

Väsman project Conceptual study results

Presenter: SRK UK – 12 November 2019

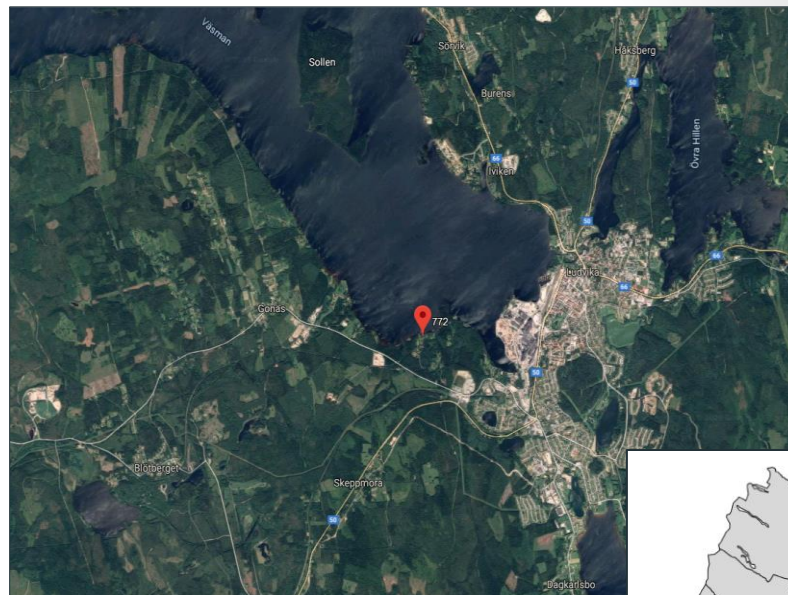
Location: Virtual



- The Väsman project is located 220 km west-northwest of Stockholm, close to the town of Ludvika.
- The project is part of the Ludvika Iron Ore Project, which also comprises the historic iron mines and deposits of Blötberget (situated approximately 3km south – west from Väsman South) and Håksberg (situated approximately 2km north east from Väsman South)
- The Väsman project encompasses the Finnäset, Lyviksberget and Väsman South orebodies, located on the south-western shore as well as beneath Lake Väsman

SRK has undertaken a conceptual study with the following main features:

- Access to Väsman is planned from the future decline leading to the Blötberget deposit for which a Feasibility Study is being undertaken
- Material from Väsman is to be transported via underground conveyors to the Blötberget portal
- The existing shaft next to the Lyviksberget deposit is to be dewatered and to be used as an exhaust air shaft
- The proposed mining method is Sub Level Open Stopping (SLOS), transverse and longitudinal without backfill
- Stope dimensions vary pending the depth and thickness of the orebody
- To reduce the risk of water inflow, a crown pillar of at least 60m is proposed below lake Väsman



Sweden

Geotechnical evaluation - Level Spacing

- Pillar requirements are for stability in top-down Long Hole Open stoping which is the proposed method of extraction below the Väsman Lake.
- Transverse stoping is proposed for wider stopes (>15m) at Väsman South
- Longitudinal stoping is proposed for narrow stopes (3m to 15m) at Lyviksberget and Finnaset
- For the Väsman area, a checker board stope pattern method has been applied for stability, as no backfill is used.
- The level spacing and thus the stope height decrease with depth. The transverse stoping width stays constant at 28m.
- A constant sill pillar high of 7.5m has been used at Lyviksberget and Finnaset areas, apart from a single existing development area at Lyviksberget, where a sill pillar of 15m has been used.

