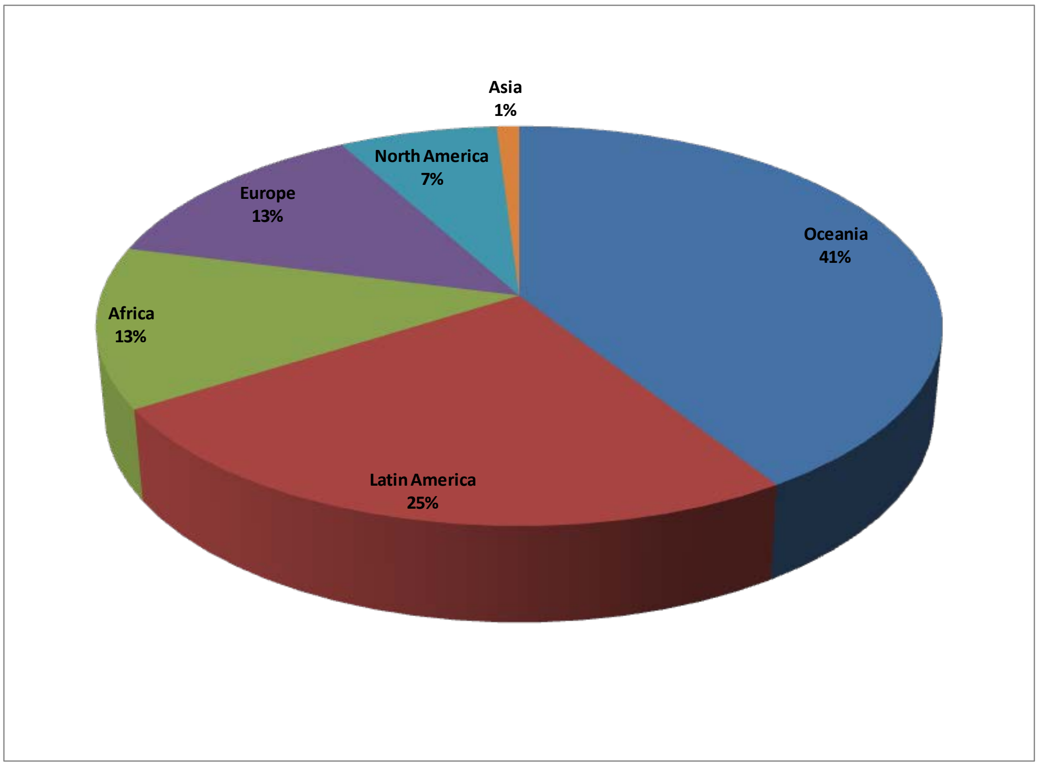
Sources: UNCTAD Iron Ore Trust Fund (data for 2000-2010), Raw Materials Group (forecast).

7.4.3 **Future Iron Ore Projects**

Historically the development of new iron ore projects has been very limited, with the vast majority in the hands of the big 3-5 producers. With profits and demand low there was little incentive to invest. However the arrival of China changed all that and 2000 onwards saw the arrival of some new players in the market place, ie Anglo American, FMG. The iron ore suppliers were all taken by surprise by the rapid and sustained increase in demand for iron ore and as a consequence iron ore prices increased several times to a level where many potential iron ore developments outside of the big miners were made potentially viable. Additional resources from the big producers were rushed into production, but at a price, and, furthermore not only could the mining community not keep pace with demand, but neither could the infrastructure for the transportation of the commodity.

It is of course important to have an idea of where the additional production is going to come from, particularly since the location will affect both direct production costs and transport costs and therefore prices. Presently, the iron ore pipeline of projects in the world is expected to produce more than 814 Mt of new iron ore production capacity to come on stream between 2011 and 2013. Of this total, around 340 Mt falls into the category “certain”, 195 Mt “probable” and 280 Mt “possible” based on the experiences of RMG. Looking at the geographical distribution of the projects, 41% are to be found in Oceania, 25% Latin America, 12% in Africa and 13% Europe, 7% in North America and only 1% in Asia; see Figure 14.

