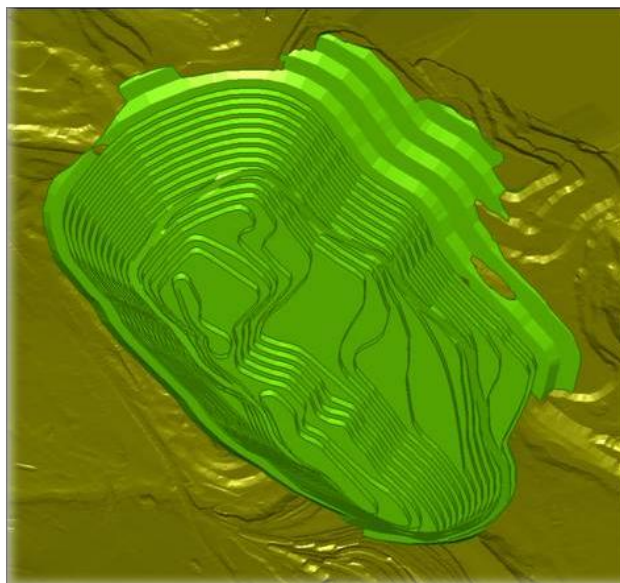




TECHNICAL REPORT
PRELIMINARY ECONOMIC ASSESSMENT REPORT
of the
SHYMANIVSKE IRON ORE DEPOSIT
for
Black Iron Inc.



NI 43-101 Technical Report

December 14, 2011

PREPARED BY:

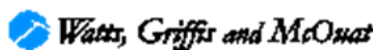
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Black Iron Inc.

NI 43-101 Technical Report – PEA of the Shymanivske Iron Ore Project



DATE AND SIGNATURE PAGE

This report is effective as of the 14th day of December 2011.

A handwritten signature in blue ink that reads 'A. Allaire'.

Andre Allaire
Eng, M.Eng., Ph.D.Eng., BBA Inc.

December 14th, 2011
Date

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M.Sc., P. Geo, Watts, Griffis and McQuat Limited

December 14th, 2011
Date

CERTIFICATE OF QUALIFICATION

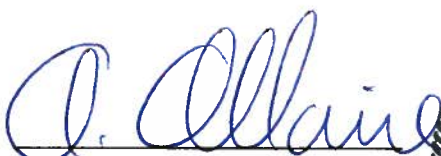
I, André Allaire, Eng., do hereby certify that :

1. I am currently employed as Manager – Mining and Metallurgy and partner in the consulting firm:
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630, boul. René-Lévesque Ouest, Suite 2500
Montréal, Québec
Canada H3B1S6
2. I graduated from McGill University of Montréal with a B. Eng. in Metallurgy in 1982, a M. Eng. in 1986 And a Ph.D. in 1991.
3. I am in good standing as a member of the Order of Engineers of Québec (#38480) and a member of the Canadian Institute of Mining Metallurgy and Petroleum.
4. I have practiced my profession continuously since my graduation.
5. I have read the definition of “qualified person” set out in the National Instrument 43-101 (“NI 43-101”) and certify that as a result of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101.
6. I am responsible for or was involved in the preparation of this Technical Report titled *Preliminary Economic Assessment Report of the Shymanivske Iron Ore Deposit for Black Iron Inc.* based on my knowledge on iron ore process design. I am aware of the metallurgical testworks performed on ores collected from Shymanivske property. I have reviewed all sections of the technical report. I visited the project site in May 2011.
7. As of the date of this certificate I am not aware of any changes in fact or circumstances with respect to the subject matter of this report which materially affects the content of the report or the conclusion reached.
8. I am independent of the issuer applying all of the tests in Section 1.5 of National Instrument 43-101.
9. I have read national Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.
10. I consent to the filing of the Technical Report with any stock exchange or any regulatory authority and any publication by them, including electronic publication

in the public company files on their websites accessible by the public, of the Technical Report.

11. A copy of the *Preliminary Economic Assessment Report of the Shymanivske Iron Ore Deposit for Black Iron Inc.* is submitted as a computer readable file. The requirement of electronic filing necessitates submitting the report as an unlocked, editable file. I accept no responsibility for any changes made to the computer file after it leaves my control.
12. As of the effective date of the technical report, to the best of my knowledge, information and belief, the technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Prepared in Montreal, Québec, December 14, 2011



Signed
André Allaire, Eng.



CERTIFICATE OF QUALIFIED PERSON

I, Hugues de Corta, Geo., do hereby certify that:

1. I reside at 601 ch Baie Dorée, Val d'Or, Québec, J9P 7B3.
2. I am currently an independent consultant.
3. This certificate accompanies the report titled "Preliminary Economic Assessment Report of the Shymanivske Iron Ore Deposit " dated December 14th, 2011.
4. I graduated from the Université de Quebec à Montréal with a B. Sc. in Earth sciences in 1984, and M. Sc. in Quaternary geology in 1988.
5. I am in good standing as a member of the Ordre des Géologues du Québec (OGQ) # 257.
6. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.
7. I have personally visited the property on July 06 and July 07 of 2010.
8. I am responsible for the coordination, consolidation and review of sections: 5, 6, 7, 8, 9, 10, 11 and 14.
9. I am an independent issuer as described in Section 1.5 of NI 43-101. I have not had any prior involvement with the Shymanivske property.
10. I have worked as a geologist for a total of 25 years since my graduation from university, as an exploration geologist and project manager for various major and junior companies and as a consultant.
11. I have read National Instrument 43-101, Form 43-101 F1 and the Technical Report as been prepared in compliance with this Instrument.
12. As of the effective date of this Technical Report, to the best of my knowledge, information and belief, the Technical Report and parts that I am responsible for, contains all scientific and technical information that is required to be disclosed to make the report not misleading.

Prepared in Val d'Or, Québec, December 14th, 2011



Signed

Hugues de Corta, P. Geo.

CERTIFICATE OF QUALIFIED PERSON

I, Richard W. Risto, do hereby certify that:

1. I reside at 22 Northridge Ave, Toronto, Ontario, Canada, M4J 4P2.
2. I am a Senior Associate Geologist with Watts, Griffis and McOuat Limited, a firm of consulting engineers and geologists, which has been authorized to practice professional engineering by Professional Engineers Ontario since 1969, and professional geoscience by the Association of Professional Geoscientists of Ontario.
3. This certificate accompanies the report titled "Preliminary Economic Assessment Report of the Shymanivske Iron Ore Deposit" dated December 14th, 2011.
4. I am a graduate from: the Brock University, St. Catharines, Ontario with an Honours B.Sc. Degree in Geology (1977); Queens University, Kingston, Ontario with a M.Sc. Degree in Mineral Exploration (1983), and I have practiced my profession for over 30 years.
5. I am a Professional Geologist licensed by the Association of Professional Geoscientists of Ontario (Membership Number 276), Member of the Association of Applied Geochemists, and Member of the Prospectors and Developers Association of Canada.
6. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.
7. I have personally visited the property on three occasions. My first Site Visit was completed April 11 to April 18; Site Visit 2, from May 22 to May 29, and Site Visit 3, from June 27 to July 3, 2011.
8. I am responsible for the coordination, consolidation and review of Section 12.
9. I am an independent issuer as described in Section 1.5 of NI 43-101. My prior involvement with the Shymanivske property includes participation in the planning process for the program and providing consulting throughout the program.
10. My relevant experience includes 30 years of field exploration and project evaluation for both previous and base metal projects including a number of iron deposits both in Canada and internationally.
11. I have read National Instrument 43-101, Form 43-101 F1 and the Technical Report as been prepared in compliance with this Instrument.
12. As of the effective date of this Technical Report, to the best of my knowledge, information and belief, the Technical Report and parts that I am responsible for, contains all scientific and technical information that is required to be disclosed to make the report not misleading.

Prepared in Toronto, Ontario, December 14th, 2011

Signed

Richard W. Risto.





TABLE OF CONTENTS

LIST OF ABBREVIATIONS	XIV
UNITS OF MEASURE	XVII
1. SUMMARY	1-1
1.1 Introduction	1-1
1.2 Geology and Mineralization	1-2
1.3 Exploration and Drilling	1-2
1.4 Data Verification	1-3
1.5 Mineral Processing and Metallurgical Testwork	1-3
1.6 Mineral Resource Estimates	1-4
1.7 Mining Methods	1-4
1.8 Recovery Methods and Processing Plant Design	1-6
1.9 Project Infrastructure	1-7
1.10 Market Studies and Contracts	1-8
1.11 Environment	1-8
1.12 Capital Costs	1-9
1.13 Operating Costs	1-10
1.14 Economic Analysis	1-11
1.15 Project Schedule	1-16
1.16 Conclusions and Recommendations	1-16
1.16.1 Mineral Resources and Drilling	1-16
1.16.2 Data Verification	1-17
1.16.3 Mineral Processing and Metallurgical Testwork	1-17
1.16.4 Project Infrastructure	1-18
1.16.5 Environmental Studies	1-18
1.16.6 Main Conclusion	1-19
2. INTRODUCTION	2-1
2.1 Scope of Study	2-1
2.2 Sources of Information	2-1
2.3 Terms of Reference	2-3
2.4 Site Visit	2-3



3.	RELIANCE ON OTHER EXPERTS.....	3-1
4.	PROPERTY DESCRIPTION AND LOCATION.....	4-1
4.1	Property Location.....	4-1
4.2	Property Description and Ownership.....	4-2
4.3	Property Agreements.....	4-4
4.4	Permitting.....	4-4
5.	ACCESSIBILITY, CLIMATE, LOCATE RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY	5-1
5.1	Access	5-1
5.2	Climate.....	5-2
5.3	Local Resources and Infrastructure.....	5-2
5.4	Physiography	5-2
6.	HISTORY.....	6-1
6.1	Shymanivske Deposit History	6-1
6.2	History of Estimates.....	6-3
6.3	1989 Mineral Estimates	6-4
6.4	2005 Estimate.....	6-11
6.4.1	Documents Related to Prospecting Works and Creation/Structure of the Database	6-12
6.4.2	Database and the Technique for its Creation	6-13
6.4.3	File Assay	6-13
6.4.4	Structure of the File Assay.....	6-14
6.4.5	Data Volume in File Assay and their Characteristics	6-14
6.4.6	File Litho	6-15
6.5	2010 Estimate.....	6-16
7.	GEOLOGICAL SETTING AND MINERALIZATION	7-1
7.1	Regional Geology	7-1
7.2	Local Geology.....	7-4
7.3	Property Geology.....	7-5
7.4	Lithology and Mineralization	7-7
7.5	Structural Geology	7-9
8.	DEPOSIT TYPES	8-1
9.	EXPLORATION.....	9-1



10. DRILLING.....	10-1
10.1 General.....	10-1
10.1.1 Deviation Tests	10-1
10.1.2 Drillholes Collar Surveying.....	10-2
10.1.3 Geotechnical Data on Drilling	10-3
10.2 Historic Drilling.....	10-4
10.3 Black Iron Twin Drilling Program (2011)	10-8
11. SAMPLE PREPARATION, ANALYSES AND SECURITY	11-1
11.1 Bulk Sample Preparation (Historical).....	11-4
11.2 Assaying	11-4
12. DATA VERIFICATION	12-1
12.1 Review of the Twin Drillhole Program and QA/QC Results	12-1
12.2 Comments and Conclusions	12-7
13. MINERAL PROCESSING AND METALLURGICAL TESTING	13-1
13.1 Historical Testwork	13-1
13.2 PEA Study Metallurgical Testwork.....	13-3
13.2.1 Sample Selection and Preparation	13-4
13.2.2 Head Assays.....	13-4
13.2.3 Mineralogical Analyses	13-5
13.2.4 Shaking Table and Davis Tube Test Results – Mekhanobrchermet.....	13-9
13.2.4.1 Shaking Table.....	13-9
13.2.4.2 Davis Tube Test.....	13-11
13.2.4.3 Shaking Table and DT versus DT Alone	13-13
13.2.4.4 Laboratory LIMS Cobbing Tests	13-14
13.2.5 Ore Grindability	13-15
13.2.6 Process Flowsheet Development	13-17
13.2.7 Proposed Flowsheet	13-18
13.2.8 Recommended Testwork for Feasibility Study	13-19
14. MINERAL RESOURCE ESTIMATES	14-1
14.1 Disclosure	14-1
14.2 Database	14-3
14.3 Parameters for Solid Construction and Topographic Surfaces.....	14-4



14.4	Block Model	14-7
14.5	Population Statistics	14-8
14.6	Compositing.....	14-10
14.7	Density Assignment	14-10
14.8	Search Ellipses	14-10
14.9	Grade Interpolation	14-12
14.10	Mineral Resource Classification	14-13
14.11	Mineral Resource Reporting	14-15
14.12	Sensitivity Analysis	14-15
14.12	Interpretation and Conclusions	14-16
15.	MINERAL RESERVE ESTIMATES.....	15-1
16.	MINING METHODS.....	16-1
16.1	Resource Block Model.....	16-1
16.1.1	Model Coordinate System	16-2
16.1.2	Model Densities	16-3
16.2	Pit Optimization.....	16-3
16.2.1	Pit Optimization Parameters	16-4
16.2.2	Cut-Off Grade Calculation	16-5
16.2.3	Pit Optimization Results.....	16-5
16.3	Engineered Pit Design	16-7
16.3.1	Pit Slope Design Criteria.....	16-7
16.3.2	Engineered Pit Design Results	16-9
16.4	In-Pit Resource Estimate	16-14
16.5	Development of the Mine Plan and Mining Operations	16-15
16.5.1	Waste and Overburden Dumps	16-17
16.5.2	Mine Operations and Mining Equipment Requirements and Selection	16-18
16.6	Drilling and Blasting	16-22
16.7	Fuel and Electricity	16-24
16.8	Manpower Requirements.....	16-24
17.	RECOVERY METHODS.....	17-1
17.1	Process Design Basis.....	17-1
17.2	Process Flowsheet and Mass and Water Balance	17-3



17.3	General Process Description and Plant Design.....	17-8
17.4	Ore Crushing, Conveying and Storage.....	17-9
17.5	Grinding and Screening.....	17-10
17.5.1	Primary Grinding Mill Sizing.....	17-10
17.6	Magnetic Separation and Regrind Circuit.....	17-11
17.6.1	Regrind Mill Sizing.....	17-12
17.7	Concentrate and Tailings Dewatering and Handling	17-12
17.8	General Concentrator Plant Services	17-13
17.9	Compressed Air.....	17-13
17.10	Freshwater and Process Water	17-13
17.11	Fire Protection	17-14
17.12	Process Design Criteria.....	17-15
17.13	Pellet Plant.....	17-17
17.13.1	Additives Grinding.....	17-17
17.13.2	Filter Cake Reception	17-18
17.13.3	Mixing	17-18
17.13.4	Balling.....	17-19
17.13.5	Green Pellet Screening.....	17-20
17.13.6	Induration.....	17-20
17.13.7	Hearth Layer	17-22
17.13.8	Machine Dribble.....	17-22
17.13.9	Clean Up Water	17-22
17.13.10	Gas and Dust Cleaning.....	17-23
17.13.11	Machine Discharge Conveyor.....	17-23
18.	PROJECT INFRASTRUCTURE.....	18-1
18.1	General Shymanivske Site Plot Plan	18-1
18.2	Railway Transportation Options Study	18-14
18.3	Port Facility	18-20
19.	MARKET STUDIES AND CONTRACTS	19-1
19.1	Crude Steel and Hot Metal Production	19-2
19.2	Blast Furnace Capacity.....	19-3
19.3	Demand for iron Ore	19-3



19.4	Conclusions	19-4
20.	ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT	20-1
20.1	Characteristics of the Area	20-2
20.2	Legislative Base for Environmental Protection	20-3
20.2.1	General Ukrainian Environmental Regulatory and Legal Requirements	20-3
20.2.2	Normative legal acts of Ukraine	20-6
20.2.3	International Conventions	20-7
20.2.4	Guidelines on the Best Available Techniques and International Practices	20-9
20.2.5	World Bank Operational Manual	20-9
20.2.6	Equator Principles	20-10
20.2.7	Performance Standards of the International Finance Corporation	20-10
20.2.8	Environmental, Health and Safety Guidelines for an Individual Sector of Industry ..	20-12
20.2.9	Current International Initiatives	20-12
20.3	Ukrainian Environmental Design Criteria	20-13
20.3.1	EIA Study	20-13
20.3.1.1	General Provision	20-13
20.3.1.2	Structure and Scope of EIA	20-13
20.3.1.3	Requirements for the EIA within the Scheme of Construction Investment Process	20-14
20.3.1.4	Mine Closure Planning	20-14
20.4	Black Iron's Environmental Management and Monitoring Program	20-15
20.5	Black Iron's Mine Permit Process	20-16
20.6	Baseline Studies	20-17
20.6.1.1	Legislative Requirements for Baseline Studies	20-18
20.6.1.2	Environmental Baseline Condition	20-21
20.6.2	Impact Evaluation and Mitigation Measures	20-21
20.6.2.1	Environment	20-21
20.6.2.2	Employment	20-22
20.6.2.3	Local Community	20-22
20.6.2.4	The Area Surrounding the Project Site	20-23
20.6.2.5	Socio-Economic Benefits	20-23
20.7	Stakeholder Engagement Plan	20-24
20.7.1	Introduction	20-24