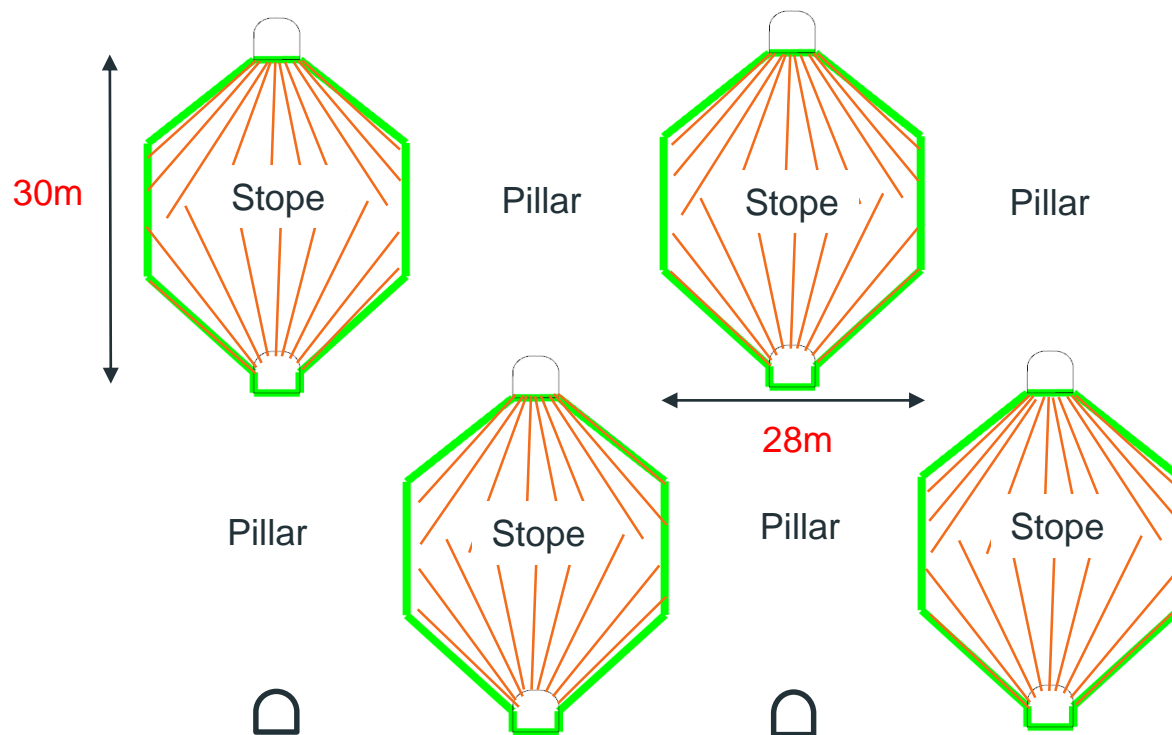
Väsman South		
From	To	Level spacing
mRL		m
-150	-180	30
-180	-210	30
-210	-240	30
-240	-270	30
-270	-300	30
-300	-330	30
-330	-360	30
-360	-385	25
-385	-410	25
-410	-435	25
-435	-460	25
-460	-485	25
-485	-510	25
-510	-530	20
-530	-550	20
-550	-570	20
-570	-590	20
-590	-610	20
-610	-630	20
-630	-650	20

Lyviksberget			
From	To	Level spacing	Comments
mRL		m	
-410.0	372.5	37.5	7.5m sill pillar
-372.5	-327.5	45.0	15m sill pillar
-327.5	-290.0	37.5	7.5m sill pillar
-290.0	-260.0	30.0	

Finnaset			
From	To	Level spacing	Comments
mRL	mRL	mRL	
-295.0	-257.5	37.5	7.5m sill pillar
-257.5	-220.0	37.5	7.5m sill pillar
-220.0	-182.5	37.5	7.5m sill pillar
-182.5	-152.5	30.0	

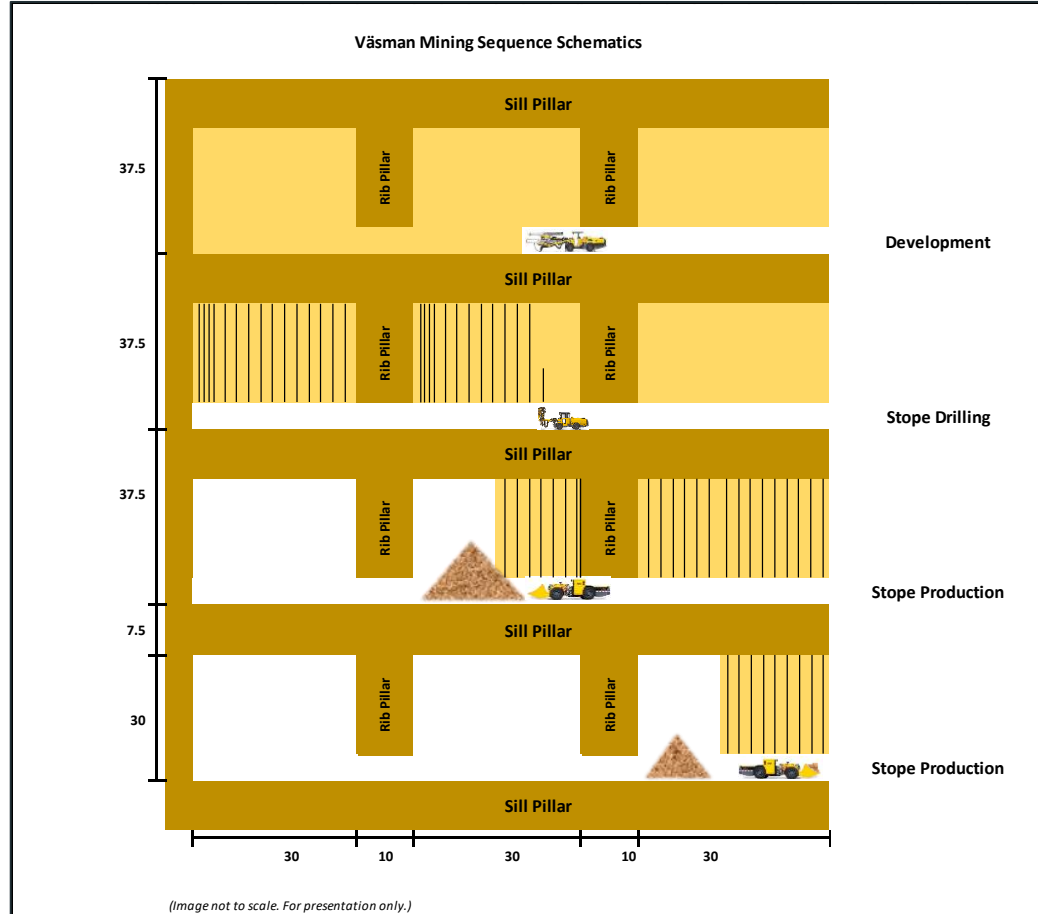
Transverse Stopes and Mining Method Assumptions