Figure 14. - World iron ore projects by region.



Sources: UNCTAD; RMD Iron Ore, RMG

However, it is also clear that many of the new projects have not been developing as fast as expected and that significant delays have occurred. In general, it can be noted that many of the large projects in West Africa have been delayed because of continued political instability in the region and in many cases the huge infrastructure development costs that are anticipated. Development costs have escalated, especially since the Global Economic crisis and figures released from the big mining conglomerates confirm that even with their self-financing status, in-house project teams and bulk buying capability the development costs are escalating at an alarming rate. The lack of ability to finance and purchase key equipment is pushing back time lines and slowing the general pace of bringing new production on-line. This is all adding to the squeeze on the supply chain and helping maintain the historically high prices for iron ore predicted in the years ahead.

Projects are slow to come out of places like Western Australia, Brazil and India because of planning constrains, environmental concerns, land issues, lack of infrastructure, services and general permitting processes which can take a long time.

Whist there are those analysts that predict there will be a large oversupply if iron ore in the relatively near-term (ie by 2016) if a significant amount of the predicted iron ore developments come on stream. However, the overriding reality of the situation is, that apart from the likes of FMG, much of the new additional capacity is going to find it very difficult to reach the market in the time scale predicted. Add into the equation that the other big three producers, who along with FMG, control around 30% of the world's iron ore production and 70% of the global seaborne trade in iron ore are unlikely to rush any new developments into production if there is any danger of oversupply to any significant extent, leads many to believe that any oversupply at best would be short lived. This is reinforced by the difficulties being faced by the established iron ore supply countries like Brazil and Australia to build the ports and rail infrastructure necessary to bring predicted supply to the market.

7.4.4 Iron Ore Prices – Major Influences

Taking into account the views expressed above regarding iron ore supply and adding in some facts about the "marginal" iron ore producers in China, we can reflect on the likely scenario for the future of iron ore prices. Firstly some observations regarding the Chinese situation.

When spot prices hit 90-100 USD/t in late 2008, half of the Chinese iron ore industry operated at a loss, and was directly or indirectly subsidized. While new additions to capacity have taken place since then, it is worth noting that the domestic price has never fallen below 95 USD/t. Since 2008 mining costs in China have risen steely for a number of reasons outlined below, leading to the fact that large segments of the Chinese iron ore mining capacity currently appears to now be sensitive at much higher levels of prices.
In addition, there are at least four other major factors that have a larger impact on Chinese iron ore miners' costs than on those of their competitors:

- Wage inflation is faster in China than in most other countries.
- The low grade of Chinese ore resources make their costs of exploitation disproportionately sensitive to increases in energy prices.
- The Chinese Yuan is likely to continue its appreciation, while the Australian and Canadian dollars and the Brazilian real have already appreciated dramatically against the US dollar, all of China's costs are Yuan denominated, while those of its competitors contain a significant dollar denominated element, in the form of, for instance, freight rates.
- Finally, freight rates are expected to remain low for several years to come, which means that imported ore is more competitive on the Chinese market.

However, RMG believe, that as capacity is added elsewhere in the world, putting some downward pressure on prices, Chinese production capacity will close, keeping the market in balance. Since the amount of additional capacity needed is in any case very large, it is difficult to foresee that the capacity reduction needed for the market to clear will be larger than the 200 Mt of Chinese capacity that can be estimated to have production costs above 120 USD/dry tonne.

From 2020 to 2030, the need for capacity additions will remain and, given experience of the complications associated with increasing capacity in Australia and Brazil at present, it is possible that these regions will find it difficult to expand production at similar rates. As a result, the 2020s may see the emergence of Africa as a major producing region. Many of the projects now being planned in Africa will not become fully operational until the early 2020s, but they will be followed by others. Accordingly, smaller new entrants to the international industry should be able to fit their extra production into the market without problems, provided, of course, that they can meet quality requirements.