20.7.2	Stakeholder Identification	20-26
20.7.3	Overview of Stakeholder's Engagement Activities	20-26
20.7.3.1	Stakeholder Engagement and Consultation of Intent Stage (2007)	20-26
20.7.4	Plan for Future Stakeholder Engagement	20-27
20.7.4.1	General Recommendations	20-27
20.7.4.2	Information Disclosure	20-28
20.7.4.3	Available Resources and Black Iron Organizational Structure	20-28
20.7.4.4	Reporting and Monitoring	20-28
20.7.4.5	Grievance Mechanism	20-29
21.	CAPITAL AND OPERATING COSTS.....	21-1
21.1	Capital and Operating Costs – Pellet Fines Concentrate, the Financial Analysis (FA) Base Case Scenario	21-1
21.2	Capital and Operating Costs – Pellet Production	21-3
21.3	Basis of Estimate and Assumptions	21-4
21.3.1	Type and Class of Estimate	21-4
21.3.2	Dates, Currency and Exchange Rates	21-5
21.3.3	Labour Rates and Labour Productivity Factors	21-5
21.3.4	General Direct Capital Costs	21-5
21.3.5	Indirect Costs.....	21-7
21.3.6	Contingency.....	21-8
21.3.7	Exclusions.....	21-9
22.	ECONOMIC ANALYSIS.....	22-1
22.1	Sensitivity Analysis	22-5
22.2	Risk Management.....	22-8
22.2.1	Scope.....	22-8
22.2.2	Risk Assessment Methodology.....	22-8
23.	ADJACENT PROPERTIES	23-1
24.	OTHER RELEVANT DATA AND INFORMATION.....	24-1
24.1	Project Implementation and Execution Plan	24-1
25.	INTERPRETATION AND CONCLUSION	25-1
25.1	Mineral Resources.....	25-1
25.2	Metallurgy and Ore Processing	25-4



25.3	Environmental Permitting and Land Acquisition	25-5
25.4	Land Acquisition and Expropriation	25-5
25.5	Rail and Port	25-6
25.6	Geotechnical and Hydrogeological	25-6
25.7	Conclusions	25-7
26.	RECOMMENDATIONS	26-1
26.1.1	Mineral Resources and Drilling	26-1
26.1.2	Data Verification	26-2
26.1.3	Mineral Processing and Metallurgical Testwork	26-2
26.1.4	Project Infrastructure	26-3
26.1.5	Environmental Studies	26-4
26.1.6	Main Conclusion	26-4
27.	REFERENCES	27-1



LIST OF TABLES

Table 1.1: Mineral Resource Estimate* for the Shymanivske Iron Ore Deposit (Cut-off Grade of 15% Fe _{tot}).....	1-4
Table 1.2: Black Iron - LG Pit Optimization. Total Resource Estimate – (COG 15% Fe _{tot}).....	1-5
Table 1.3: Black Iron Engineered Pit Design. Total Resource Estimate (COG 15% Fe _{tot})	1-6
Table 1.4: Total Estimated Initial CAPEX Costs – PF Concentrate (M \$).....	1-9
Table 1.5: Total Estimated Initial CAPEX Costs – Pellet Production (M \$).....	1-10
Table 1.6: Estimated Operating Costs for PF Concentrate Option (\$/tonne of concentrate) ...	1-11
Table 1.7: Estimated Operating Costs for Pellet Production Option (\$/tonne of Pellets).....	1-11
Table 1.8: PF Concentrate Sales.....	1-12
Table 1.9: Pellet Sales	1-12
Table 1.10: Sensitivity Analysis Table for PF Concentrate Sales	1-14
Table 1.11: Sensitivity Analysis Table for Pellet Sales	1-15
Table 3.1: Technical Report Section List of Responsibility	3-2
Table 4.1: Program of Work Under Special Permit No. 4537	4-3
Table 6.1: Major Groups Based on Level of Exploration	6-3
Table 6.2: Summary of Resource Estimate with a Fe _{mag} COG of 10%	6-5
Table 6.3: Content of Fe _{tot} and Fe _{mag} by Ferriferous Horizons.....	6-6
Table 6.4: Resources Presented by Category in the Contour of the 1989 Open Pit.....	6-9
Table 6.5: Resources Below the Design Contour of Open Pit Down to 500 m Depth	6-10
Table 6.6: Lithologic Domains.....	6-17
Table 6.7: Avg. Results of Resource Estimate for the Ferriferous Units sx1f, sx2f and sx4f ...	6-19
Table 7.1:- Stratigraphic Table of Formations.....	7-5
Table 12.1: Summary of the Twin Drillhole Program	12-1
Table 13.1: Historical Magnetic Separation Results	13-2
Table 13.2: Composite Sample Make-Up	13-4
Table 13.3: Head Assays of Composite Samples.....	13-5
Table 13.4: Mineralogical Analysis of Composite Sample 1 by Size Fraction	13-7
Table 13.5: Mineralogical Analysis of Composite Sample 2 by Size Fraction	13-8
Table 13.6: Gravity Separation for Composite 1-Shaking Table Results.....	13-9
Table 13.7: Gravity Separation for Composite 2-Shaking Table Results.....	13-10



Table 13.8: Magnetic Separation for Composite 1 – Davis Tube Results.....	13-11
Table 13.9: Magnetic Separation for Composite 2 – Davis Tube Results.....	13-12
Table 13.10: Magnetic Separation by Davis Tube on Combined Gravity Middlings and Tails.....	13-14
Table 13.11: Magnetic Separation Only Versus Gravity and Magnetic Separation	13-14
Table 13.12: Magnetite Distribution of Cobbing Step at -20 Mesh (0.841 mm)	13-15
Table 13.13: Magnetite Distribution of Cobbing Step at -35 Mesh (0.420 mm)	13-15
Table 13.14: Grindability Test Result Summary	13-16
Table 13.15: SMC Test Summary.....	13-16
Table 13.16: Major Testwork Planned for Feasibility Study	13-20
Table 14.1: Lithologic Domains.....	14-5
Table 14.2: ID ² Interpolation Parameters, First Search Ellipsoid	14-11
Table 14.3: ID ² Interpolation Parameters, Second Search Ellipsoid	14-11
Table 14.4: Solid and Domain Precedence for Block Modelling of the Shymanivske Deposit.....	14-12
Table 14.5: Distance Criteria for Classification of Resources Based on Range of Variograms and Density of Drilling	14-13
Table 14.6: Mineral Resource Estimate for Shymanivske Deposit in Measured and Indicated Categories (COG of 15% Fe _{tot})	14-15
Table 14.7: Mineral Resource Estimate for Shymanivske Deposit in Inferred Category (COG of 15% Fe _{tot})	14-15
Table 14.8: Sensitivity Table, Measured and Indicated Resource in Shymanivske Deposit.....	14-16
Table 14.9: Sensitivity Table, Inferred Resource in Shymanivske Deposit.....	14-16
Table 14.10: Mineral Resource Estimate for Shymanivske Iron Ore deposit (COG Of 15% Fe _{tot})	14-17
Table 16.1: Block Model Items.....	16-1
Table 16.2: Pit Optimization Parameters	16-4
Table 16.3: Black Iron Pit Optimization Results	16-7
Table 16.4: Pit Design Parameters	16-8
Table 16.5: Black Iron In-Pit Resource Results	16-14
Table 16.6: Tonnages of Material Moved Over the LOM for Production of 7.3 Mt/y of Concentrate	16-16
Table 16.7: Mining Equipment List.....	16-21
Table 16.8: Drilling and Blasting Design Parameters	16-23



Table 16.9: Mining Equipment Estimated Fuel Consumption	16-25
Table 16.10: Mining Equipment Estimated Electricity Consumption.....	16-26
Table 16.11: Mine Area Hourly Personnel	16-27
Table 16.12: Mine Area Salaried Personnel and Total Headcount.....	16-28
Table 17.1: Concentrate Production Target and Nominal and Design Rates	17-2
Table 17.2: SAG Mill Power Requirements	17-11
Table 17.3: Concentrator Process Design Criteria	17-16
Table 18.1: Preliminary Plot Plan Legend.....	18-5
Table 18.2: Black Iron Power Load Calculation	18-11
Table 18.3: Existing Port Capacities Available for Black Iron	18-21
Table 20.1: Required Permits from Environmental Authorities	20-5
Table 20.2: Legal Baseline Requirements	20-18
Table 20.3: Baseline Study Categories.....	20-20
Table 20.4: Approximate Land Take and Work Phase Duration.....	20-23
Table 21.1: Total Estimated Initial Capital Costs – Pellet Feed Concentrate Production Only (M\$), FA Base Case Scenario.....	21-1
Table 21.2: Total Estimated Average Operating Costs (\$/t pellet feed concentrate), FA Base Case Scenario	21-2
Table 21.3: Total Estimated Initial Capital Costs for Pellet Production (M\$)	21-3
Table 21.4: Total Estimated Average Operating Costs (\$/t pellet).....	21-4
Table 22.1: Project Undiscounted Cash Flow Table for PF Concentrate Sales.....	22-3
Table 22.2: Project Undiscounted Cash Flow Table for Pellet Sales.....	22-3
Table 22.3: Financial Analysis Results for PF Concentrate Sales	22-4
Table 22.4: Financial Analysis Results for Pellet Sales	22-4
Table 22.5: Sensitivity Analysis Table for PF Concentrate Sales	22-6
Table 22.6: Sensitivity Analysis Table for Pellet Sales	22-7
Table 22.7: Classification of Occurrence and Manageability	22-9
Table 22.8: Risk Register.....	22-9
Table 25.1: Mineral Resource Estimate* for Shymanivske Iron Ore Deposit (Cut-off Of 15% Fe _{tot})	25-2
Table 25.2: Black Iron In-Pit Resource Results	25-4
Table 26.1: Next Study Phase Cost Estimate	26-4



LIST OF FIGURES

Figure 1.1: Sensitivity Analysis Graph for PF Concentrate Sales	1-14
Figure 1.2 - Sensitivity Analysis Graph for Pellet Sales	1-15
Figure 4.1: Map of Ukraine with Project Location	4-1
Figure 4.2: Local Map with Deposit Location and Existing Infrastructure	4-2
Figure 5.1: Road Access to the Property	5-1
Figure 6.1: Geology Map of Level +50 m with Drillholes and Cross Section Location.....	6-7
Figure 7.1: Regional Geology of the Kryviy Rih Belt (top of figure looking north, the red star shows the approximate location of the Project)	7-2
Figure 7.2: Typical Geological Section of the Kryviy Rih Belt (looking north-northeast)	7-3
Figure 10.1: Shymanivske Drillhole Plan Map – Historical Diamond Drillholes	10-7
Figure 12.1: % Fe _{tot} at SGS Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-4
Figure 12.2: % Fe _{mag} at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-4
Figure 12.3: %FeO at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-5
Figure 12.4: %SiO ₂ at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-5
Figure 12.5: %P at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-6
Figure 12.6: %S at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples	12-6
Figure 13.1: Weight and Iron Recovery versus Iron Grade for Composite Samples 1 and 2	13-13
Figure 13.2: Simplified Process Block Diagram	13-19
Figure 14.1: Typical Cross Section of the Deposit.....	14-6
Figure 14.2: Solid Models Seen from the Upper South-West	14-6
Figure 14.3: Block Model (Pale Blue) with the Three Mineralized Domains Shows From the Upper South-West (SX1F, 2F and 4F).....	14-7
Figure 14.4: Log Normal Histogram for SX1F Ore Domain	14-8
Figure 14.5: Log Normal Histogram for SX2F Ore Domain	14-9



Figure 14.6: Log Normal Histogram for SX4F Ore Domain	14-9
Figure 16.1: Block Model Coordinate System.....	16-3
Figure 16.2: Black Iron Pit Optimization Plan View.....	16-6
Figure 16.3: Black Iron Pit Optimization 3-D View	16-6
Figure 16.4: Black Iron Engineered Pit Design, Plan View and 3-D View	16-10
Figure 16.5: Black Iron Pit Section View E 520,027.50 m	16-11
Figure 16.6: Black Iron Pit Section View E 520,437.50 m	16-11
Figure 16.7: Black Iron Pit Section View E 520,707.50 m	16-12
Figure 16.8: Black Iron Pit Section View N 5,298,680 m	16-12
Figure 16.9: Black Iron Pit Section View N 5,298,910 m	16-13
Figure 16.10: Black Iron Pit Section View N 5,299,320 m	16-13
Figure 16.11: Annual Mine Truck Fleet Requirements	16-22
Figure 17.1: Process Flow Diagram Crushing, Stockpiling and Conveying	17-4
Figure 17.2: Process Flow Diagram Grinding and Separation.....	17-5
Figure 17.3: Process Flow Diagram Water Distribution	17-6
Figure 17.4: Overall Pelletizing Flowsheet.....	17-7
Figure 18.1: Preliminary Plot Plan	18-4
Figure 18.2: Layout of Plant's Main Substation	18-13
Figure 18.3: Elevation of a 330 kV Transformer Feeder.....	18-13
Figure 18.4: General View of Transportation Mode	18-15
Figure 18.5: Railway Route Option #1	18-16
Figure 18.6: Railway Route Option #3	18-16
Figure 18.7: Shymanivske Railway Station.....	18-17
Figure 18.8: Railway Connection to Moiseevka Station.....	18-18
Figure 18.9: New Railway Yard B at Khimicheskaya.....	18-19
Figure 18.10: Proposed General Arrangement of Facilities.....	18-20
Figure 20.1: Understanding IFC's Environmental and Social Review Process.....	20-12
Figure 20.2: Black Iron's SHEC Systems Structure	20-16
Figure 22.1: Sensitivity Analysis Graph for PF Concentrate Sales.....	22-6
Figure 22.2: Sensitivity Analysis Graph for Pellet Sales	22-7
Figure 24.1: Preliminary Construction Manpower Curve for the FA Base Case Scenario.....	24-2
Figure 24.2: Simplified Project Execution Schedule for the FA Base Case Scenario.....	24-3



LIST OF ABBREVIATIONS

Two Dimensional	2D
Three Dimensional.....	3D
Breton, Banville and Associates	BBA
Bench Face Angle.....	BFA
Banded Iron Formation	BIF
Black Iron Inc.	Black Iron, BKI
Basic Oxygen Furnace.....	BOF
Bond Work Index	BWI
Capital Expenditure.....	CAPEX
Council of the Canadian Institute of Mining Metallurgy and Petroleum	CIM
Comma Separated Value.....	CSV
Crusher work index	CWI
Cut-Off Grade	COG
Database.....	DB
Diamond Drillhole.....	DDH
Digital Elevation Model	DEM
Diameter	dia
Davis Tube	DT, DTT
Drop-Weight Test.....	DWT
Environmental Assessment	EA
Environmental Impact Assessment.....	EIA
Environmental Impact Statement.....	EIS
European Bank for Reconstruction and Development.....	EBRD
Engineering, Procurement, and Construction Management	EPCM
Environmental Preview Report	EPR
Evapotranspiration	ET
Financial Analysis	FA
Magnetite	Fe ₃ O ₄
Magnetite Iron	Fe _{mag}
Total Iron Content	Fe _{tot}



Freight on Board	FOB
Feasibility Study.....	FS
General and Administration	G&A
General Arrangement	GA
Gravity Gradient Instruments	GGI
Ore dressing and Processing Plant	GOK
Geographic Information System	GIS
Global Positioning System	GPS
Government Service Centre	GSC
Hematite.....	Fe ₂ O ₃
Heavy Liquid Separation.....	HLS
Inverse Squared Distance.....	ID ²
Iron Formation.....	IF
International Finance Corporation.....	IFC
Inter-ramp Angles	IRA
Internal Rate of Return.....	IRR
Length	L
Lerchs-Grossman 3-D.....	LG 3-D
Low Intensity Magnetic Separation	LIMS
Loss on Ignition.....	LOI
Life of Mine	LOM
Mekhanobrchermet	MCM
Work Index of Coarse Particle	Mia
Work Index of the Fine Particle	Mib
Memorandum of Understanding	MOU
Major Resource Project	MRP
MineSight Economical Planner	MSEP
Interpajp	NPIG
Net Present Value	NPV
Overburden	OB
Ordre des Géologues du Québec	OGQ
Oxide Iron Formation	OIF