- The proposed mining method is Sub Level Open Stopping (SLOS) without backfill.
- Transverse stopes dimensions are: 20/25/30m high by 28m wide and between 15m to 60m long (Hanging wall to Footwall)
- The pillars for the Väsman zone are the same dimensions as the stopes as no backfill is used



Longitudinal Stope and Pillar Design (Lyviksberget and Finnaset)

- Longitudinal stopes are 30m high x 30m long and between 3 and 15m wide
- Rib pillars are 10m wide
- Sill pillars are 7.5m high

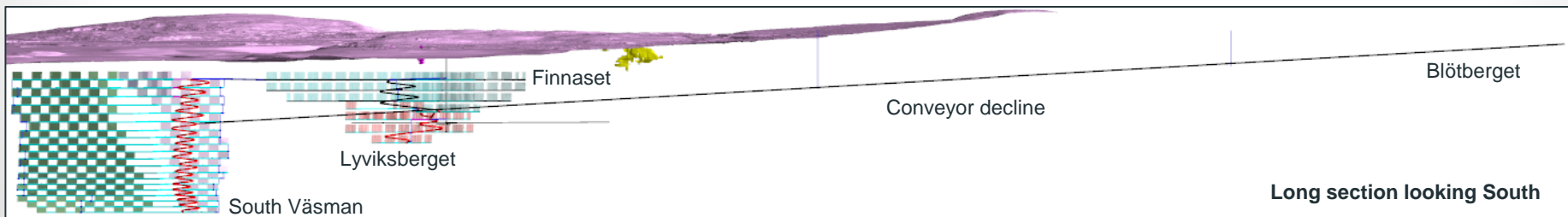
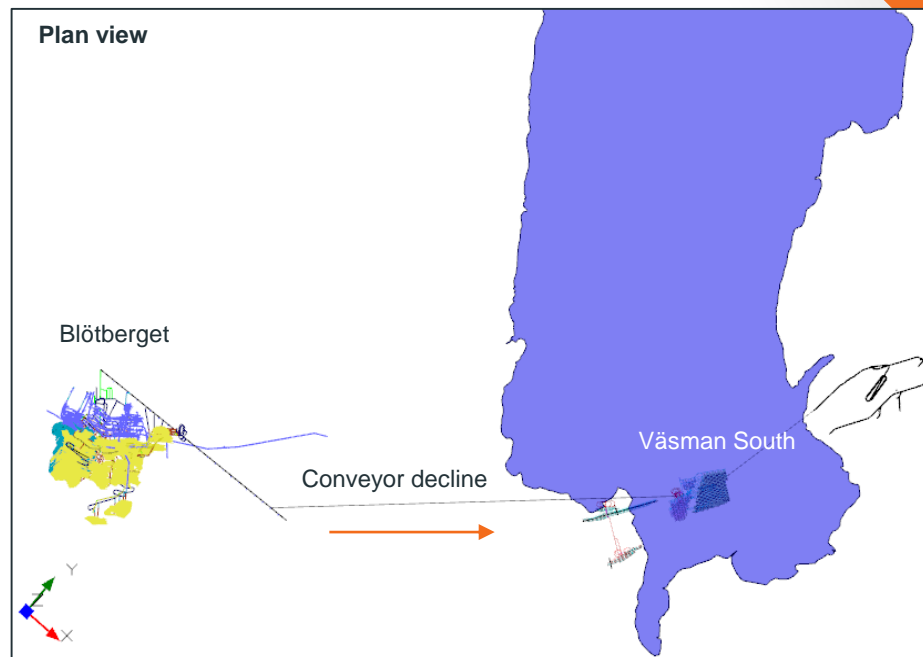