7.4.5 The Market for Pellet Feed and Sinter Feed Producers from Europe

A - The sinter market
Most integrated steel mills (i.e. using ore products to produce steel via a Blast furnace and Basic Oxygen furnace route) can operate on several types of products; installed capacity of sintering plants will guide the outline of demand in different regions. Presently, the world-wide sinter capacity is roughly 700 Mt; however, some existing sintering capacity is permanently off-line or is misplaced geographically (such as most likely in Europe) or is threatened to be shut down for environmental reasons.

We know from industry sources that there is a possibility to mix sinter feed with small amount of finely ground materials such as iron ore concentrate or pellet feed. Although there are some possible grade benefits by using concentrates there are other issues to the operation, which includes losses of dusts, cooling issues (in the case of magnetite rich concentrates) and productivity concerns. Typically in Western style sintering operations there is a limit of around 10-

15% of concentrate/pellet feed material into sintering, but using this figure world-wide it would translate in to market size of 70-105 Mt.

In Europe there is sintering capacity of around 100M tonnes which could provide a reasonable sized market for concentrates of up to 8M tonnes. It is already known that steelmakers in Europe are having to cope with changes (sinter fines are getting lower average particle size and contain more “super” fines) in the physical properties of the existing sinter feeds, especially from Brazil. This is forcing operators to look at ways of using more fines in their sinter feed, whilst maintaining acceptable productivity and product quality.

B - Pelletising and Pellet Feed

As described elsewhere in this report, as the quality of the iron ore declines, pellets will be a major solution to the problems of both the steelmaker and the miner. The main reasons for using pellets have been outlined and as Chinese ore is becoming more and more finely ground it has led to an fierce expansion of pellet production in China, around 20 units in 2001 is now around 120 units. Continued expansion in pelletising is expected. As Chinese mines are being depleted this could well open up for extensive demands for imports of pellet feed into China, thereby consuming the much predicted increase in production of the pellet feed materials. But key is the fact that much of the pellet feeds coming on stream are haematitic, whereas the producers of magnetite concentrates will be a small minority with a product in demand to enhance the quality of the raw materials fed to the pellet plants.

There are plans for around 130Mt/y of new pelletising capacity coming onstream in the next 5 years, however, like mining projects, evidence suggests that the time lines will be extended and it is entirely possible that many of these pelletising operations will also depend on the development time lines of new mining capacity.

However there is one area of pelletising that is likely to increase significantly over the coming years, and that is in the production of high quality DR pellets, which require iron ore feed high in iron and low in gangue minerals, such as silica and alumina. This market in particular benefits from the supply of high quality magnetite to the DR pellet producer.

C - DRI Production and DR Pellets

Direct reduced iron (DRI) is a secondary route to steel making and whilst it consumes a small proportion of iron ore production it does demand a high quality of feed material, providing a potential niche market to smaller iron ore concentrate producers. Most DR is produced using high grade DR pellets which are typically produced in much the same way as the majority of blast furnace pellets. Instead of sending the pellets to a BF, the DRI pellets are fed into a direct reduction furnace or shaft (the Midrex type shaft furnace is presently the most prominent) where the pellets are (chemically) reduced by a reformed natural gas and the whole process takes place in a solid state. The output is a sponge iron pellet which is typically 95-97% Fe content, and are then usually fed to an Electric Arc Furnace (EAF) and similar for conversion to steels. These processes typically take place where there is a ready source of natural gas, typically in places like Venezuela and the Middle East region.

D - Other Markets
There are a number of non-metallurgical applications that could provide a niche market for Nordic Iron Ore, primarily in heavy media and Dense aggregates (for pipe coating). The market for dense media is relatively small at around 250kt/y in the greater European area, while the market for heavy aggregates can be expected to be in excess of 1Mt/y. This market is generally dependent upon pipeline coatings, used primarily for oil and gas pipelines laid in water.