Operating Expenditure	OPEX
Project Control File	PCF
Preliminary Economic Assessment.....	PEA
Pellet Feed	PF
Process Flowsheet.....	PFS
Quality Assurance	QA
Quality Control	QC
Quantitative Evaluation of Minerals by Scanning Electron Microscopy	QEMSCAN
Qualified Person	QP
Run-of-Mine	ROM
Rod Work Index	RWI
Semi Autogenous.....	SAG
Satmagan.....	Sat
Silicate-Carbonate Iron Formation	SCIF
Stakeholder Engagement Plan	SEP
Specific Gravity	SG
Sales, General, and Administrative Expenses	SG&A
SGS Lakefield Research.....	SGS Lakefield
Safety, Health, Environment and Community	SHEC
Silicate Iron Formation	SIF
Single Line Diagram.....	SLD
SAG Mill Comminution.....	SMC
SAG Power Index	SPI
Stripping Ratio	S/R
Total Iron Content	Fe _{tot}
Tailings Storage Facility.....	TSF
Toronto Stock Exchange.....	TSX
Watts, Griffis and McOuat.....	WGM
Waste Management Plan.....	WMP
Weight Recovery.....	wt. rec.
Wilfley Table	WT
Yuzhny GOK.....	YUGOK



UNITS OF MEASURE

Foot.....	' ,ft
Inches	" ,in
Dollar.....	\$
Dollar per tonne	\$/t
Degree	°
Micron	µm
Centimeter	cm
Canadian Dollars	CDN
Feet per minute	fpm
Gram	g
Gram per cubic centimeter.....	g/cc, g/cm ³
Gallons per minute	GPM
Giga watt hour.....	GWh
Hectare	ha
Horsepower.....	hp
Kilogram.....	kg
Kilometer.....	km
Square kilometer	km ²
Kilotonne	kt
Kilovolt	kV
Kilowatt	kW
Kilowatt-hours per tonne	kWh/t
Pounds per hour	lb/h
Meter.....	m
Million	M
Million tonnes per year.....	M t/y
Cubic metre per hour	m ³ /h
Mile	mi
Millimeter.....	mm
Million tonnes	Mt
Metric tonnes per hour	mt/h
Mega Watt.....	MW
Standard cubic feet per minute	scfm
Tonnes	t
tonnes per hour.....	t/h
tonnes per cubic meter	t/m ³
tonnes per year	t/y
metric tons	tonnes or t
short tons	tons



1. SUMMARY

1.1 Introduction

The following Technical Report (the Report) presents the results of the Preliminary Economic Assessment (PEA) for the development of the Shymanivske deposit in the KrivBass iron ore basin (Kryviy Rih) of the Dnepropetrovsk region in Ukraine. The Shymanivske subsurface usage permit for the extraction of iron ore, registered as “Special Permit No. 4537”, is 100% owned by Black Iron Inc. The property area covers 256 hectares and is located approximately 330 km south-east of Kiev and 150 km north of the Black Sea in Ukraine.

In January 2011, Black Iron commissioned the engineering consulting group BBA Inc. to perform a PEA based on the development of the Shymanivske deposit to produce 7.3 Mtpy of magnetic iron concentrate on a dry basis. The concentrate must be of suitable grade and quality to permit the production of 7.6 Mt/y of acid pellets. In completing this work, BBA conducted multiple site visits between October 2010 and August 2011.

A previous NI 43-101 compliant resource estimate was prepared by Genivar in January 2011. The data used in compiling the resource report was based on historical information as there were no physical drill cores remaining. In June 2011, a “Twin Drillhole” Program was completed by Georesources LLC, a Ukrainian drilling contractor to collect material for metallurgical testwork and to validate the historic drilling completed on the Property. Watts, Griffis and McOuat Limited (WGM) was mandated to review the twin drillhole sampling and assaying QA/QC results for the Shymanivske iron ore deposit and confirmed that the historic drilling results were reasonably validated by the Twin Drillhole Program. An updated block model was developed for the present PEA using the historical data from the previous NI 43-101 resource report.



1.2 Geology and Mineralization

The Shymanivske deposit of ferriferous quartzites is in the Inguletsky district of Kryviy Rih in the Dnepropetrovsk region of Ukraine. It is a stratiform iron formation, folded and faulted by at least one cross-cutting early fault system and one late sub-concordant fault system. The banded iron formation (BIF) of ferriferous quartzites comprises magnetite, magnetite-hematite, and hematite varieties, the most economically significant being the unoxidized magnetite and magnetite-hematite varieties. The high-grade ores consist mainly of iron oxides, which form column-like, lens-like, or layer-like segregations and bodies within the BIF units, the characteristics of which vary from location to location within the basin.

The geological structure of the deposit consists of metamorphic rocks of Novokrivorozhsky, Skelevatsky, Saksagansky and Gdantsevsky suites of the Proterozoic and granitoids of Dneprovsky complex of the Archaeozoic. The complex of metamorphic rocks is overlain by a cover of sedimentary carbonates from the Cenozoic period with a thickness ranging from 9.7 to 21 m, averaging 16 m.

1.3 Exploration and Drilling

Previous exploration work consisted essentially of geophysical surveys. They cover several periods between 1925 and 1984. In early 2011, Black Iron contracted Abitibi Geophysics to conduct a ground survey and produce density and magnetic anomaly maps and a report.

Historical drilling was done along sections with hole spacing's ranging from 80 to 300 meters along strike with vertical depths of 250 to 500 meters. The drilling totalled about 40 000 meters spread over 215 holes. The Twin Drillhole Program was completed in June 2011 and consisted of 22 drillholes, totalling 6042 m; the primary goal of this program was to collect material for metallurgical testwork by drilling a selection of holes as close as possible and at similar attitude to historic locations. The secondary goal was to validate historic drilling completed on the Property. Validation was required because documentation available concerning the historic drilling was incomplete.



1.4 Data Verification

Black Iron requested Watts, Griffis and McOuat Limited ("WGM") to review the "Twin Drillhole" sampling and assaying QA/QC results for the Shymanivske iron ore deposit.

Overall, WGM believes that the historic drilling results are reasonably validated by the twin drillhole results. WGM's recommendations include further independent and verification assaying to confirm Fe_{mag} results to generally advance data quality.

1.5 Mineral Processing and Metallurgical Testwork

A metallurgical testwork program was developed by BBA Inc. in the early stages of the Study to characterize the Black Iron Shymanivske ore body. The objective of the testwork was to evaluate the ore's amenability to being processed by gravity separation and/or by magnetic separation in order to produce a commercially acceptable, quality product that would allow for the economical development of the Shymanivske Project. An important part of the testwork consisted of evaluating whether a gravity separation circuit prior to a magnetic separation circuit could contribute to an increase in iron and weight recovery.

Based on the preliminary gravity and Davis Tube tests, which were carried out at the Mekhanobrchermet (MCM) Institute in Ukraine, it was determined that magnetic separation alone is the most sensible option.

In addition to the testwork carried out at MCM, grindability testing and QEMSCAN analyses were carried out at SGS Lakefield in Canada on sub-samples of selected composite samples.

After the preliminary testing, further laboratory tests were carried out on several flowsheet configurations. The results from this testwork were used to develop the preliminary Process Flowsheet as well as preliminary mass and water balance, forming the basis of the process design for this Study. Preliminary sizing of major process equipment was also developed based on the mass and water balances and ore grindability test results.



It should be noted that the iron and weight recovery relationships that were developed for this Study were based on limited metallurgical test results. Given the data verification process showed that magnetite contents measured by MCM's lab were slightly but consistently, lower than those measured by SGS Lakefield, it is recommended that these relationships be validated and updated with additional metallurgical testing and verification of magnetite assays as this may further improve weight yield.

1.6 Mineral Resource Estimates

The Mineral Resources developed for the Shymanivske Project was prepared using historical technical data and classified as Measured, Indicated or Inferred.

For studies at the Feasibility level, CIM guidelines require that only material categorized as Measured or Indicated be classified as a reserve. Considering that this present Study is a Preliminary Economic Assessment, these guidelines require that all material classified as Measured, Indicated, or Inferred be reported as a Mineral Resource. Table 1.1 below summarizes the updated Mineral Resource Estimate for the Shymanivske deposit.

Table 1.1: Mineral Resource Estimate* for the Shymanivske Iron Ore Deposit (Cut-off Grade of 15%

Fe_{tot})			
Category	Tonnes (Million)	Fe_{tot} %	Fe_{maq} %
Measured	306.3	31.3	18.9
Indicated	66.4	31.9	20.3
Inferred	480.3	30.2	17.4

*Tonnage and grade numbers rounded to first decimals

1.7 Mining Methods

The block model used in this Preliminary Economic Assessment for the Black Iron Project was prepared and provided to BBA by Black Iron Inc. The block model was imported into MineSight software to a project control file (PCF), as provided, with no modification to the given



information. The model was checked to ensure the validity and integrity of the transfer into the MineSight program.

Pit optimization was carried out for the Black Iron Project using the true pit optimizer algorithm Lerchs-Grossman 3-D (“LG 3-D”) in MineSight. The LG 3-D algorithm is based on the graph theory and calculates the net value of each block in the model, i.e. profit minus loss. With all mining costs, processing costs, processing recoveries, weighted recovery values and overall pit slope, the pit optimizer searches for the pit shell with the highest undiscounted cash flow. All blocks classified as Measured, Indicated and Inferred material are included in the Resource Estimate.

The results of the pit optimizations at a cut-off grade (COG) of 15%Fe_{tot} are shown in Table 1.2 below.

Table 1.2: Black Iron - LG Pit Optimization. Total Resource Estimate – (COG 15% Fe_{tot})

Category	Tonnage (kt)	% Fe _{tot}	Wt.Rec%	Fe Conc. (kt)
Measured	304,015	31.34	29.91	90 930
Indicated	65,409	31.92	31.62	20 681
Inferred	359,772	30.95	28.62	102 976
Total	729,196	31.20	29.43	214 587
	Waste (kt)			
Rock	1,142,150			
OB	180,322			
		Total S/R		
Total Stripping	1,322,473	1.81		

The detailed mine design was carried out using the LG 3-D optimized pit shell as a base and factors that are required for a mine are added during the engineered pit design phase. These factors include a haulage ramp, safety berms, bench face angles (BFA), inter-ramp angles (IRA) and bench height.

The mining resources for the engineered pit design were calculated for the Black Iron engineered pit at an in-pit cut-off grade of 15% Fe_{tot}. The calculated mining resources totaled



681 Mt with an average grade of 31.30 % Fe_{tot}. The total waste contained in the pit is 1,367 Mt including 94 Mt of overburden and historic neighbouring YUGOK waste dumps that partially impinge on the Shymanivske property. This results in a stripping ratio (S/R) of 2.01, as shown in Table 1.3.

Table 1.3: Black Iron Engineered Pit Design. Total Resource Estimate (COG 15% Fe_{tot})

Category	Tonnage (kt)	% Fe _{tot}	Wt. Rec%	Fe Conc. (kt)
Measured	297,121	31.41	30.01	89 175
Indicated	64,788	31.92	31.66	20 515
Inferred	319,549	31.50	28.76	91 918
Total	681,458	31.30	29.58	201 608
	Waste (kt)			
Rock	1,272,480			
OB	94 062			
		Total S/R		
Total Stripping	1,366,541	2.01		

As part of this Study, a preliminary mine plan was developed and used for the Capital and Operating Cost Estimates for the Project.

1.8 Recovery Methods and Processing Plant Design

The metallurgical testwork for the Shymanivske deposit performed during this Study allowed for the development of the process mass and water balances. These were used to develop a preliminary process plant design. Considering a target concentrate production of 7.3 Mt/y of Pellet Feed (PF) concentrate on a dry basis, the crushing and grinding areas are required to process 24.7 Mt/y of ore. This generates 17.4 Mt/y of tailings for disposal. A mine plan was developed for 7.3 Mt/y of final product and based on the Resource Estimate, the mine life will be approximately 28.3 years. From annual tonnages, hourly tonnage rates were calculated for each area of the plant and used as criteria to size major equipment. A process design criteria and a major equipment list have been developed and used for the processing plant Capital Cost



Estimate. Power, fuel, consumables and manpower requirements were also estimated and used to derive the processing Operating Cost Estimate.

1.9 Project Infrastructure

As part of this Study, a preliminary site plan was developed for the Shymanivske site. Major site infrastructure consists of the following:

- Shymanivske open pit and associated waste rock dumps;
- Truck shop, mine garage administration, and warehouse;
- The main processing facilities consisting of the following:
 - Crusher area and crushed ore conveyors;
 - Crushed ore stockpile, reclaim and conveyors;
 - Processing plant, including concentrator and pellet plant;
 - Thickener.
- Concentrate conveyors, train loadout and emergency concentrate stockpile;
- Tailings thickener;
- Tailings and Polishing Pond;
- The proposed rail spur connecting directly to the Ukrainian National Rail;
- Fuel storage and distribution area;
- Main haulage road which will transport ore and waste from the pit to the crusher and waste and overburden dumps;
- Service roads;
- Haulage truck underpass;
- Main electrical substation and secondary electrical substations;
- Fire water and pumping station;
- Sanitary treatment facilities, health and safety and emergency building;
- Concentrator and Pellet Plant lay down area and consumables laydown area;
- Pellet Plant facilities, including additives grinding building, additive mixing building, filter cake blending shed, scrap removal screen building, and pellet stockpile.



Upon reviewing three main port options, the privately owned TIS-Ruda terminal located at the Yuzhny Port was selected as the most optimal and cost efficient option. TIS-Ruda has a processing capacity of 250 cars/day and a maximum transfer/warehouse capacity of 270,000 t. Black Iron will negotiate an operator's agreement with TIS-Ruda covering all port activities, including what is needed from the Port Authorities (Port of Yuzhny).

1.10 Market Studies and Contracts

Black Iron has engaged in discussions with several potential customers interested in pellet fines or pellets which will be produced at the Shymanivske facility. As of the effective date of this Report, Black Iron has not entered into any material commercial agreements with any potential customer or export service suppliers.

Black Iron mandated CRU Strategies, a division of CRU International Limited of the United Kingdom, to perform a market study. The main objective of the study was to provide a view of developments in the steel and iron ore markets that would affect the prospects of Black Iron's proposed Shymanivske iron ore mine given this Project will likely be built to serve export markets. Black Iron identified the following countries and regions as its main targets: European Union, Turkey, China, India, Japan, South Korea, Taiwan and Southeast Asia.

1.11 Environment

Black Iron's Project is subject to requirements for Environmental Impact Assessment (EIA) under Ukrainian regulations. Ukrainian law requires the completion of an EIA (or OVOS, Ukrainian equivalent) procedure associated with the Declaration of Intent and Justification of Site Selection; this is already underway, based on preliminary environmental studies undertaken by the "Yuzhgiproruda" Design Institute (city of Kharkov). The purpose of the EIA is to determine the acceptability and feasibility of planned activities from the viewpoint of ensuring safety of the environment.



Black Iron's management desires to develop a mine that is in harmony with the local communities and environment, and which contributes to the sustainable socio-economic development in the south-eastern region of Ukraine. As the project progresses, the company will develop and implement appropriate Safety, Health, Environment and Community (SHEC) systems relevant to each major lifecycle stage from development and operation to ultimately closure.

1.12 Capital Costs

The Shymanivske Iron Ore Project scope covered in this Study is based on the construction of a Greenfield facility having a nominal annual production capacity of 7.3 Mt of pellet feed concentrate on a dry basis. The Capital and Operating Cost Estimates related to the mine, concentrator and Shymanivske site infrastructure have been developed by BBA. Costs related to the railway, port facilities, environmental, Tailings Pond and site Closure Plan have been developed by another Black Iron Consultant. BBA consolidated the cost information from all sources.

BBA also looked at the option of producing 7.6 Mt/y of pellets (dry basis) at the Shymanivske site. The capital costs of both options are presented in Table 1.4 and Table 1.5.