Base case – Single conveyor decline access from Blötberget to Väsman

- Vent raises every 1,100 m at the conveyor decline
- Early production (year 2 – 0.6Mt)
- Higher truck haulage distance from the bottom of Väsman to crusher station compared with Option 2
- 60 m Crown pillar below lake
- Life of Mine 8 years
- Slow ramp up due to limited working faces and ventilation development

Mining sequence

- Year 1 - Conveyor decline (240m a month) from Blötberget to Finnaset with vent raises every 1,100m
- Year 2 – Conveyor continues to Väsman with parallel ventilation drive from Finnaset to the existing shaft at Lyviksberget, production begin August
- Year 3 – Decline to the top area of Väsman, additional ventilation infrastructure and production rate of 2.0 Mt
- Year 4 full production rate of 3.4 Mt



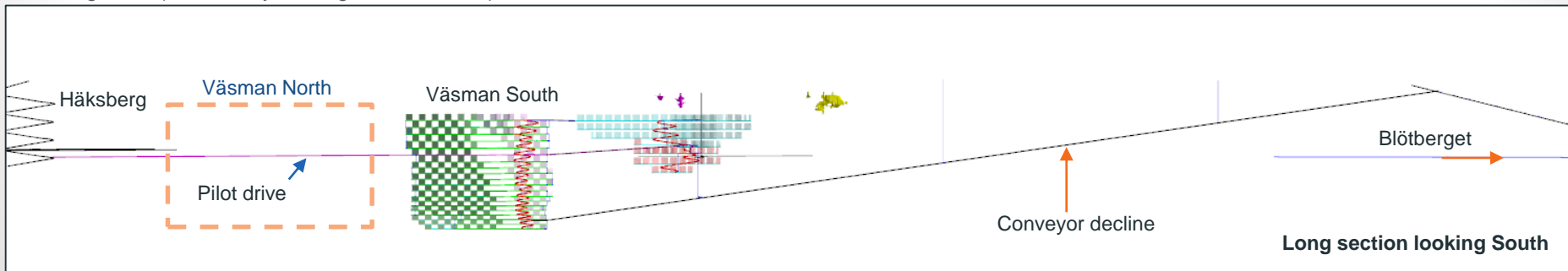
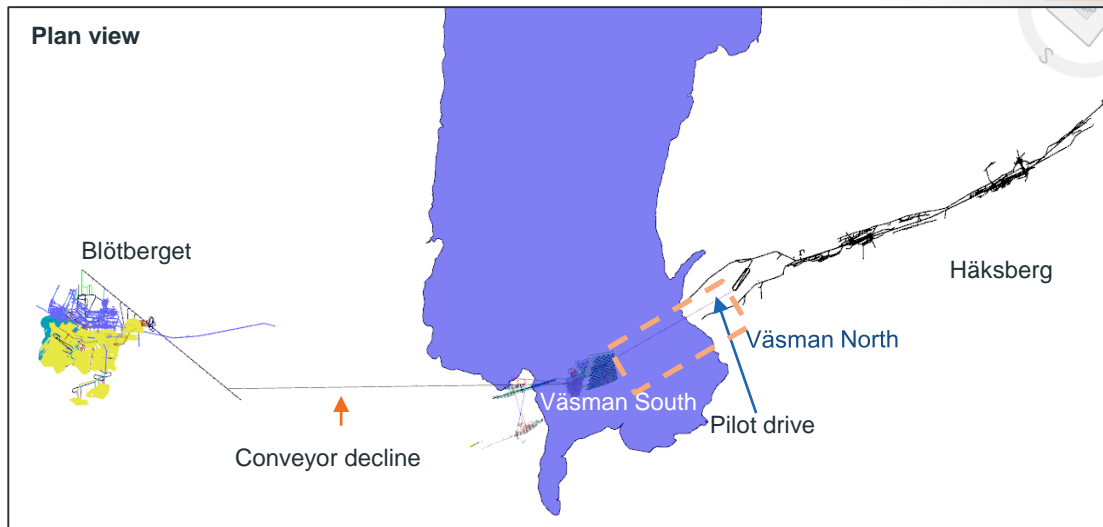
Access Option – Option 2