7.5 Shipping product to Market

NIO has a number of options for their port of loading, all of which are connected by Swedish national rail:

- Oxelosund – With around 13.5-14m draft the port is currently capable of taking up to Panamax or small or partially laden Cape. Plans are in place to deepen the harbour to 16m to take larger vessels. Currently used for dry bulk cargo handling. Suitable for transporting to ME/Asia and China (as already takes place from more northerly Finnish Port of Kotka in similar/smaller vessels). Limited investment required
- Gavle/Granudden – has 13m draft port capable of handling vessels to handimax & broad beam vessels. Although this is the nearest port to the mine it does have some ice restrictions for 4 months of the year.
- Lysekil/Brofjorden – Deep water port potential – up to 25m and suitable for large Cape-size vessels to reach the far away markets such as China. Longest distance to port and port would need development (high costs) – however it does offer shortest shipping route to most markets and potential to take elevated tonnage

The key point here is that there are ports already connected by good rail that can export product almost straight away without major investment.

7.6 Major Opportunities for Nordic Iron Ore

7.6.1 Pellet Plant and Sinter Plant

NIO can produce a high grade concentrate which is suitable for use primarily in pellet plants. However, in Europe there is only one pellet plant at the Tata Steel operations in IJmuiden, Holland. Currently Tata steel buy there ore primarily from Brazil (hematite) but also use some magnetite ore from Europe (LKAB and Northern Iron). Additionally Tata have agreed to take 1mt/y concentrate from Northland Resources from 2013. It is estimated that by 2014/15 Tata steel could have around half their pelletising plant requirement supplied as magnetite from Europe. This should still provide an opportunity for NIO to replace Brazilian feed material, up to 1Mt/y.

Further opportunities lie in Europe to supply to the steelmakers sinter plants; though this depends on the physical constraints of individual operators, their current supply and potential (and will) to invest in improved sinter feed preparation. However evidence suggests that several European steel mills are working to improve processes that will lead to an increased use of concentrate in the sinter plants. Realistically it is estimated that this market could amount to >2Mt/y in Western Europe.

Outside of Europe, in the Mediterranean and MENA region there are a number of opportunities at existing sinter plants and planned pelletisers. However political and economic unrest has recently seen many of the planned developments delayed. The opportunities are highlighted in the DRI section below.

Asia and China provide a significant and growing market opportunity to sell high grade concentrates, both to pelletisers and sintering operations. The volumes flowing into the region are huge and the addition of 2-5Mt/y of magnetite concentrate over a 3 year period constitutes a very small percentage of the expected increases in demand to these regions. It has been estimated that the **additional** demand could be as high as 200 Mt over a 3 year period, so such a small quantity would hardly be noticed, but it would be most welcomed by the purchasers, as there are few producers of magnetite concentrates expected in the market place. One of the significant advantages to selling the product in the Chinese/Asian market is that there is a premium being paid for high quality ore. This premium is tracked and published by the likes of Steel Index, and generally varies between 3.5c and 10c/dmtu/Fe unit above 62%Fe. This is explained further in the section below - NIO Pricing.

7.6.2 DR Pellet Market

There is no real opportunity to sell to the DR market in Europe, however the market in the MENA and Turkey regions currently produces close to 20Mt of DRI per year requiring around to 30Mt/y of pellet feed products. Ultimately it is an attractive market due to its strong steel production growth prospects and because of the high degree of self-sufficiency among steel producers who rely on DRI for nearly all metallics requirements as a consequence of the shortages of scrap in the region. Furthermore there are some producers of pellets in the region currently meeting much of the local demand. Current and planned pelletising operations include:

- Currently GIIC/Foulath have over 11 million tonnes of pelletising capacity,
- Planned Foulath capacity is a further 21Mt out of Egypt and Oman
- London Mining is pushing ahead with its 5 Mt project in Saudi Arabia
- Oman, Sohar Industrial Port Company, together with VALE, build two 4.5 Mt/a plants
- Other smaller operations account for further potential of >5Mt/y