Table 1.4: Total Estimated Initial CAPEX Costs – PF Concentrate (M \$)

Total Estimated Initial CAPEX Costs – PF concentrate (M \$)	
Mining Capitalized Pre-Stripping Costs	73.5
Other Pre-Production Capitalized Costs	13.6
Concentrator and Site Infrastructure	419.8
Environmental and Tailings Management	80.1
Rail Transportation System	11.4
Port Facilities	Nil
Indirect Costs & Land Acquisition	166.8
Contingency	130.6
Total	895.8

**Table 1.5: Total Estimated Initial CAPEX Costs – Pellet Production (M \$)**

Total Estimated Initial CAPEX Costs – Pellet Production (M \$)	
Mining Capitalized Pre-Stripping Costs	73.5
Other Pre-Production Capitalized Costs	14.6
Concentrator and Site Infrastructure	414.2
Pellet Plant	518.7
Environmental and Tailings Management	80.1
Rail Transportation System	12.0
Port Facilities	Nil
Indirect Costs & Land Acquisition	215.2
Contingency	243.0
Total	1571.3

The leased equipment (mining equipment and railcars), with an estimated value of \$354.3M was excluded from the capital costs and included in the operating costs. There are no rehabilitation and closure costs that are required to be disbursed prior to production start up. Canadian and US dollars were assumed to be at par and the Ukraine Hryvnia at 7.694 to one Canadian dollar.

1.13 Operating Costs

Table 1.6 and Table 1.7 present a summary of total estimated operating costs for both the PF concentrate and pellet production options.

**Table 1.6: Estimated Operating Costs for PF Concentrate Option (\$/tonne of concentrate)**

Estimated Operating Costs for PF Concentrate Option (\$/tonne of concentrate)			
	Average Years (0-20)	Average Years (1-7)	Average Years (8-20)
Mining	24.05	31.38	20.10
Concentrator	15.44	15.44	15.44
Site Infrastructure	0.67	0.67	0.67
Sales & General Administration	1.49	1.49	1.49
Environmental and Tailings Management	0.13	0.13	0.13
Rail Transportation	5.42	5.85	5.18
Port Facility	5.20	5.20	5.20
Total	52.40	60.17	48.22

Table 1.7: Estimated Operating Costs for Pellet Production Option (\$/tonne of Pellets)

Estimated Operating Costs for Pellet Production Option (\$/tonne of Pellets)			
	Average Years (0-20)	Average Years (1-7)	Average Years (8-20)
Mining	23.26	30.35	19.44
Concentrator	14.93	14.93	14.93
Pelletizing	13.15	13.15	13.15
Site Infrastructure	0.65	0.65	0.65
Sales & General Administration	1.45	1.45	1.45
Environmental and Tailings Management	0.13	0.13	0.13
Rail Transportation	5.39	5.81	5.17
Port Facility	5.20	5.20	5.20
Total	64.15	71.66	60.11

Royalties estimated at 0.40 CAD \$ / t ore mined are not included in the Operating Cost Estimate presented, but are treated separately in the economic analysis.

1.14 Economic Analysis

The economic evaluation of the Shymanivske Iron Ore Project was performed using the discounted cash flow model. The Capital and Operating Cost Estimates, based on the mine plan developed in this Study to produce 7.3 Mt of PF concentrate annually, were used as input to the



model. A financial analysis was also performed for the option of producing 7.6 Mt of iron ore pellets annually, assuming that a pelletizing facility is built at the mine site. The Internal Rate of Return (IRR) on the total investment was calculated based on 100% equity financing. The Net Present Value (NPV), based on discounting rate between 0% and 10%, resulting from the net cash flow generated by the Project was also calculated. The payback period is also indicated as a financial measure. A discount rate is applied to the cash flow to arrive at a NPV and payback period. The NPV calculation was done at discount rates of 0%, 5%, 8% and 10%. The Base Case NPV was assumed at a discount rate of 8%. Table 1.8 and Table 1.9 present the results of the financial analysis for PF concentrate and pellet sales.

Table 1.8: PF Concentrate Sales

PF Concentrate Sales		
IRR	42.1%	
	NPV	Payback
0%	\$7 655 M	1.8 yrs
5%	\$4 144 M	2 yrs
8%	\$2 966 M	2.2 yrs
10%	\$2 400 M	2.3 yrs

Table 1.9: Pellet Sales

Pellet Sales		
IRR	35.2%	
	NPV	Payback
0%	\$10 814 M	2.4 yrs
5%	\$5 768 M	2.7 yrs
8%	\$4 070 M	2.9 yrs
10%	\$3 253 M	3.1 yrs

As can be seen, for the PF concentrate sales scenario, the Project is forecasted to provide an IRR of 42.1% (before tax) and using discount rate of 8% the NPV is 2,966 M. The payback period is 2.2 years after the start of production. For the pellet sales scenario, the Project is forecasted to provide an IRR of 35.2% (before tax) and using a discount rate of 8% the NPV is \$4,070 M. The payback period is 2.9 years after the start of production.



A sensitivity analysis indicates that the Project NPV is most sensitive to commodity selling price followed by operating costs and then initial capital cost. The results of the sensitivity analysis are presented in Table 1.10 and Figure 1.1 for the case of PF concentrate sales, and in Table 1.11 and Figure 1.2 for the case of pellet sales.



Table 1.10: Sensitivity Analysis Table for PF Concentrate Sales

	PF Concentrate Sales		Sensitivities											
			INITIAL CAPEX				SELLING PRICE				OPEX			
			+30%		-30%		+30%		-30%		+30%		-30%	
IRR	42.1%		32.8%		58.7%		66.4%		15.4%		29.7%		53.8%	
	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback
0%	\$7,655 M	1.8 yrs	\$7,386 M	2.6 yrs	\$7,923 M	1.3 yrs	\$12,791 M	1.1 yrs	\$2,519 M	6.8 yrs	\$5,355 M	2.9 yrs	\$9,955 M	1.4 yrs
5%	\$4,144 M	2 yrs	\$3,884 M	3 yrs	\$4,404 M	1.4 yrs	\$7,217 M	1.2 yrs	\$1,070 M	8.2 yrs	\$2,739 M	3.4 yrs	\$5,549 M	1.6 yrs
8%	\$2,966 M	2.2 yrs	\$2,712 M	3.2 yrs	\$3,221 M	1.4 yrs	\$5,533 M	1.3 yrs	\$599 M	9.8 yrs	\$1,873 M	3.8 yrs	\$4,059 M	1.6 yrs
10%	\$2,400 M	2.3 yrs	\$2,149 M	3.4 yrs	\$2,652 M	1.5 yrs	\$4,423 M	1.3 yrs	\$377 M	11.2 yrs	\$1,461 M	4 yrs	\$3,340 M	1.7 yrs
Please note that this financial analysis is before tax.														

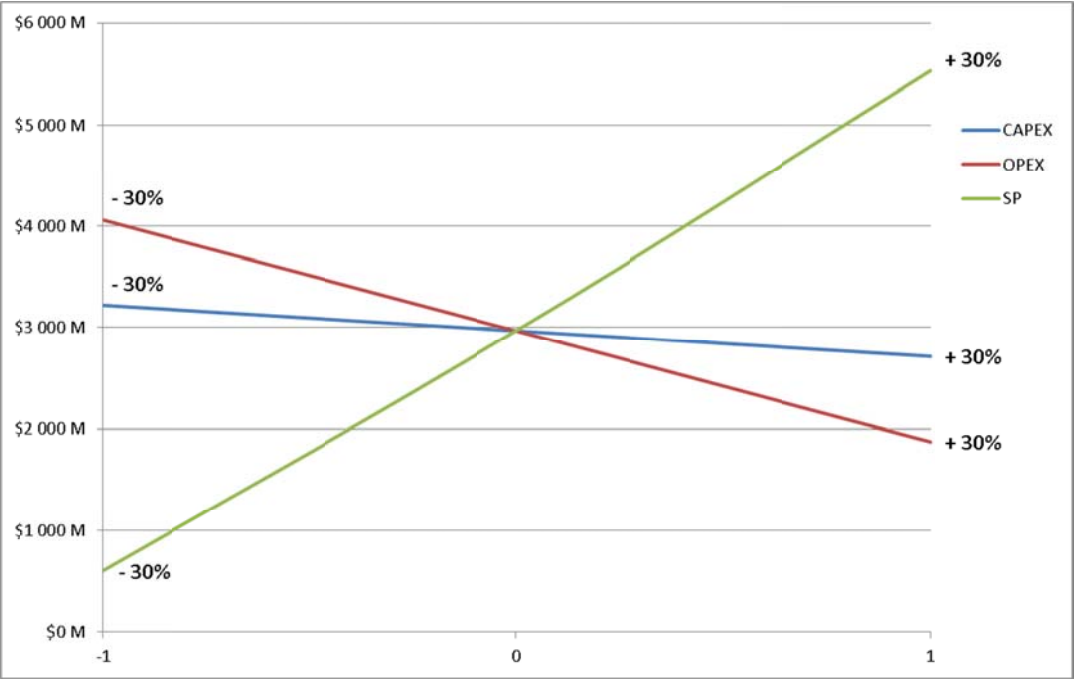


Figure 1.1: Sensitivity Analysis Graph for PF Concentrate Sales



Table 1.11: Sensitivity Analysis Table for Pellet Sales

	Pellet Sales		Sensitivities											
			INITIAL CAPEX				SELLING PRICE				OPEX			
			+30%		-30%		+30%		-30%		+30%		-30%	
IRR	35.2%		27.4%		49.0%		53.8%		14.6%		26.4%		43.6%	
	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback
0%	\$10,814 M	2.4 yrs	\$10,343 M	3.3 yrs	\$11,286 M	1.6 yrs	\$17,714 M	1.5 yrs	\$3,915 M	6.7 yrs	\$7,092 M	3.5 yrs	\$13,726 M	1.9 yrs
5%	\$5,768 M	2.7 yrs	\$5,312 M	3.8 yrs	\$6,224 M	1.7 yrs	\$9,989 M	1.6 yrs	\$1,647 M	8.2 yrs	\$4,000 M	4 yrs	\$7,536 M	2 yrs
8%	\$4,070 M	2.9 yrs	\$3,623 M	4.2 yrs	\$4,517 M	1.8 yrs	\$7,240 M	1.7 yrs	\$901 M	9.8 yrs	\$2,699 M	4.5 yrs	\$5,441 M	2.2 yrs
10%	\$3,253 M	3.1 yrs	\$2,812 M	4.5 yrs	\$3,695 M	1.9 yrs	\$5,960 M	1.7 yrs	\$547 M	11.3 yrs	\$2,077 M	4.8 yrs	\$4,429 M	2.3 yrs
Please note that this financial analysis is before tax.														

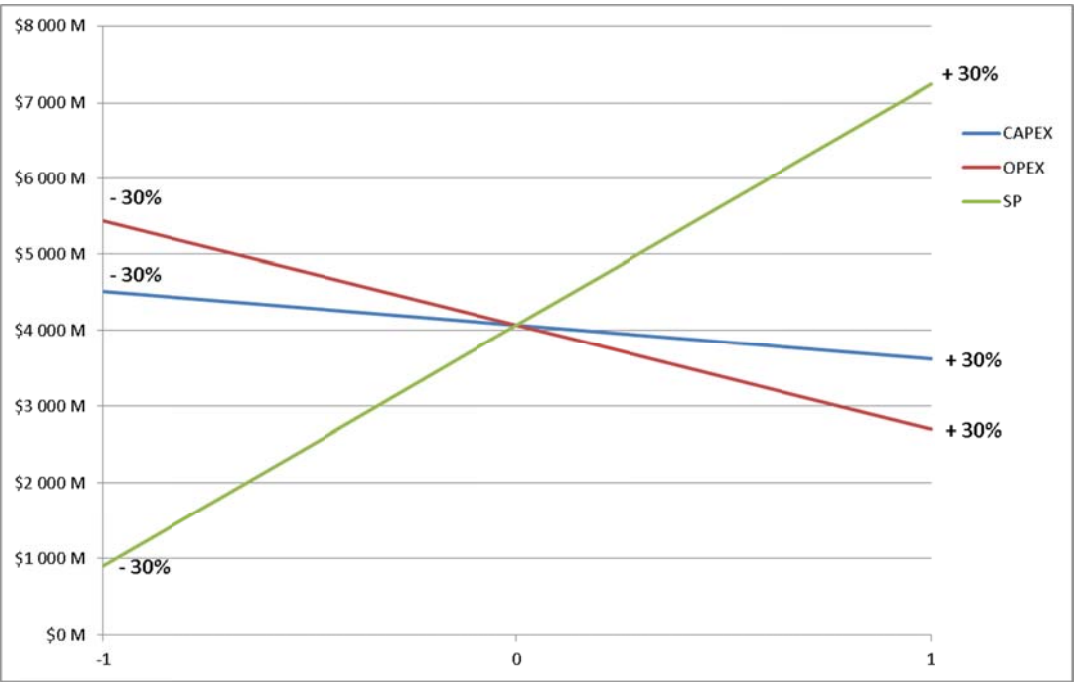


Figure 1.2 - Sensitivity Analysis Graph for Pellet Sales



1.15 Project Schedule

A preliminary project execution schedule was developed, based on BBA's understanding of the Environmental Assessment and Permitting process. Construction can begin once all of the required permits are obtained which is currently estimated as September 2013. Based on a target duration of 27 months, construction of the mine, plants and all infrastructure tie-ins is estimated to be completed by the end of November 2015. The plant startup is expected at the end of December 2015.

1.16 Conclusions and Recommendations

1.16.1 Mineral Resources and Drilling

The mineral resources and drilling review led to the following remarks:

- A more regular pattern of drilling should be used going forward, and wherever possible, it should be a priority for the drillhole to pass through the entire mineralized zone.
- Down-dip drilling should also be kept to a minimum. A targeted exploration program will most likely increase the Mineral Resources at depth; however, an "economic lower level" or maximum depth of viable extraction should be determined in a subsequent Study;
- Although the author cannot verify the quality assurance (QA) and quality control (QC) processes and methods used in compiling the historical technical data, the author believes that the historical technical data is relevant to the overall potential of the Shymanivske Project and in establishing updated Mineral Resources. Further engineering and economic studies are required to support the current conclusions.
- For further engineering and economic studies, the following recommendations would help improve the quality of the block model:
 - confirm and revise the existing geological interpretation and resource classification with infill and definition drilling



- cut-off grade (COG) should be applied to the Fe_{mag} vs Fe_{tot} values to reflect the selected magnetic separation processing scenario
- constrain resource reporting and estimation by pit design/optimization and,
- incorporate all rock units with corresponding bulk density values.

1.16.2 Data Verification

Overall, WGM believes that the historic drilling results are reasonably validated by the twin drillholes results. Recommendations include but are not limited to:

- Further independent verification assaying to confirm Fe_{mag} results and others, to generally advance data quality.
- A detailed review and comparison between the Soviet documentation and the Geo Inter Consulting database for each drillhole be undertaken and corrections made to match downhole survey azimuth to Soviet documentation.

1.16.3 Mineral Processing and Metallurgical Testwork

Additional testwork will be required for the Feasibility Study, which includes Davis Tube testing on selected drill core intervals to develop reliable weight, iron, and magnetite recovery relationships. Grindability testing, variability testing, rheology tests, and water treatment tests also need to be conducted. Finally, pilot scale testing for engineering design data, filtration and thickening tests should be considered.

To further increase the weight recovery, the use of flotation should be trialed. Also a trade-off study is recommended to evaluate the use of larger SAG mills with wrap-around motors versus smaller SAG mills with pre-crushing and pebble crushing be conducted to reduce cost.



1.16.4 Project Infrastructure

The initial assessment of the existing rail network and preferred port facility infrastructure suggests that sufficient capacity currently exists for the planned initial production. As a result, no additional capital is anticipated to increase the current capacity of the rail network and port facilities. In the PEA Report, costs estimates for rail cars and other equipment is considered as a lease-to-buy option. At the mine, the Owner will build a mine spur, railway station, loadout and maintenance facility. These costs are included in the CAPEX estimate.

Access to the rail network capacity and Ukrainian bulk ports needs to be firmed up by Black Iron management. In order to get permits from the Federal Railway “Ukrzaliznyca” concerning access and connection to the Federal Railway at Moiseevka station; approval of the route, a rail haulage contract, long-term agreement with port authorities and other service contracts must be in place. In terms of the Yuzhny Port, Black Iron needs to enter into a long term contract with a private service provider at this facility prior to the existing capacity being secured by other potential users of this facility. The Owners of the preferred Port own additional land adjacent to their existing facility suitable for Port expansion in the event the existing installed capacity is secured by an alternate company prior to Black Iron.

1.16.5 Environmental Studies

The benefits from the planned mining operations have been assessed as outweighing potential negative consequences on the health of people and on the environment. The change to the current topographic character of the landscape will be the most significant permanent impact of the operations.