Option 2 – Single conveyor decline access from Blötberget to Väsman and second parallel access (pilot drive) from Häksberg

- Pilot drive to be used as exploration development for Väsman North
- Additional ventilation and secondary egress which allows location of the crusher at the bottom of Väsman South
- Downwards haulage only (truck/ore passes)
- LoM 8 years
- More development meters but lower transport costs than the Base Case

Mining sequence

- Year 1 - Conveyor decline (240m a month) from Blötberget to the bottom of Väsman with vent raises every 1,100m and parallel pilot drive from Häksberg (240m a Month)
- Year 2 – Conveyor continues to the bottom of Väsman, the pilot drive reaches existing ventilation shaft at Lyviksberget and the Väsman Decline is developed from both ends
- Year 3 – Full production rate of 3.4 Mt achieved from all three mining areas (Väsman, Lyviksberget and Finnaset)



Based on a production rate assessment the Väsman production rate is around 3.4 Mt per year:

- Longitudinal stoping - Normally up to 1.0 Mtpa from (peaking at 1.8 Mtpa at the beginning when no transverse stoping is taking place)
- Transverse stoping - Up to 2.4 Mtpa

Applied assumptions:

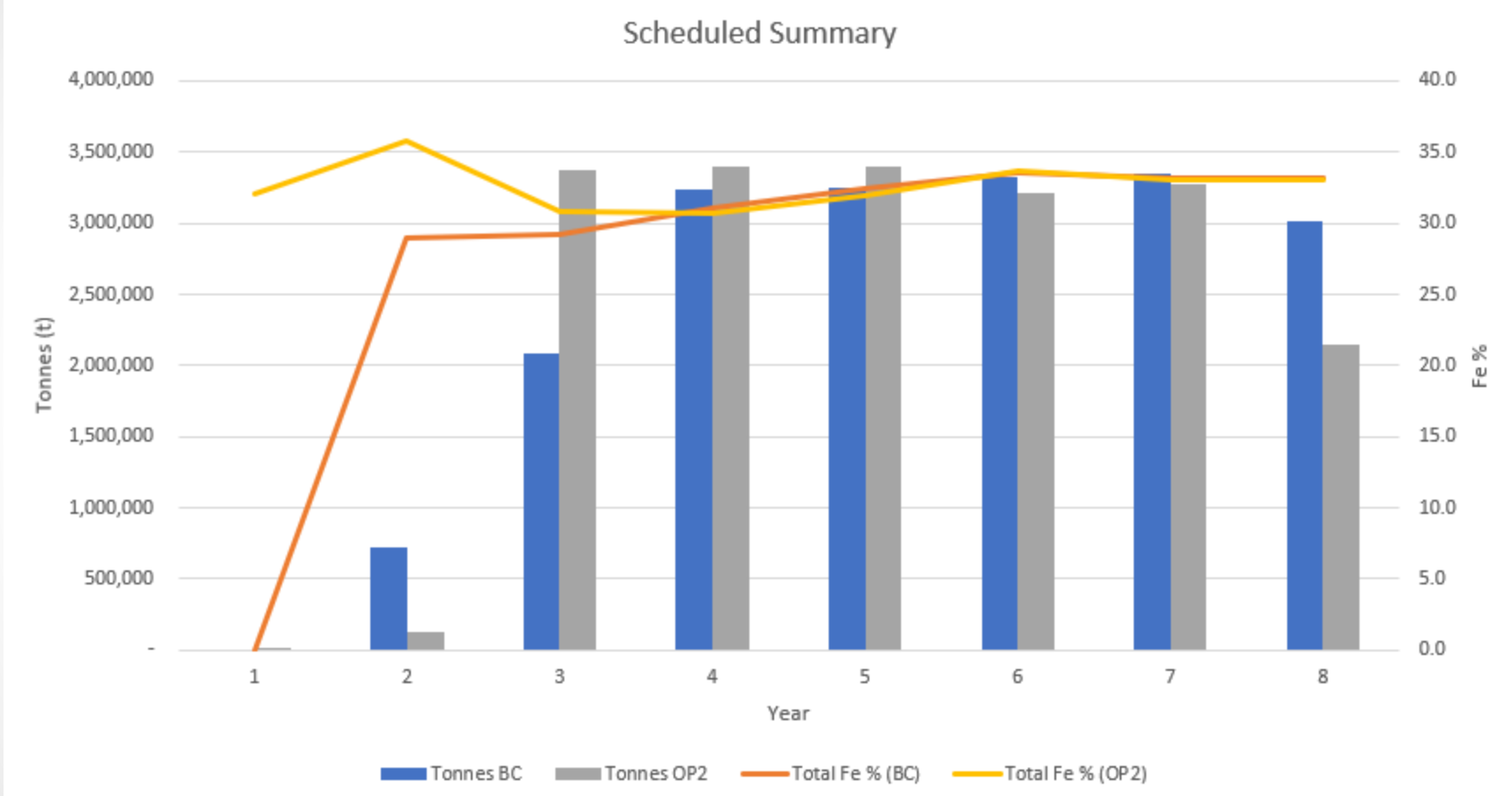
- Blasting 2 rings (2.2m each) every other day
- 2 production stopes per level
- 2 production zones (1 longitudinal and 1 transverse)