7.6.3 NIO Product Pricing

RMG and other specialist commodities analysts all have a view on the forward pricing of the iron ore which is derived from knowledge of the industries and developments, an understanding of global economics and overall general experience of commodities analysis. Many have views that conflict; however, here we have used analyst's views that we believe have the best track records in recent years. RMG has put forward its long term prices cases for standard products, which can then be used to estimate a forward long term price for iron ore products to be used in the economic and financial models.

Although currently there are some differences in the way settlement prices are calculated between Asia and Europe; many believe that these differences in methodology will be trend to the pricing mechanism favored by the larger sellers and buyers, i.e. the methodology as applied to China; whether this is the Australian, Brazilian or, indeed, combined model.

Therefore it has been assumed that in time there will be a global application of the pricing mechanism that prevails in China; consequently using a base case of a long term price for 62%Fe iron ore CFR China and then adjusted for the Fe content using a conservative predicted value for the premium paid (as documented and quoted by Steel Index, Platts and others) for high grade concentrates of $5/t per 1%Fe above the base 58%Fe gives an additional premium of $25/t (ie 5*5), which is an equivalent price of $145/dmt CFR China.

Assuming that NIO has markets in N Europe, Mediterranean & MENA and China/Asia, the respective long term average shipping prices to these regions are estimated to be $4/t, $24/t and $36/t from a Southern Swedish deep-water port. If there is 1/3rd of the product to each market then the average shipping cost is predicted to be $24/t, adjusted to be competitive with Brazilian priced materials to the same markets. On this basis it would give NIO an average net-back calculated FOB price of $121 /dmt for high grade concentrate of 67%Fe.

7.7 Further Work

Firstly NIO need to establish the products that can be made from the resources at Blotberget and Haksberg and secondly establish with the market the suitability of the products and the willingness to purchase.

The market for iron ore can be difficult to define for each individual user, for example all the European blast furnaces will operate with slightly differing blends of iron ores and ferrous burden, often it is not just a case of the most technically suitable ores as much as sentimentality and economics. Hence different end users will buy differing ores for different reasons. Sometimes they may only purchase limited amounts or include a penalty which may devalue the product.

NIO needs to establish what the economic impact the production and sale of these products has on the business and identify where the market is and who the likely buyers are.

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Further, NIO needs to look for Lol´s or forward contractual agreements with buyers to improve credibility within the financial community. Additionally, agreements that can bring long-term markets opportunities and possibly the introduction of financing should be reviewed.

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8. Economical evaluation

The purpose of the economical evaluation is to put the selected production scenario (here named the “Base case”) into economic context and determine at what point the Project will be able to generate sufficient cashflows to warrant developing into a mine.

In order to assess the viability of the selected production scenario a few simple cashflow projections, including a couple of sensitivity analysis, with net present value (NPV) and internal rate of return (IRR) calculations have been made. The cashflow projection shown in Figure 15 below (and in Appendix 13) is based on the “Base case” using the capital cost estimate in section 6.3 (capital costs) and the operating cost estimates in section 6.4. The revenue used in the cashflow is based on the latest market price status and forecasts for a pellet feed concentrate with 67% Fe content, see section 7 (marketing and pricing), is set at 121 USD/t FOB swedish port. Time schedule for mine development and production is based on the estimations in section 4 (mining).