It is expected that improved infrastructure and demand for social services will also result from the establishment of the mine, and, in turn, will lead to increased interest from regional and/or international investors or various types. The establishment of the mine may result in an overall improvement in the population trend through employees and their families moving to the region.



The impact of the operations on the social economy will be assessed in the EIA and other research reports published.

1.16.6 Main Conclusion

Based on the work accomplished and the results obtained in this PEA Study, it is BBA's opinion that the Project is sufficiently robust to warrant proceeding with a Feasibility Study.



2. INTRODUCTION

2.1 Scope of Study

The following Technical Report (the Report) presents the results of the Preliminary Economic Assessment (PEA) for the development of the Shymanivske deposit in the KrivBass iron ore basin (Kryviy Rih) of the Dnepropetrovsk Region in Ukraine. In January 2011, Black Iron Inc. (Black Iron) commissioned the engineering consulting group BBA Inc (BBA). to perform this Study. This report was prepared at the request of Mr. Matt Simpson, CEO of Black Iron. Black Iron is a Canadian iron ore exploration and development company listed on the Toronto Stock Exchange (TSX) under the symbol BKI, with its head office situated at:

65 Queen St. West
Suite 800
Toronto, ON
Canada, M5H 2M5
Tel: (416) 861-5932

This Technical Report titled “Preliminary Economic Assessment of the Shymanivske Iron Ore Project” was prepared by a Qualified Person following the guidelines of the “Canadian Securities Administrators” National Instrument 43-101 (effective June 20, 2011), and in conformity with the guidelines of the Canadian Mining, Metallurgy and Petroleum (CIM) Standard on Mineral Resources and Reserves.

This Report is considered effective as of December 14th, 2011.

2.2 Sources of Information

This Report is based in part on, metallurgical testwork, internal company technical reports, maps, published government reports, company letters and memoranda and public information, as listed in Section 27 “References” of this Report. Sections from reports authored by other



Consultants may have been directly quoted or summarized in this Report, and are so indicated where appropriate.

It should be noted that the authors have relied upon selected portions or excerpts from material contained in the following NI 43-101 compliant Technical Report. This Report is publicly available on SEDAR (www.sedar.com):

“Resource Estimate - Shymanivske Deposit in Ukraine Technical Report NI 43-101”, dated January 2011, prepared and signed by Hugues de Corta.

This PEA has been completed using the previously mentioned Technical Report as well as available information contained in, but not limited to the following reports and documents:

- Grindability characteristics of the ore from the Shymanivske deposit conducted by SGS Lakefield (SGS);
- Report of baseline mineralogical and metallurgical characteristics as well as a report on the development of a beneficiation process by Mekhanobrchermet (MCM);
- Block model developed by independent QP, Hugues de Corta;
- A conceptual process flowsheet developed by BBA based on similar operations;
- Internal and commercially available databases and cost models;
- Data verification report on the Twin Drillhole Program by WGM;
- Market study report provided by CRU Strategies.



2.3 Terms of Reference

Unless otherwise stated:

- All units of measurement in the Report are in the metric system;
- All costs, revenues and values are expressed in terms of Canadian (CAD) Dollars;
- A foreign exchange rate of \$1.00USD = \$1.00CAD = 7.69 UAH, was used.

2.4 Site Visit

As per Black Iron's request, BBA completed multiple site visits. The multiple site visits took place between October 2010 and August 2011. The primary objective of the site visits was to verify the site conditions and existing database, identify risks and major deficiencies in the Project that need to be investigated and, to comment on the reasonableness of the Project's fundamentals for further study and potential investment and development. Black Iron staff was available for discussion and provided a tour of the Property and facilities. BBA performed a visual examination of selected drill cores retrieved from ongoing twin drillholes and advanced exploration drilling programs. The core storage facility was inspected, the existing QA/QC procedures were checked and the first composite sample for metallurgical testing was selected. A helicopter fly-over of the project land was used to determine the best project infrastructure and layout.



3. RELIANCE ON OTHER EXPERTS

BBA prepared this Report using reports and documents as noted in Section 27 “References” of this Report. BBA has not verified the legal titles to the Property nor any underlying agreement(s) that may exist concerning the licenses or other agreement(s) between third parties, but has relied on Black Iron to have conducted the proper legal due diligence. Any statements and opinions expressed in this document are given in good faith and in the belief that such statements and opinions are not false and misleading at the date of this Report.

It should be understood that the Mineral Resources presented in this Study are estimates of the size and grade of the deposits, based on a certain number of drillholes and samples and on assumptions and parameters currently available. The level of confidence in the estimates depends upon a number of uncertainties. These uncertainties include, but are not limited to, future changes in metal prices and/or production costs, differences in size, grade and recovery rates from those expected, and changes in project parameters. In addition, there is no assurance that the project implementation will be realized.

BBA had the responsibility for assuring that this Technical Report meets the guidelines and standards stipulated. Certain sections of this Report however, were contributed by WGM, CRU Strategies, Hugues de Corta, or other Black Iron consultants. Table 3.1 outlines responsibility for the various sections of the Report.



Table 3.1: Technical Report Section List of Responsibility

Section Number	Section Title	Responsibility	Comments and Exceptions
1	SUMMARY	BBA	
2	INTRODUCTION	BBA	
3	RELIANCE ON OTHER EXPERTS	BBA	
4	PROPERTY DESCRIPTION AND LOCATION	BBA/BKI	
5	ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY	Hugues de Corta	
6	HISTORY	Hugues de Corta	
7	GEOLOGICAL SETTING AND MINERALIZATION	Hugues de Corta	
8	DEPOSIT TYPE	Hugues de Corta	
9	EXPLORATION	Hugues de Corta	
10	DRILLING	Hugues de Corta/BKI	
11	SAMPLE PREPARATION, ASSAYING AND SECURITY	Hugues de Corta	
12	DATA VERIFICATION	WGM	
13	MINERAL PROCESSING AND METALLURGICAL TESTING	BBA	
14	MINERAL RESOURCE ESTIMATE	Hugues de Corta/BKI	
15	MINERAL RESERVE ESTIMATE	BBA	
16	MINING METHODS	BBA	
17	RECOVERY METHODS	BBA	
18	PROJECT INFRASTRUCTURE	BBA	
19	MARKET STUDIES AND CONTRACTS	BBA	Source: Black Iron's independent consultant CRU Strategies is not considered as a QP



Section Number	Section Title	Responsibility	Comments and Exceptions
20	ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT	BBA	
21	CAPITAL AND OPERATING COSTS	BBA	
22	ECONOMIC ANALYSIS	BBA	
23	ADJACENT PROPERTIES	BBA	
24	OTHER RELEVANT DATA AND INFORMATION	BBA	
25	INTERPRETATION AND CONCLUSIONS	BBA	
26	RECOMMENDATIONS	BBA	
27	REFERENCES	BBA	



The following Qualified Persons (QP), as such term is defined by NI 43-101, have contributed to the writing of this Report and have provided the requisite QP certificates included at the beginning of this Report. The information contained in the certificates is outlined in the sections of this Report that each of the QPs are responsible for.

- André Allaire, BBA
- Hugues de Corta, Independent
- Richard Risto, WGM

The individuals listed below, who have contributed to the completion of the PEA Study and to this Report, have extensive experience in the mining and metals industry or in a supporting capacity in the industry. They are not considered as QPs as defined by NI 43-101, for the purpose of this Report.

▪ Nikola Vukovic	M.Eng. (Mining Engineering)	BBA
▪ Enzo Palumbo	M.Eng. (Metallurgical Engineering)	BBA
▪ Angelo Grandillo	M. Eng. (Metallurgical Engineering)	BBA
▪ Farshid Ghazanfari	Geologist	Black Iron
▪	Iron Ore Market Specialists	CRU Strategies

Black Iron retained the services of CRU Strategies, a division of CRU Limited, to perform a market study to evaluate potential target markets for the Black Iron Shymanivske iron ore concentrate and/or pellets. BBA has reviewed the contents of the market study report and believes that it provides a reasonable overview of the past and current iron ore market as well as projections according to various recognized sources.

Drill core samples collected and prepared by Black Iron were submitted to Mekhanobrchermet Institute in Kryviy Rih in Ukraine, and SGS Lakefield Research in Lakefield Ontario, which is an accredited laboratory. Although BBA has reviewed the testwork results generated by Mekhanobrchermet and SGS and believes that they are generally accurate, BBA is relying on Mekhanobrchermet and SGS as independent experts.



4. PROPERTY DESCRIPTION AND LOCATION

4.1 Property Location

The Shymanivske iron ore deposit in Ukraine is strategically situated between Europe, Russia, Asia and the Middle East. It encompasses an area of 256 ha and is located approximately 330 km southeast of Kiev, in the well-known iron ore mining district of KrivBass. KrivBass is the heart of the mining and metallurgy in the country, containing 42% of Ukraine's ore reserves. The mine site is located 8 km south of the city of Kryviy Rih and Black Iron currently holds an extraction permit for this property. Figure 4.1 shows a map of Ukraine with the project site location. The pit is centered at approximately 47°50'N latitude and 33°16'E longitude. Zelenivske, also shown in Figure 4.1 is another undeveloped iron ore deposit for which Black Iron holds an exploration permit.

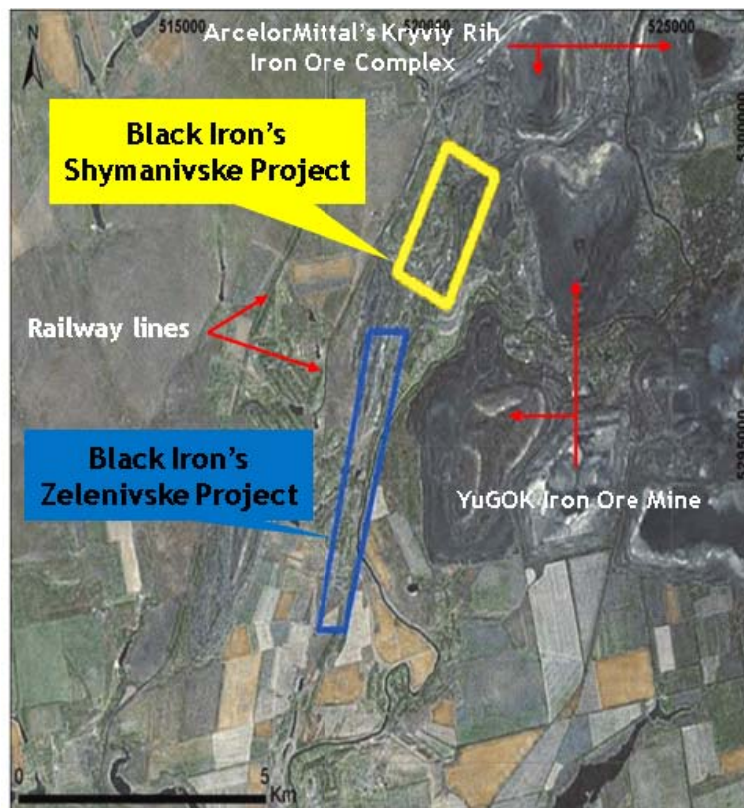


Figure 4.1: Map of Ukraine with Project Location

4.2 Property Description and Ownership

The existing Special Permit No. 4537, issued on November 1st, 2007 covers 2.56 km² of land and is valid until 2024 with the ability to renew in 20 year increments. The permit authorizes the extraction of the subsurface ferrous quartzite minerals from the Shymanivske deposit. The Shymanivske land is entirely owned by the Ukrainian state.

The east and south side of the project development faces some space limitations due to the close proximity of active mine operations and infrastructure. However, on the west side of the existing mining lease, the presence of approximately 2,600 hectares of land owned by the Ministry of Defense (which has indicated a willingness to lease or sell) should be more than sufficient to support project development and further expansions. Figure 4.2 is a local map presenting the existing infrastructure and site conditions surrounding the project footprint.

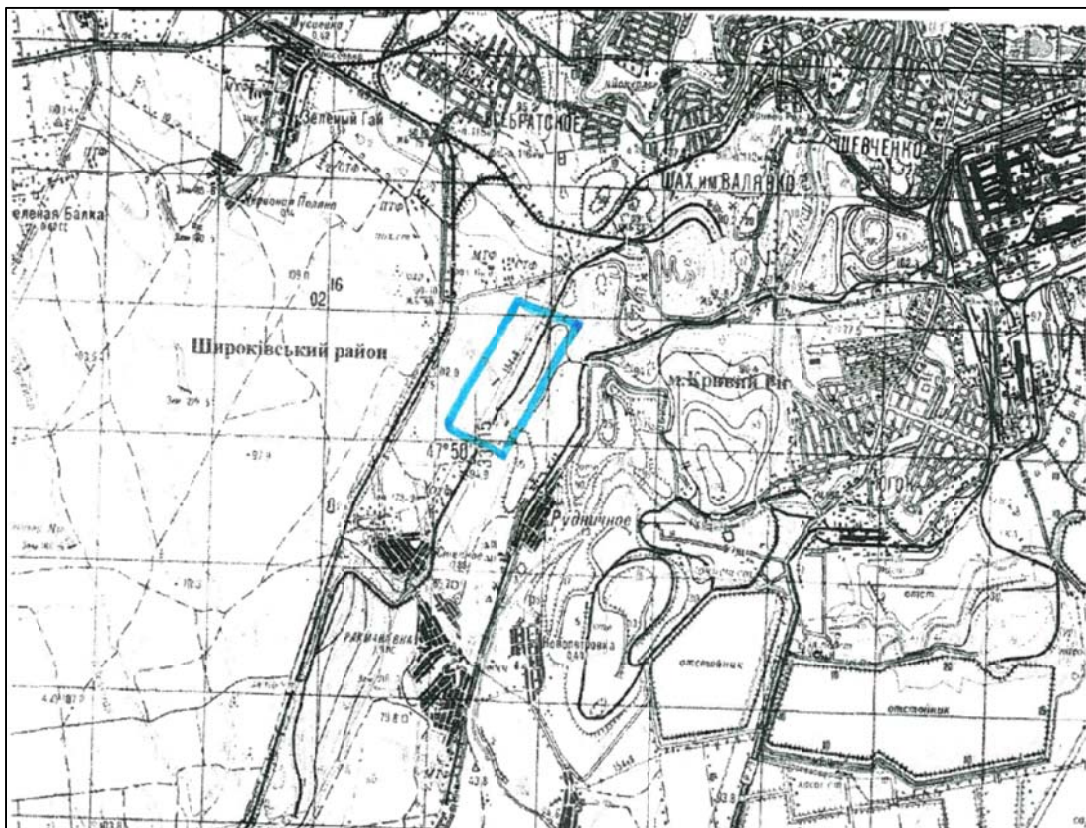


Figure 4.2: Local Map with Deposit Location and Existing Infrastructure



In order to maintain the active mining licence, the following work program is required by Ukraine Government. During the site visit, it was confirmed that scheduled work prior to the fourth quarter of 2011 has been completed and the new revised work program was received, outlining the program activities up to 2014. Table 4.1 presents the type of work and time schedule for the planned activities with items shaded in grey being completed.

Table 4.1: Program of Work Under Special Permit No. 4537

Type of Work	Beginning	End	Estimated Cost CAD\$
Creation of computer geodatabase	1 qt 2005	2 qt 2005	6,500
Collection of necessary technical data before starting the mining method design option	2 qt 2005	3 qt 2006	2,600
Prior to the project, analyze options and select the mining method. Estimate the influence on the environment	3 qt 2005	3 qt 2006	34,460
Prepare topographic map of territory where the mine is located for design work in 1:1000 scale; mine plan (boundaries)	4 qt 2006	4 qt 2009	39,000
Collection of “pre-project materials on development of Shymanivske field”	1 qt 2010	4 qt 2010	2,600
Preparation of project development works (mining part)	1 qt 2011	3 qt 2012	103
Preparation and approval of a draft mining allotment	4 qt 2012	4 qt 2013	39,000
Construction of site infrastructure, procurement of equipment for the extraction of ferriferous quartzites	1 qt 2014	4 qt 2017	11,730,500
Construction of concentrator and pellet plant	1 qt 2016	4 qt 2017	52
Start of mine development and extraction of ferriferous quartzites	1 qt 2018	4 qt 2024	1,300,390



4.3 Property Agreements

A land Consultant was hired by Black Iron to perform a detailed “land audit” of the required project lands. The audit confirmed that the Shymanivske lands (256 ha), forestry land (76 ha) and military land (2,600 ha) are all owned by the Ukrainian state (as opposed to private owners). Black Iron is currently in discussion with the military regarding the acquisition of the 2,600 ha of military land and is in the process of signing a Memorandum of Understanding (MOU) summarizing the basic terms of a transaction. In addition, Black Iron submitted an application for the Shymanivske lands (256 ha) to the Kryviy Rih City Council. A similar application for the forestry lands (76 ha) is expected to follow in due course.