Modifying factors and schedules summary

- A 0.5m dilution skin was applied on the HW and FW sides
- Development assumes 0% dilution/losses
- Additional 20% losses applied on the transverse stope and 5% on longitudinal stope design as currently SO does not take under consideration stope shoulders and bottom trough
- Mining losses applied 3%
- Developments with Fe < 10% are reported as a waste
- Production ramp up base case
 - Year 1 – conveyor decline (240m per month)
 - Year 2 – 0.6 Mt
 - Year 3 – 2.4 Mt
 - Year 4 – 3.4 Mt
- Production ramp up Option 2
 - Year 1 – Conveyor decline and pilot drive (parallel 240m per month each)
 - Year 2 – 0.1 Mt
 - Year 3 – 3.4 Mt

- Iron ore price – 104.05 USD/t product – Magnetite (Blötberget (BB) report)
- Mining cost – 12.00 USD/t RoM (BB report reference without backfill)
- Beneficiation Plant + Tailings – 4.81 USD/t RoM (from BB report plus additional 30%)
- G&A – 4.67 USD/t RoM (from BB report)
- Concentrate transport – 6.23 (USD/t product from BB report)
- Break even Cut-off grade 21.8% Fe

Inputs	Value	Unit
Development		
Ore drives/ vent drives	1,913	USD/t RoM
Decline / ramp access / access drive	2,125	USD/t RoM
Conveyor drive	2,975	USD/t RoM
Ventraise / escape way	1,500	USD/t RoM
Mining costs		
Longitudinal SLOS	18.0	USD/t RoM
Transverse SLOS	12.0	USD/t RoM
Processing parameters		
Transport to plant	1.6	USD/t RoM
Processing to concentrate	11.3	USD/tconc
Recovery	90%	%
Concentrate grade	68%	Fe%
Royalty	0.2%	% revenue
G&A	4.67	USD/t RoM
Revenue		
Concentrate 68%	104	USD/tconc
Shipping cost	13.3	USD/tconc



Financial results – Operational and Capital Costs

Capital Expenditure			RoM		Concentrate	
	Base case (USDm)	Option 2 (USDm)	Base case (USD/t RoM)	Option 2 (USD/t RoM)	Base case (USD/t Conc)	Option 2 (USD/t Conc)
Capital Development	58	66	3.1	3.5	7.2	8.2
Underground infrastructure	28	28	1.5	1.5	3.4	3.4
Processing plant	24	24	1.3	1.3	3.0	3.0
Mob/demob contractor	1	1	0.1	0.1	0.1	0.1
Closure cost	5	5	0.3	0.3	0.6	0.6
Total Capital Expenditure	116	124	6.1	6.5	14.4	15.3

Operating Costs			RoM		Concentrate	
	Base case (USDm)	Option 2 (USDm)	Base case (USD/t RoM)	Option 2 (USD/t RoM)	Base case (USD/t Conc)	Option 2 (USD/t Conc)
Mining	298	298	15.7	15.7	36.9	36.9
Production	247	247	14.0	14.0	30.6	30.6
Longitudinal	107	107	18.0	18.0	13.2	13.2
Transverse	140	140	12.0	12.0	17.3	17.3
Lateral Development - Ore drives	51	51	37.7	37.7	6.4	6.3
Processing to concentrate	91	91	4.8	4.8	11.3	11.3
Shipping costs	107	107	5.7	5.7	13.3	13.3
G&A	89	89	4.7	4.7	11.0	11.0
Royalty	2	2	0.1	0.1	0.2	0.2
Total Operating Costs	587	587	31.0	31.0	72.7	72.7

NPV	Base case	Option 2
Discount	(USDm)	(USDm)
0%	136.8	129.4
4%	99.0	91.8
8%	70.9	63.7
10%	59.6	52.4
12%	49.7	42.6
14%	41.2	34.1