Figure 15 Cashflow over time

Nordic Iron Ore AB
Ludvika Mines
Base case

Håksberg/Blötberget =	2-Shafts
Production lead time =	15 months
Prod. Ramp up to full production =	2 years
Grade Ore (% Fe)	32,8%
ROM (Mt)	5,50
Product mass (Mt	2,18
Mass Recovery to product	39,6%
Capex Contingency	0%
WC as % of revenues	15%
FX (USD/SEK) =	7

Cash cost:	SEK/dmt Concentrate		
Mining	200,0		
ROM transport	9,8	55,2%	
Crushing-Hoisting	16,4	2,7%	
Benificiation	66,9	4,5%	62,5%
Logistics	60,0	18,5%	
Contingency	9,0	16,6%	
Total	362,1	2,5%	
Concentrate (USD/dmt)	51,7		

CASHFLOW ASSUMPTIONS	Date: 2011-10-31	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
Years		-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ore Production, Mton			0,00	0,00	0,00	0,00	2,90	4,2	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	4,4	61,0
Conc. Production Mton			0,00	0,00	0,00	0,00	1,15	1,66	2,18	2,18	2,18	2,18	2,18	2,18	2,18	2,18	2,18	1,74	22,4
Revenue, USDm/year	*Intäkt per år*		0,0	0,0	0,0	0,0	139,1	201,4	263,8	263,8	263,8	263,8	263,8	263,8	263,8	263,8	263,8	211,0	2 714,5
Cash costs, USDm/year			0,0	0,0	0,0	0,0	-59,5	-86,1	-112,8	-112,8	-112,8	-112,8	-112,8	-112,8	-112,8	-112,8	-112,8	-90,2	-1 160,5
Royalties 2‰			0,0	0,0	0,0	0,0	-0,4	-0,5	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,7	-0,6	
Overhead, USDm/year			-0,3	-1,3	-1,6	-3,0	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-3,6	-45,5
Operating profit, USDm/year	Rörelseresultat		-0,3	-1,3	-1,6	-3,0	75,7	111,2	146,7	146,7	146,7	146,7	146,7	146,7	146,7	146,7	146,7	116,7	1 501,4
Opex USD/t	Kostnad per ton						55,2	54,2	53,7	53,7	53,7	53,7	53,7	53,7	53,7	53,7	53,7	54,1	
Changes in Working Capital			0,0	0,0	0,0	0,0	-20,9	-9,4	-9,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,9	
Capital expenditures																			
[DFS incl. trial production]				10,7															10,7
Pre-production cost (MUSD)					100,0	202,1													302,1
Additional costs (MUSD)							68,0	15,6		16,6		16,6		16,6		16,6			150,1
Project costs 12%,(MUSD)					12,0	24,2	8,2	1,9	0,0	2,0	0,0	2,0	0,0	2,0	0,0	2,0	0,0	0,0	54,3
Contingency (MUSD)					0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Total capital expenditures		0,0	0,0	10,7	112,0	226,3	76,2	17,5	0,0	18,6	0,0	18,6	0,0	18,6	0,0	18,6	0,0	0,0	517,1
Cash flow (pre-financing and pre-tax)		0,0	0,0	-12,0	-113,6	-229,3	-21,4	84,4	137,4	128,2	146,7	128,2	146,7	128,2	146,7	128,2	146,7	124,6	1 069,6
Discounted cash flows			0,0	-11,1	-97,4	-182,0	-15,7	57,4	86,6	74,8	79,3	64,1	68,0	55,0	58,3	47,1	50,0	39,3	373,5

WACC	8%
As from investment decision (after DFS)	
Payback time (yrs)	6,0
IRR	24%
NPV	415,3

No allowance for an operating cost escalation (inflation-factor) has been made.

At this stage of the project it is considered sufficient to analyse the viability of the project on a pre-financing and pre-tax basis.

The base case projection shows: The selected production scenario has a good profitability, 24% IRR, SEK 2,91 Mrd NPV, 6,0 years payback time, at a long term FOB-price per ton concentrate of 121 USD or 847 SEK.

The sensitivity analysis show:

- On capex +20% will reduce IRR to 19%; -20% increases IRR to 30%
- Based on opex +20% will reduce IRR to 19%; -20% increases IRR to 28%
- Based on price +20% will increase IRR to 33%; -20% reduces IRR to 13%