Black Iron is not aware of any environmental liabilities or any royalties attached to the Property, other than levies that are payable to the Ukrainian Government, currently estimated at \$0.40USD per tonne mined, based on the expected grade at the Shymanivske Project.

4.4 Permitting

Black Iron does not currently have the necessary surface rights to conduct mining activities on the Shymanivske Project. However, surface rights are not required to conduct the proposed exploration activities. A mining allotment for the Shymanivske Project will be obtained post-completion of the Feasibility Study, as many of the inputs required to obtain this permit are generated during the study, slated to kick-off in early 2012.

5. ACCESSIBILITY, CLIMATE, LOCATE RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Access

The Government owned Pridneprovsk Rail System is located within 2 km of the Shymanivske Property. A letter dated July 13th, 2010 received from the railway managers, confirms their readiness and ability to rail at least ten million tonnes of iron ore product produced by Black Iron to various Black Sea ports.

The roads from Kryviy Rih to the Shymanivske site are mostly paved with asphalt and the final few kilometers are comprised of a solid stone base as shown in Figure 5.1. Very close to the site is a small bridge with a 20 m span that is 10 m wide and is functional and well maintained.

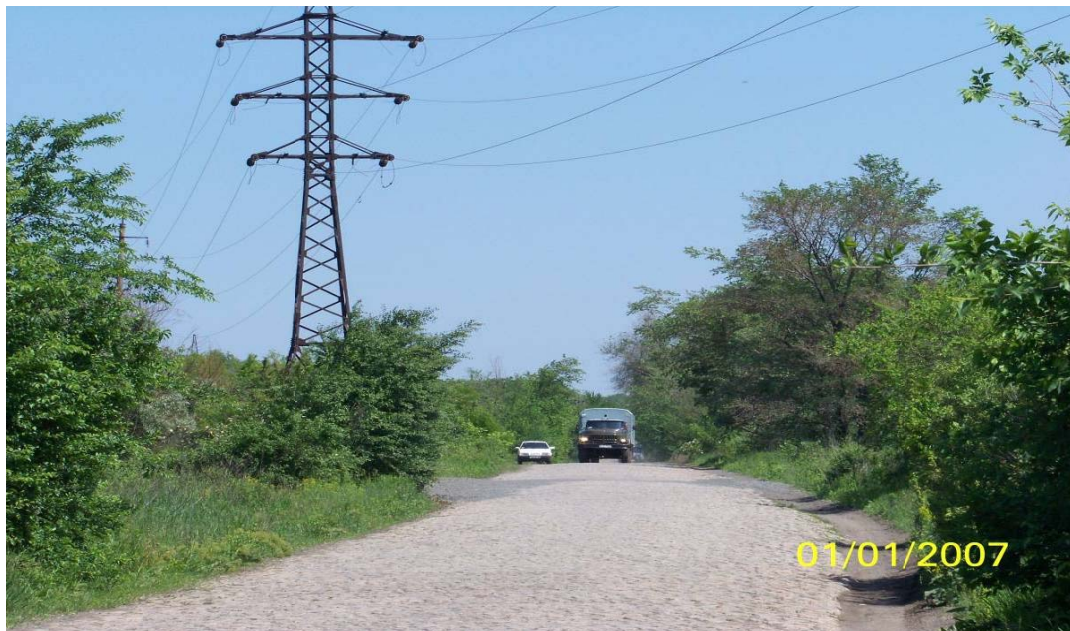


Figure 5.1: Road Access to the Property

The Shymanivske deposit is approximately 160 km away from the Dnipropetrovsk International Airport, which provides airline services to major European countries and the Middle East.



There are five ports ranging from 140 km to 520 km away from the site including Odessa, Kerch, Yuzhny, Izmail and Nikolaev. The preferred port for Black Iron is Yuzhny, which is 392 km away.

5.2 Climate

The climate of the Kryviy Rih region is temperate continental with an average annual temperature of +8.3°C. The average temperature in the coldest month of January is 4.9°C. The maximum temperature in the hottest month of July is +38°C. The average snow depth is 10-14 cm and the maximum frost penetration is between 0.8-1.0 m.

The relative humidity during the winter is 80-85% and 55-60% during summer. The average annual precipitation is between 400-600 mm. The prevailing winds are from the east and north-east.

5.3 Local Resources and Infrastructure

The Shymanivske Property is located 8 kilometers south of Kryviy Rih - a major city with a population of approximately 750,000 people. There are universities and trade schools which in large part, exist to supply direct and indirect labour to the local iron ore mines. High voltage power lines run a few kilometres from the Property. Hence, the Property is well-positioned to access a source of existing skilled labour, water and the regional power grid.

5.4 Physiography

The topography of the deposit is even with general sloping to the south-east. The central part is divided by the valley of Tymashova, which runs south-east towards the Ingulets River. The highest altitude within the Property is in the western part (where an old underground direct ship iron ore mine shaft is located) at +100 m, as compared to the eastern part (near old shafts from the YUGOK mine) at +80 m, while the central part is lower, ranging from +20 m to +44 m. The lowest altitude is the valley of Tymashova (+12.8 m) and riverbed of the Ingulets River (+5.29 m). The overburden consists of a flat lying formation of carbonates from the Cenozoic



period, which varies in thickness from 9.7 m to 21.2 m with an average of 16 m. The vegetation consists mainly of grassy pastures and shrubby areas.

The original topography was slightly modified by human activity. There are three small quarries from excavation of high grade iron ore and building materials (limestone, bentonite, clay and sand).



6. HISTORY

The Property was originally owned by the former USSR Government and subsequently Ukraine Government upon breakup of the USSR in 1991. In 2001, the Property was purchased by Geo Alliance Group Limited and on October 25th, 2010, Black Iron acquired the Property.

6.1 Shymanivske Deposit History

Historical geological exploration works carried out on the joint Likhmanovsky syncline and Tarapako- Likhmanovsky anticline (recent name – Shymanivske deposit) can be divided into four periods:

- the first period up to 1965;
- the second period from 1965-1978;
- the third period from 1982-1984;
- the fourth period from 1985-1989.

Within the limits of the Likhmanovsky syncline, the first geophysical survey was executed between 1925 and 1927. All geophysical works completed up until 1947 in KrivBass were summarized in 1949 by the Chair of Geophysics from the Dnepropetrovsk Mining Institute. During this period, new maps (scale 1:100,000) were created with geological interpretation based on geophysical results. Between 1953 and 1955, the southern part of the Tarapako- Likhmanovsky anticline and the adjacent part of Likhmanovsky syncline were covered by geophysical surveys. Magnetic prospecting was carried out on a tightly spaced grid measuring 20x50 m and gravity prospecting using variometers on grid spacings of 40x100 m. All of these works were performed by agencies of the former USSR.

In the period leading up to 1965, all exploration work was carried out on high grade iron ore located in the Likhmanovsky syncline which belongs to the contact of the Gdantsevsky and Saksagansky suites. Thirty-two holes were drilled with a total length of 6,818 m. Depths of holes varied from 10 to 500 m.



From 1965 to 1967, exploration work was carried out by an entity known as Inguletsky GRP of Trust “Krivbassgeologiya” along the strike of the Likhmanovsky syncline, and parts of the Shymanivske deposit. The work was conducted to estimate the general direction of iron ore bands; to specify the geological structure; to define various material types; and to determine if the chemical and processing characteristics of rocks from the fourth and fifth ferriferous horizons were a possible source for ore supply to existing beneficiation complexes in the southern part of KrivBass. As a result of this work, the existing resources of ferriferous quartzites were classified as a category similar to Inferred. At the same time, the former Central GDS of Trust “Krivbassgeologiya” carried out the exploration work in the southern part of the Tarapako-Likhmanovsky anticline with the purpose of clarifying the site’s geological structure and quality of the unoxidized quartzites contained in the first and second ferriferous horizons. Altogether, nine holes with a total length of 2,580 m were drilled in the period between 1965 and 1976.

During the 1977-78 period, the Central GDS of Trust “Krivbassgeologiya” carried out work on site to estimate the ferriferous quartzites together with low ore quartzites of the Valyavkinsky and Skelevatsky magnetite deposits. The results of the estimation from this period (Zelskaya L.N.) formed the basis for a technical study and development of the low ore quartzites of Likhmanovsky and the basic synclines of KrivBass. This study was completed by the Yuzhhyprorud Institute.

The first study of ferriferous quartzites from the Shymanivske deposit, stratigraphically located on the contact of the Gdantsevsky and Saksagansky layers of Krivorozhsky series (deposit “Skladka Rudneva”) as a source of iron ore for production of magnetite concentrate, was performed in 1982. Between 1982 and 1984, the Yuzhhyprorud Institute performed additional drilling and carried out a technical study that was approved by TsKZ from the USSR Ministry of Ferrous Metals. Thirty-two holes were drilled with a total length of 9,903 m. The preliminary technical study was based on ferriferous quartzites of the I, II, IV and V ferriferous horizons from the Shymanivske deposit as a possible additional source of ore for the NKODPE beneficiation plant.



Between 1986 and 1988, the same institute, based on additional drilling, created a Feasibility Report outlining development plans in more detail.

6.2 History of Estimates

Two previous estimates of resources were carried out by former USSR organizations on the Property. These estimates were categorized with the then existing classification system of B, C1 and C2 categories, which are similar but not equivalent to actual CIM standards of Measured, Indicated and Inferred.

According to this system, mineral concentrations were divided into seven categories in three (3) major groups based on the level of exploration performed, as set out in Table 6.1.

Table 6.1: Major Groups Based on Level of Exploration

CIS Classification	CIS Categories	Comparable CIM Classification
Explored Resources	A and B	Measured Resources
Explored Resources	C1	Indicated/Measured Resources
Evaluated Resources	C2	Inferred/Indicated Resources
Prognosticated Resources	P1, P2 and P3	Exploration Data

In 1989, a graphical estimate was produced. The method of estimation is described in Section 6.3 with results summarized in subsequent tables.

In 2005, a computerized estimate was produced by digitizing all of the previous data using Micromine software. All of the original computations and results were lost but the database was kept intact. This database is the one used for the current estimate and is described in Section 6.4.



6.3 1989 Mineral Estimates

The first Resource Estimate available was done in 1989. It was done “by hand” on scaled drafting paper. Here are the main points of the methodology used.

“The estimation of unoxidized ferriferous quartzites is executed at magnetite iron (Fe_{mag}) cut-off grades (COG) of 16%, 12%, and 10%, and oxidized quartzites are estimated at total iron (Fe_{tot}) COGs of 30% and 26%.”

The extent of the deposit is 2 km long by 1.2-1.5 km wide.

The main goals of the work were:

- General estimation of iron-ore bands;
- Specification of geological structure;
- Studying of material and chemical compounds;
- Evaluate the properties of rocks contained in the fourth and fifth ferriferous horizons from the point of view of industrial treatment.

The standards confirmed by GKZ (State Commission on Resources) of the former USSR on September 12th, 1988, are the basis for the calculation of ferriferous quartzite resources. These standards are described as follows:

- The COG of Fe_{mag} in assays for contouring of ore bodies is 10%;
- The minimum thickness of ore bodies and maximum thickness of streaks of waste rocks and non-standard ores included in the calculation of resources is 10 m;
- To calculate the resources in the contours of the open pit in the Feasibility Report, a maximum depth of 250 m from surface was used.



To determine the resources from oxidized quartzites (sx5f), a cut-off grade of 28% was used and the minimum thickness of ore bodies and maximum thickness of streaks of waste rocks and non-standard ores included in calculation of resources was 10 m.

As one can see from Table 6.2, the ferriferous quartzite resources supplied for approval are a little bit lower than in the confirmed constant standards. The difference in Resource Estimates is the reflection of a recent interpretation of the historic geological data using a modern system for data validation.

Table 6.2: Summary of Resource Estimate with a Fe_{mag} COG of 10%

Confirmed in Constant Standards			Supplied for Approval to GKZ of the USSR			Difference		
Resource	Iron Content %		Resource	Iron Content %		Resource	Iron Content %	
	Fe_{tot}	Fe_{mag}		Fe_{tot}	Fe_{mag}		Fe_{tot}	Fe_{mag}
364.0 Mt	31.52	20.37	332.0 Mt	32.0	19.89	- 8.8 %	+0.48	-0.48

The details of the method used for this Resource Estimate are as follows:

The most expedient method to calculate the unoxidized ferriferous quartzites is using vertical sections. This method of calculation of resources is accepted for all deposits of KrivBass, and is now used by the operating mines. Contacts of resource units by holes are connected with geophysical data. Intra-unit non-standard streaks with true thickness more than 10 m are contoured on sections and excluded from the calculation. The contours of bedded units were drafted on vertical sections and horizontal geological plans.

Calculation of average contents of Fe_{tot} and Fe_{mag} were made by the average weighted method by weighting ordinary assays with their length in the drillhole intersections.

For each geological section, the surface of the polygons contouring the corresponding category of resources was calculated. The average content of Fe_{tot} and Fe_{mag} was calculated as the average weighted content of drillholes intersecting the given area.

**Table 6.3: Content of Fe_{tot} and Fe_{mag} by Ferriferous Horizons**

Name of Resource	Number of Samples	Average Value of Volume Weight, t/m ³	Content of Fe _{tot} %	Content of Fe _{mag} %
Unoxidized Quartzites				
Sx1f	93	3.40	31.9	18.06
Sx2f	200	3.42	33.4	19.98
Sx4f	134	3.39	31.8	18.85
Oxidized Quartzites				
Sx5f	21	3.31	31.6	1.73

Since average densities for the first (sx1f), second (sx2f) and fourth (sx4f) ferriferous horizons are very close, as seen in Table 6.3, differing from each other by less than 1%, the calculation of resources for unoxidized quartzites was done using a uniform volume weight of 3.4 t/m³.

Deleterious impurities (phosphorus and sulphur content) were defined by results of analyses of bulk assays. Their values are considerably below the maximum permissible (phosphorus – 0.079-0.094%, sulphur – 0.114 – 0.143%).

The computed areas of mineralized zone were defined by planimetry on geological sections drawn on scaled paper. The divergence between the basic and control measurements of the areas was estimated at no more than 3%.

Computation of resources and allocation of blocks of resources according to different categories is based on the cut-off grade of Fe_{mag}.

Resources of unoxidized ferriferous quartzites are carried to category B in the most studied sites of the deposit between cross sections two and five (their locations are shown in Figure 6.1).