Capital Expenditure – First 2 years	Base case	Option 2
	(USDm)	(USDm)
Capital Development	16.2	31.2
Capital Lateral Development	15.0	29.0
Capital Vertical Development	1.2	2.3
Underground infrastructure	26.7	26.7
Processing plant	24.0	24.0
Mob/demob contractor	0.5	0.5
Closure cost	0.0	0.0
Total Capital Expenditure	67.3	82.4

SRK has undertaken a conceptual study on the Väsman project with the following main outcomes:

- Two options have been evaluated:
 - Base case – Single access from the Blötberget decline
 - Option 2 – As per Base Case and additional access via pilot drive from Håksberg to allow underground drilling of the Väsman North deposit
- Main features of both options:
 - Access to these orebodies is planned from the future decline leading to the Blötberget deposit for which a Feasibility Study is being undertaken
 - The proposed mining method is Sub Level Open Stopping (SLOS), transverse and longitudinal without backfill
 - Material from the mine is to be transported via underground conveyors to the Blötberget portal
 - The existing shaft next to the Lyviksberget deposit is to be dewatered and to be used as an exhaust air shaft
- Conclusions:
 - Based on the current model and cost input parameters, which are mainly based on the Blötberget Feasibility study, further work is recommended on determining the technical and economical viability of the Väsman project in more detail.

SRK would like to make the following recommendations:

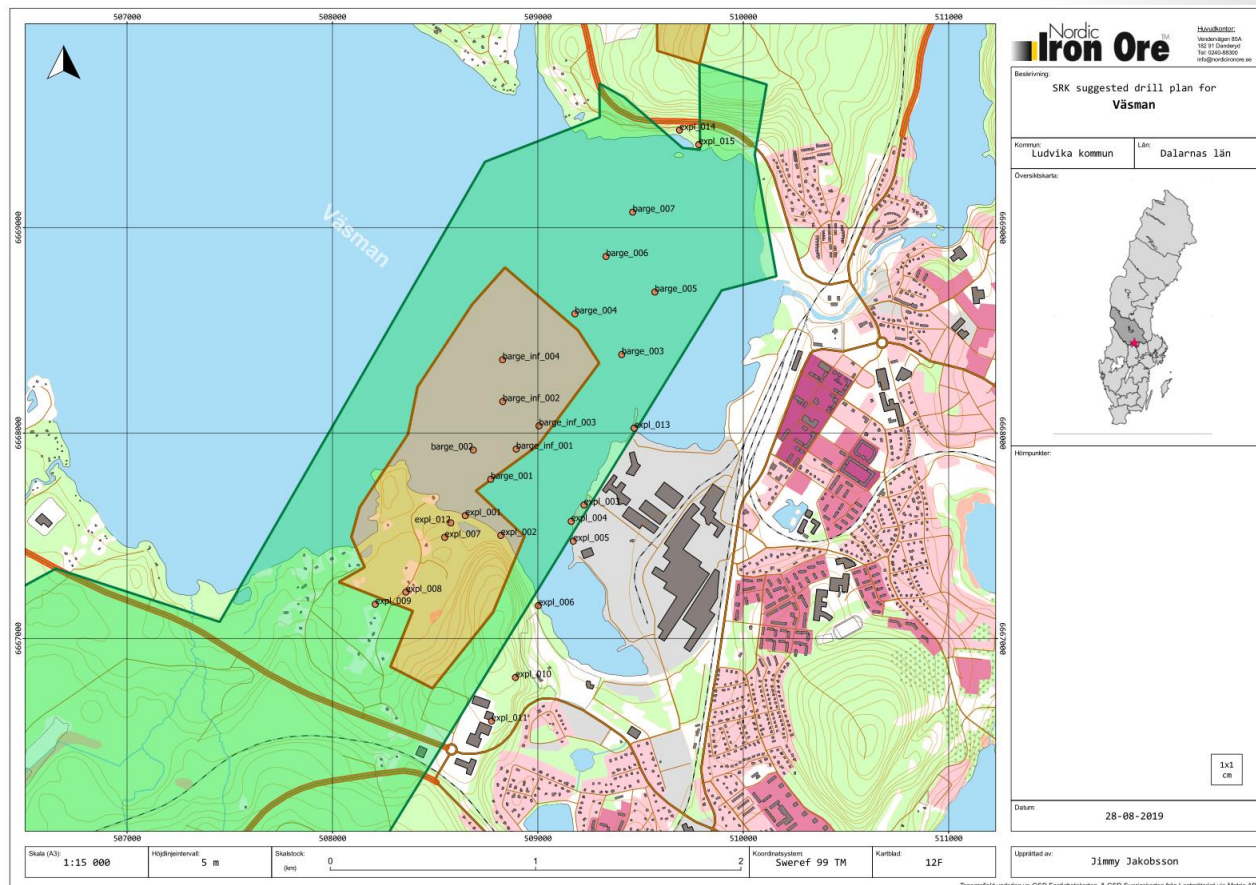
- Further delineation of the resources by additional drilling (see next slide)
- Further analysis of the advantages of the additional access from Håksberg, and confirmation of development costs
- Technical study on North Väsman (limited data)
- Technical study on Håksberg (historic mining)