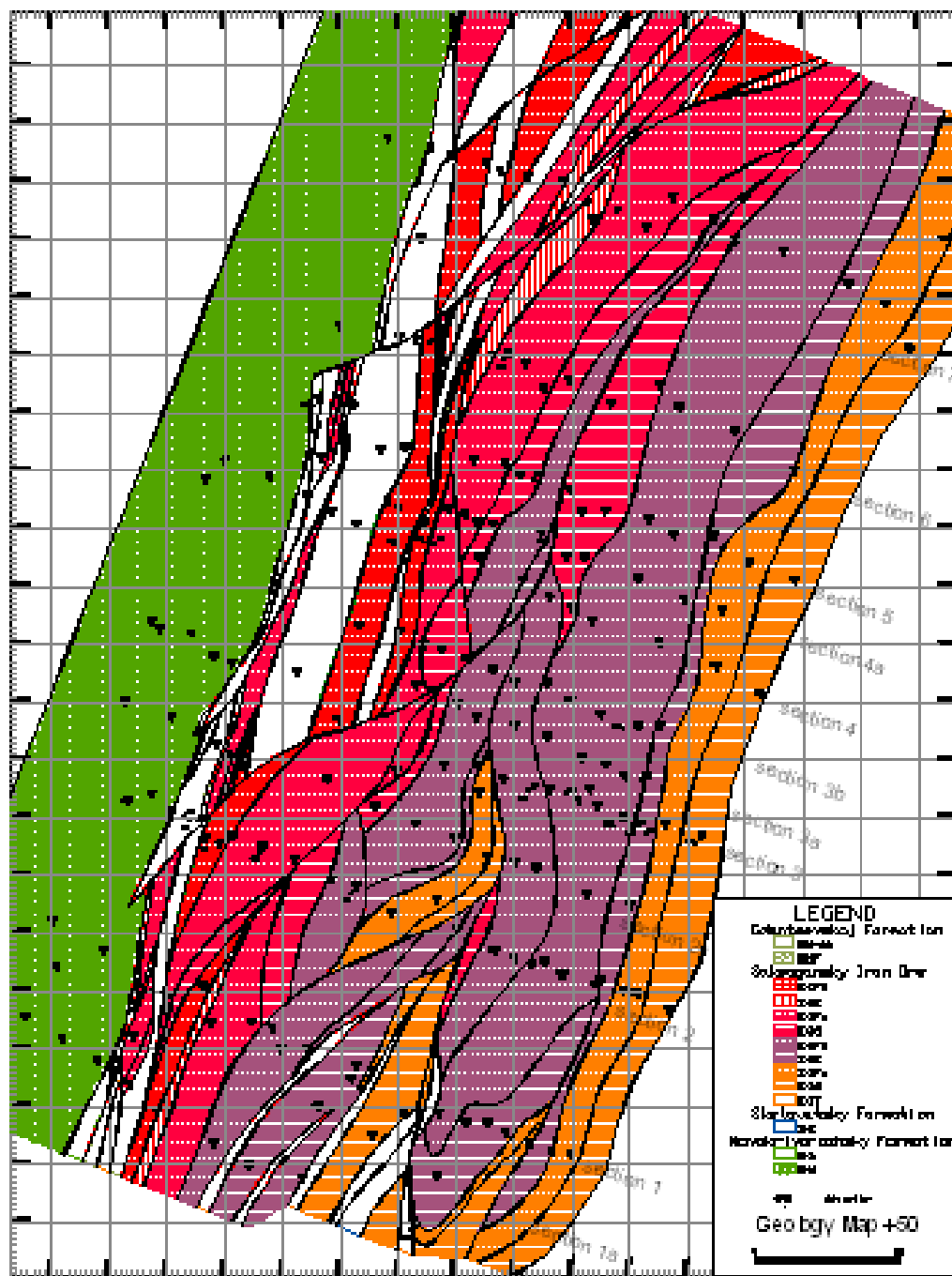


Figure 6.1: Geology Map of Level +50 m with Drillholes and Cross Section Location



Distance between holes down dip of formations varies from 40 to 130 m, mainly 90-100 m. On the strike of mineralized zone, the distance between cross sections varies from 80 to 146 m. Fluctuations in lengths of blocks of category B are connected with the locations of the cross sections.

It is necessary to note that in a single case (Sections 2a, 3), where a fault passes between two holes 50-80 m apart and which have crossed the same strata of ferriferous quartzites, the area of calculated blocks was limited by that fault.

Resources of unoxidized quartzites are carried out to category C1 from 182-305 m on strike and 120-240 m down dip of drillhole intersections.

Resources of ferriferous quartzites are carried out to category C2, under condition of their thinning, by crossing of individual holes with extrapolation of 200-300 m.

Category B resources are constituted by the mineralized zone of the second ferriferous horizons (sx2f) and in a rather small amount by the first ferriferous horizon (sx1f), as shown in Figure 6.1.

The second ferriferous horizon (sx2f) has the highest quantity of resources of category B in the so-called eastern, central, and western mineralized zones.

The mineralized zones of the fourth ferriferous horizon (sx4f) are crossed by no more than two to three holes on a section, therefore all resources are carried to category C1 (except on edges, where they are carried to category C2).

Table 6.4 and Table 6.5 summarize the Resource Estimate by both ferriferous horizon and by category.

**Table 6.4: Resources Presented by Category in the Contour of the 1989 Open Pit**

Ferriferous Horizons	Resources Mt.	Fe_{tot} %	Fe_{mag} %
Category B			
sx1f	6.002	31.5	17.45
sx2f	80.811	32.5	20.34
Total	86.813	32.4	20.14
Category C1			
sx1f	24.150	30.8	17.51
sx2f	137.403	31.6	19.84
sx4f	74.409	32.7	20.41
Total	235.962	31.9	19.78
Category B+ C1			
sx1f	30.152	31.0	17.50
sx2f	218.214	31.9	20.02
sx4f	74.409	32.7	20.41
Total	322.775	32.0	19.87
Category C2			
sx1f	1.170	33.1	18.34
sx4f	8.005	32.3	20.52
Total	9.175	32.4	20.24

Table 6.4 and Table 6.5 are taken from the 1989 technical report which was written in accordance with former USSR norms. The historical estimate remains relevant as the most recent and disclosable Resource Estimate of the Shymanivske Project, and establishes the historical continuity of a resource at the site. A further Resource Estimate was made in 2005 and confirmed the 1989 calculations.

In the contour of the open pit, resources of category B represent 26.9 % of the total. Resources of category C2 make less than 3 % from the general resources of the deposit; thus do not materially impact the viability of the deposit going into production.

According to constant standards within the design contour of the open pit, the oxidized quartzites of the fifth ferriferous horizon (sx5f) are also computed. The resources of categories



C1 and C2 are 3.672 Mt. and 19.286 Mt., with an Fe_{tot} content of 33.5 % and 34.4 % respectively.

Resources of unoxidized and oxidized ferriferous quartzites below the design contour of the open pit, down to a depth of 500 m from the surface, are classified primarily in category C2 with a small amount in C1 (within depths of 300 m adjoining the design contour of the open pit). Their quantity and quality are summarized in Table 6.5.

Table 6.5: Resources Below the Design Contour of Open Pit Down to 500 m Depth

Ferriferous Horizons	Resources Mt.	Fe_{tot} %	Fe_{mag} %
Unoxidized Quartzites			
Category C1			
sx1f	23.402	30.6	17.93
sx2f	2.241	29.8	15.84
Total by Category C1	25.643	30.6	17.75
Category C2			
sx1f	90.640	31.0	17.08
sx2f	92.427	31.8	18.47
sx4f	301.907	30.6	18.88
Total by Category C2	484.974	30.9	18.46
Oxidized Quartzites			
Category C2			
sx5f	93.223	31.9	4.05

The resources of unoxidized quartzites, which have been calculated in categories B+C1, total 322.8 Mt, as shown in Table 6.4.

The main type of unoxidized ferriferous quartzite is made of silicate and magnetite with an Fe_{mag} content greater or equivalent to 16%. These quartzites compose the central part of the mineralized zone, making up to 70-77% from all calculated resources.

Magnetite-silicate quartzites with an Fe_{mag} content of 10-16% represent 23-30% of the deposit and compose transitional packages containing crystalline rocks.



Average contents of iron are rather homogeneous both on strike and down dip. The average content of Fe_{tot} is 32% and Fe_{mag} is 19.89%. The average content of deleterious impurities, sulphur and phosphorus, are insignificant and do not exceed values (0.3%) admissible at metallurgical treatment. The content of other components such as Mn, C, Ti, etc., are also insignificant.

6.4 2005 Estimate

In 2005, the Russian company, Geo Inter Consulting, produced an estimation of resources using Micromine software. The Micromine results and files cannot be located but the database used to execute the work is still available and was provided by the Client for the current evaluation (presented in Section 14.2).

The 2005 estimate report outlines the results of work performed: Methodical management and creation of a computer database containing iron ore deposits for the purposes of computer modeling to estimate the resources/reserves of iron quartzite of the Shymanivske deposit, licensed and validated by research-and-production investment group Interpajp (NPIG).

For the creation of the database, and at the request of Geo Inter Consulting, the company NPIG had digitized two geological reports. The first report is a preliminary investigation of quartzites I, II, IV and V (sx1f, sx2f, sx4f and sx5f) as contained in the Shymanivske iron formation, and was carried out by the Krivirozskoi prospecting institution GTO Yuzikriologij in 1982-1984. A second similar report was carried out by the Krivirozskoi prospecting institution between 1984-1989. These reports were used to create the database in addition to using TIFF images. The quality of the given text and tabulated material was satisfactory and did not create difficulties for translation into digital format. All graphics were scanned preserving original scale, without distortions.

The database was created by importing CSV, DXF and XLS formats of tabular data into the Micromine platform. The scanned images in TIFF format then subsequently were converted to UTM WGS84 system and used to create sections in Micromine.



6.4.1 Documents Related to Prospecting Works and Creation/Structure of the Database

For creation of the Shymanivske iron quartzite deposit, geological database results of the preliminary and detailed investigation conducted from 1982-89, performed by the Krivorzskoi prospecting expedition, and also data of earlier exploration programs, were used. During the preliminary and detailed investigation process, 215 holes were drilled and the following sample analysis was conducted:

- 5,168 samples were tested for "Fe percentage";
- 4,726 samples tested for "Fe magnetic characteristics";
- 283 samples went through full chemical analysis and definition of "Fe magnetic characteristics".

To ensure thorough quality control of the work, 393 internal control tests were performed, a further 393 external control tests were made, and 236 spectral analyses were also done. The database that was created, based on results of exploration work, has the following structure:

Basic Database Files (the files directly used for modeling):

- "Testing" (Assay);
- "Lithology" (Litho);
- "Drillhole collar" (Collar);
- "Inclinometry" (Survey);
- "3-D drillhole coordinates" (Coord).

Additional Database Files (data or auxiliary files used during interpretation, modeling, and estimation of the deposit):

- "Analyses of group tests" (Bulk Assay);
- "Geotechnical tests" (Geotech);



- "Spectral analysis" (Fire Assay);
- "Internal control of not oxidized quartzites" (Internal Control fresh quartzite);
- "Internal control of the oxidized quartzites" (Internal Control oxide quartzite);
- "External control of not oxidized quartzites" (External Control fresh quartzite);
- "External control of the oxidized quartzites" (External Control oxide quartzite);
- A geological map of the surface Proterozoic formations (horizon + 50m) - the Project with files DXF (Geology Map +50m) and file in Micromine format (Plot_Geology Map +50m);
- A geological horizons map (-90) - the Project with files DXF (Geology Map-90m) and a file in Micromine format (Plot_Geology Map-90m);
- Generated in Micromine environment on high-altitude marked drillhole collars with surface map (Topo Map);
- A Legend with stratigraphic codes (Legend Litho).

6.4.2 Database and the Technique for its Creation

In the database, electronic files have English names for universal use by systems with no "Cyrillic" alphabet, and for an opportunity to be used by experts with no knowledge of the Russian language. Also, the names of columns in files are presented in both Russian and English for the above specified reason. For data input, English symbols were used only, and, as a divider, dots were used for fractional numbers that are necessary for recognition in specialized software file applications. Each data set and file structure formatting was carried out to meet requirements of specialized programs used for computer modelling.

6.4.3 File Assay

The file assay summarizes data results from ordinary chemical analyses and tests (regular assay) conducted during the exploration stage as carried out in the Krivorozhskoj chemical laboratory. Preparation tests were also carried out in the same laboratory. To create the Assay file, tables with results of ordinary test ore samples for definition of "total iron" and "magnetite percentage" iron characteristics, were used. Data input was performed by hand using two different operators who created a duplicate file to be used for checking of exceptional results



and mistakes in input. The questionable or error input files were corrected under "primary source", and "adjusted" files were generated. "Adjusted" files were brought and imported into the Micromine environment by Geo Inter Consulting experts in accordance with the required formatting for cross-checking and continuation of block modeling work. Work on data input was carried out by Juzjkrgeologij geologists. Control and process management were carried out by the company Geo Inter Consulting.

6.4.4 Structure of the File Assay

▪ Hole ID	▪ Sample
▪ From	▪ To
▪ Length	▪ Fe Total (%)
▪ Fe Magnetic (%)	▪ Core Recovery (m)
▪ Core Recovery (%)	▪ Line #
▪ Sample Theoretical Weight	

6.4.5 Data Volume in File Assay and their Characteristics

The file has data on 215 drillholes including depth of boreholes, started from top to bottom. The missing drilling intervals (no assay), were marked by indexes "ns". Final data on drillhole depths were not retrieved from tables with results from analyses of ordinary tests, but were retrieved from geological profiles and checked and cross-checked with Assay, Collar, Survey, and Litho files.

The assays are available on all drillholes which have intersected resource horizons or zones with iron mineralization (186 drillholes). Exploration drillholes (29 drillholes) which have not intersected zones with iron mineralization and have no assay data but for which there are lithology/stratigraphy data or results, were brought into the Assay file and marked by index "ns" for interpretation and modeling use. Also, in historical data, in drillhole sections with pure or no drillhole core recovery, these intervals were filled with values "ns"; with no definitions.



The historic file has 5,168 tests with definition of "Total Iron" among which 4,726 tests have definition of "Magnetite Percentage". From a total number of 5,168 core samples used for ordinary ore testing, the test results of 5,085 samples were presented, which represents 98.4% of total test results. From a total number of 4,726 tests for definition of "Magnetite Percentage", the data for 4,660 test results were presented, which represents 98.6% of the total test results. On assays (3,096 tests) with 10% Fe content or more (accepted definition for Shymanivske deposits), test results were presented for 3,055 tests, which represents 98.7% of the total test results. Data on theoretical and actual weights of assays/tests have also been entered into the Assay file as additional information contained in exploration reports, used to a certain degree for an estimation of reliability of exploration data.

6.4.6 File Litho

The file with lithologic coding was created based on drillhole profiles. This is unlike drillhole daily logs with data on core description, where more reliable information was practically excluded because of the disagreements in stratigraphic and lithologic (petrographic) interpretation from different explorers/executors at different stages of the exploration work. At the origin, separation/interpretation of geological sections tolerated less detailed information on lithology (petrography) and stratigraphy which is sufficient. Lithology intervals from recorded geological sections were copied out and entered twice by different geologists' interpretations, similar to a technique applied in the Assay file. For stratigraphic and lithologic (petrographic) section separation and computerization of data, the company Geo Inter Consulting developed a "Legend with lithology codes" and with digital alphabetic codes assigned to each separated horizon/level.

After duplicate data entry, a check by subtraction of files based on a digital code was made. The recognized input mistakes were corrected based on a primary source (geological descriptions), and as a result, an adjusted file was generated. Method development and the above specified operations were carried out by geologists and operators and the verification was performed by Geo Inter Consulting. Experts from Geo Inter Consulting then transferred the adjusted files



using the required format for file import into the Micromine software for further cross-checking and modelling.

The results of the 2005 estimate confirm the calculations that were made in 1989.

6.5 2010 Estimate

During the third quarter of 2010, at the request of Black Iron, Genivar consulting company was given the mandate to prepare an NI 43-101 Technical Report on the Shymanivske Property located in the Dnepropetrovsk area of Ukraine.

This Report included a Resource Estimate based solely on the historical data provided by the Client. This data is the same as that established for the 1989 estimate and digitized for the 2005 estimate using Micromine software by Geo Inter Consulting.

This new estimate was carried out on a GEMS software platform (version 6.2). The steps for producing the estimate are described below:

Solid Construction of Lithologic Domains:

The 13 sections provided as TIFF images were georeferenced, and the polygons of the lithologic domains delimited by drill intersections were digitized for each section. To create the solids, the polygons were extruded on each side of the sections at mid distance between the sections and to the Property boundaries for the southernmost and northernmost sections. Each solid was tagged according to its rock code and given the properties of the unit listed in Table 6.6.



Table 6.6: Lithologic Domains

Domains	Rock Code	Waste/Ore	2005 DB Density	Litho
FOX	121	o	3.00	Altered ore
OX	21	w	2.50	Altered waste
NKA	2	w	2.80	Amphibolites
NKM	1	w	2.70	Migmatites
GD1_2S	20	w	2.52	Sandstones
SK2	4	w	2.85	Schists
SK3	3	w	2.85	Conglomerates
SX1F	8	o	3.40	Magnetite-quartzite
SX1S	6	w	3.07	Quartzite-schists
SX1T	5	w	3.07	Quartz-chlorite dyke
SX2F	11	o	3.42	Magnetite-quartzite
SX2S	9	w	3.08	Quartzite-schists
SX4F	14	o	3.39	Magnetite-quartzite
SX4S	12	w	3.13	Quartzite-schists
SX5F	18	o	3.31	Martite-magnetite-qz
SX5S	15	w	3.17	Quartzite-schists

Note; Densities for FOX, OX, NKM and NKA are from general knowledge since no data were provided

Compositing of Assays:

The assays obtained from the database were validated in GEMS for overlaps and inconsistencies, and were composited for Fe_{tot} and Fe_{mag} on 10 m intervals within the different domains.

Block Model:

The block model was built to encompass the projected pit area and go down to the -440 m level. It consisted in 1,299,600 cubes with 10 m sides oriented perpendicular to the sections, along the general strike of the units at 21.5°N.

**Search Ellipse:**

Two search ellipses were built for the categories of measured and indicated. Their parameters are:

Measured	75 m x 100 m
Indicated	120 m x 175 m

The long axis of the ellipses is oriented horizontally along strike (parallel to the columns of the block model).