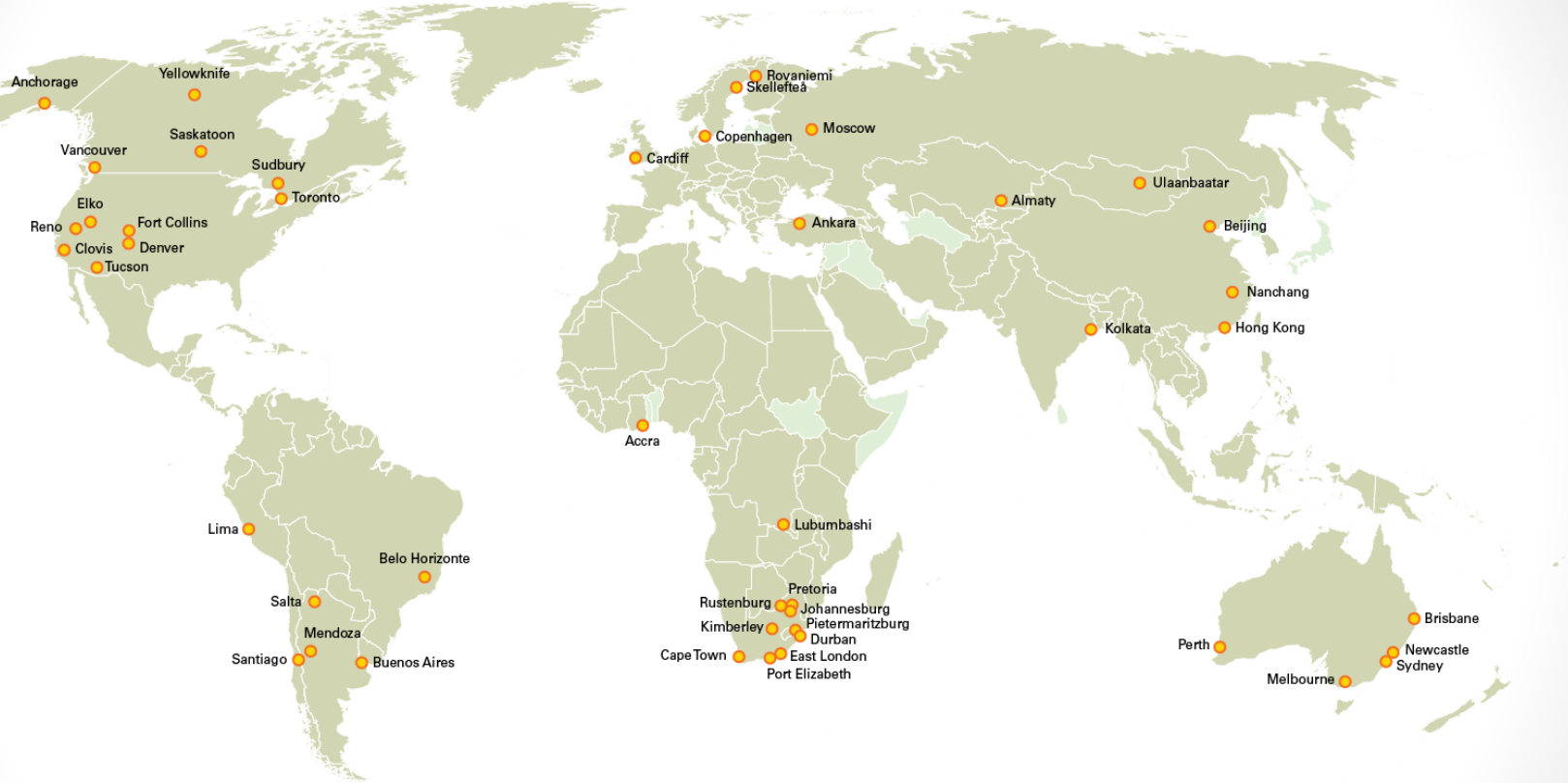
Recommendations - Drilling

The following drilling metres have been proposed:

Land	8,975 m
Barge	4,375 m
Total	13,350 m

The holes are to be properly surveyed and cemented to reduce the risk of water inflow into any future underground workings.





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