Interpolation Formula:

The weighted inverse distance formula was used to attribute assay parameters to the blocks from the drillhole intersections. A restrictive value based on two to twelve samples encountered by the ellipses and an enlarged value based on one to six samples was calculated and averaged to obtain the final value.

Volumetric Reporting:

The reporting of tonnage and grades was done after each interpolation pass on each of the four ore lithologies for the two categories of Measured and Indicated resources, and by the following levels:

- From + 60 m (top bedrock level) to – 40 m;
- From – 40 m to – 140 m;
- From – 140 m to – 240 m;
- From – 240 m to – 340 m;
- From – 340 m to – 440 m.

The COG used for reporting is 28% Fe_{tot}.



Method of Estimation and Results:

For each individual solid, initialized with its rock type and density, two separate restrictive interpolation passes and two separate enlarged interpolation passes for the Measured and Indicated ellipses were executed. The volume, tonnage and grade were reported according to the volumetric parameters.

The averaged (avg.) results obtained for the 2010 Resource Estimate are summarized in Table 6.7 and Table 6.8.

Table 6.7: Avg. Results of Resource Estimate for the Ferriferous Units sx1f, sx2f and sx4f

Level	Measured			Indicated		
	Tonnage (kt)	Fe _{tot}	Fe _{mag}	Tonnage (kt)	Fe _{tot}	Fe _{mag}
-40	101,844	31.81	18.72	7,945	31.78	18.69
-140	101,778	31.91	18.67	14,151	31.87	18.75
-240	57,192	31.88	19.29	12,913	31.82	19.4
-340	23,729	32.09	19.22	11,875	32.04	19.79
-440	5,256	29.51	13.85	8,821	29.69	13.59
Total	289,799	31.84	18.77	55,705	31.76	18.75

Table 6.8: Avg. Results of Resource Estimate in the Measured and Indicated Categories sx1f, sx2f and sx4f

Level	Inferred		
	Tonnage (kt)	Fe _{tot} %	Fe _{mag} %
-40	119 295	31.33	18.60
-140	86 831	31.13	18.23
-240	80 850	30.92	17.94
-340	80 323	30.87	18.14
-440	101 594	30.88	18.22
Total	468 892	31.05	18.26



7. GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The Kryviy Rih Belt of Iron Formations (BIF), is of the early Proterozoic age and is very similar to the Lake Superior-type in Canada.

The Kryviy Rih iron ore deposits, within the Kryviy Rih iron basin (KrivBass), are located approximately 330 km southeast of Kiev and 150 km north of the Black Sea in the Ukraine.

They lie within the valley of the Ingulets River and its tributaries, Saksagan and Zheltaya, and extend in a north-northeast direction over an interval of about 100 km. The basin is developed within the crystalline basement of the Kurainian massif, comprising Archaean gneisses, granites, migmatites, amphibolites and schists exposed to the west and east of the 2200-2000 million years Palaeoproterozoic KrivBass geosyncline. The Proterozoic Kryviy Rih series within the KrivBass is divided into three sections:

- A lower arkose-quartzite and phyllitic sequence, with a horizon of talc schists;
- A middle, ore-bearing ferriferous quartzite (banded iron formation - BIF) and slate sequence, which includes nine BIF horizons intercalated with quartz-sericite, chlorite-sericite, slates and microquartzites and;
- An upper, quartzite-sandstone-slate sequence with lenses of marble.

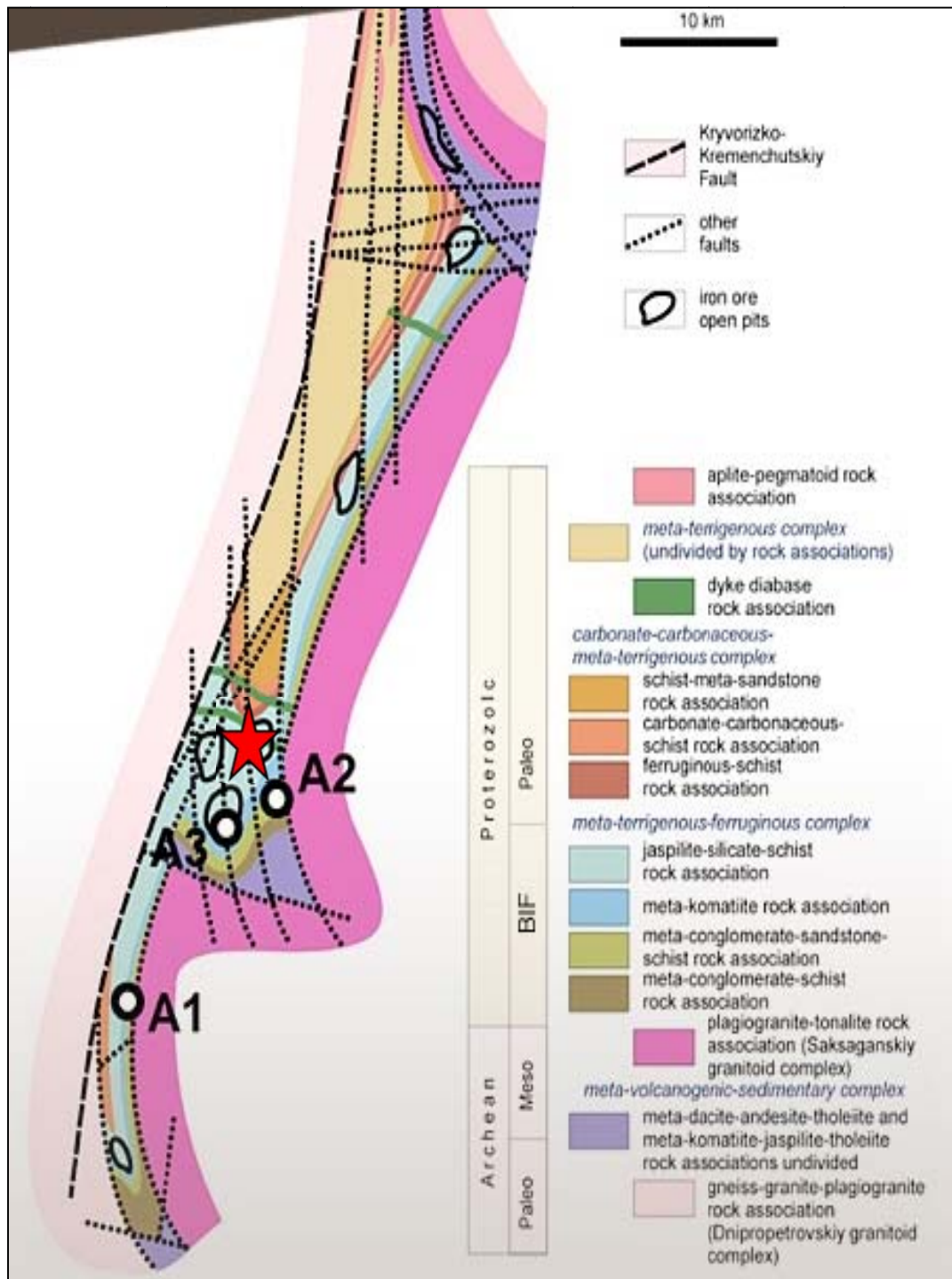


Figure 7.1: Regional Geology of the Kryviy Rih Belt (top of figure looking north, the red star shows the approximate location of the Project)

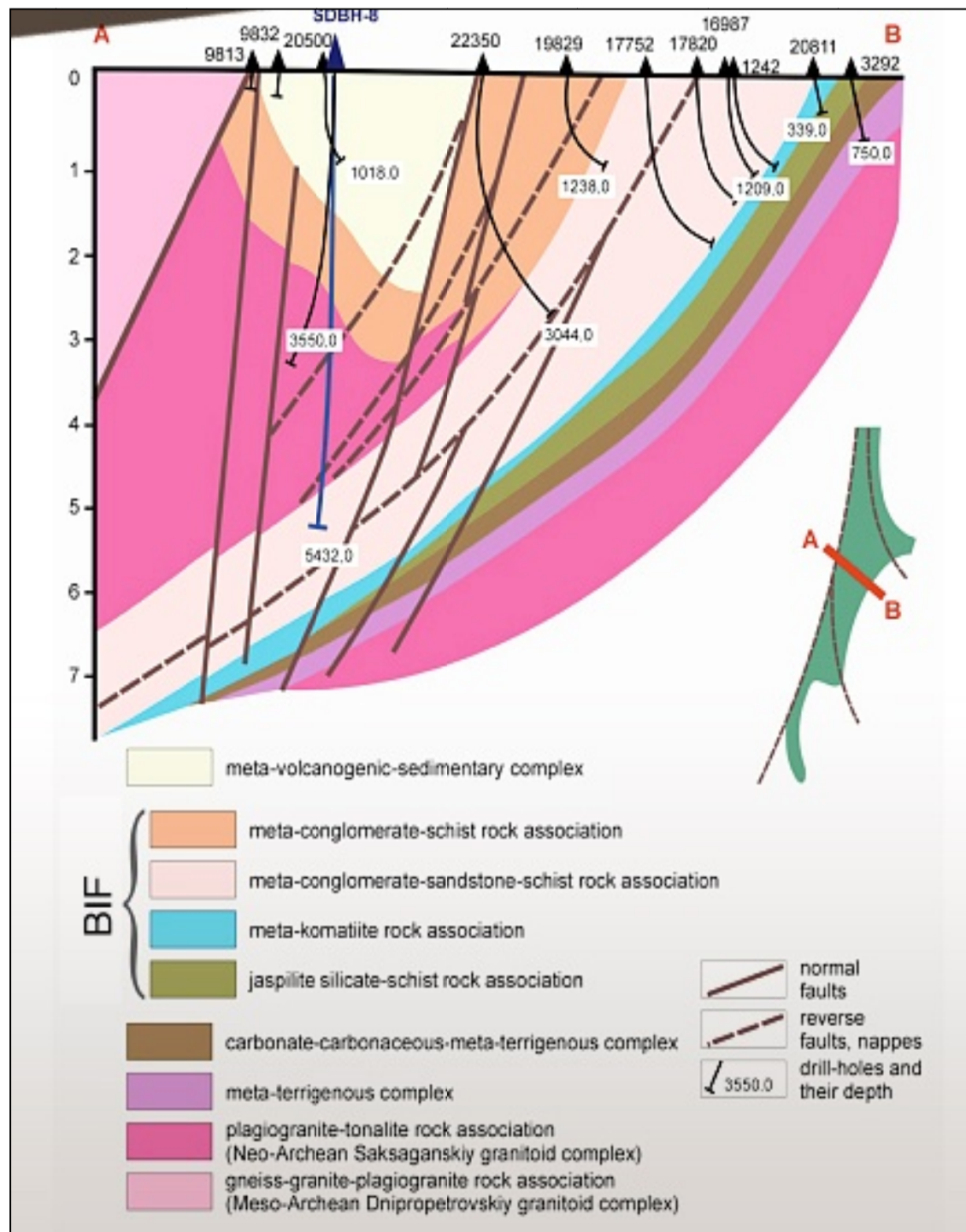


Figure 7.2: Typical Geological Section of the Kryviy Rih Belt (looking north-northeast)



7.2 Local Geology

The richest concentrations of ore in the main Saksagan ore field are associated with the fifth and sixth BIF units, which contain higher grade primary mineralization, and have thinner bedding which contributed to the development of the deformation. The ore segregations are located totally within the BIF units, on the limbs and within the keels of the synclines. In the southern ore fields, concordant planar ore layers are localized in the unconformable contact between the middle and upper sections of the Kryviy Rih series. In the northern ore fields, the ores have been hydrothermally-metasomatically altered.

Four principal types of enriched ores have been recognized in the KrivBass group as follows:

- i) Martite and hematite-martite - in addition to martite and relict hematite, relict magnetite, dispersed hematite, chlorite, sericite, pyrite, carbonates, clay minerals, quartz, and apatite have been observed in small amounts. The average content of this ore style is recorded at 63.7% Fe, 0.26% P, and 0.043% S;
- ii) Martite-hematite-hydrohematite-hydrogoethite - in addition to the assemblages listed above, there are also dispersed hematite, martite, sericite, quartz, clay minerals, alunite and sphene in small and accessory amounts. The average content of this ore style is recorded as 62.3% Fe, 0.08% P, and 0.03% S;
- iii) Hematite-hydrohematite-hydrogoethite - in addition to the main ore minerals, there is kaolinite, clay minerals, chlorite and carbonates. The average content of this ore style is recorded as 57.5% Fe, 0.088% P, very low S;
- iv) Magnetite and magnetite-specularite - in addition to the dominant magnetite and specularite, amphiboles (cummingtonite, grunerite, and riebeckite), aegirine, biotite, albite, quartz, carbonates, chlorite, grains of pyrite, pyrrhotite and chalcopyrite, have been recorded. The average content of this ore style is recorded as 54.0% Fe, 0.04% P, and 0.15% S.



The original resource of high-grade iron ore within the KrivBass group totalled 19.6 Gt (including 4 Gt at a grade of 57.6% Fe), plus 18 Gt of unenriched BIF averaging 35.9% Fe.

Most of the higher grade ore had been exhausted by 1990 when the annual production was 186 Mt at a grade of 35.2% Fe.

7.3 Property Geology

The Shymanivske deposit of ferriferous quartzites is in the Inguletsky territory of Kryviy Rih in the Dnepropetrovsk region of Ukraine.

It is a stratiform iron formation, folded and faulted by at least one cross-cutting early fault system and one late sub-concordant fault system as shown in Figure 7.1 and Figure 7.2.

The general strike of the mineralized layers trends towards 020°N and dips steeply to the west. From the south, the deposit is limited by cross section 1a, being the northern border of the Zelenovsky deposit of ferriferous quartzites and from the north - by cross section seven (7) as shown in Section 14, Figure 14.2. From the west, the deposit is limited by the western dip and from the east – old overburden dumps of YUODPE. The extent of deposit is 2 km in length and 1.2-1.5 km in width. The stratigraphy of local geology is described in Table 7.1.

Table 7.1:- Stratigraphic Table of Formations

Geological Name	Alphabetic Code	Numeric Code	Lithologic Description
Q IV-N1	Q	22	All unconsolidated material
	OX	21	Sections with altered material
	FOX	121	Section with alteration in ore bodies - zone with oxidized iron quartzite
PR1 gd Gdantsevskoj Formation			
PR1gd2, PR1gd1	GD1-2S	20	Schist Gdantsevskoj Suites of varying composition Q-Ser-Graph, Q-Bi-Cl, sandstones, Quartzites, quartz-carbonate rocks, layers with various structure Gdantsevskoj formation Q-Ser-Graph, Q-Bi-Cl, Sandstone, Quartzite, quartz-carbonates type/origin



Geological Name	Alphabetic Code	Numeric Code	Lithologic Description
PR1gd1- PR1sx	GD1F	19	Martite – Magnetite, Carbonate-Magnetite
PR1 sx Saksaganskaj Formation			
PR1sx5f	SX5Fb	18	Quartzite, Hematite-magnetite, magnetite-martite, hematite-martite, martite.
PR1sx5f	SX5Fa-b	1618	Not layered/dismember iron quartzite, The fifth iron horizon/level.
PR1sx5f	SX5Fn	17	Fe _{tot} <28% substandard
PR1sx5f	SX5Fa	16	Ferriferous quartzites silicate-magnetite, magnetite-silicate.
PR1sx5s	SX5S	15	Quartzite with waste layers Bi-Cl and Cl-Am slate
PR1sx4f	SX4Fa	14	Quartzite magnetite, magnetite silicate, silicate-magnetite
PR1sx4f	SX4Fn	13	Quartzite magnetite, magnetite-silicate, substandard Fe _{mag} <10%
PR1sx4s	SX4S	12	Q-Cl-Bi, Q-Graph-Bi, Q-Cl-Am, Q-Am-Cl Quartzite layers with no ore
PR1sx2f	SX2Fa	11	Quartzite q-Mt, q-Si-Mt, q-Mt-Si.
PR1sx2f	SX2Fn	10	Quartzite q-Mt-Si substandard/category Fe _{mag} < 10%)
PR1sx2s	SX2S	9	Q-Cl, Q-Cl-Am, Q-Am-Cl, -Cl-Bi quartzite layers with no ore
PR1sx1f	SX1Fa	8	Quartzite Si-Mt, Mt-Si.
PR1sx1f	SX1Fn	7	Quartzite Mt-Si substandard/category (Fe _{mag} <10%)
PR1sx1s	SX1S	6	Schists Q-Ser-Cl, Q-Am-Cl, with interlayers of quartzite with no ore
PR1sx1s	SX1T	5	Schists Cl-Ta, Ta-Am, Ta-Am-Cl, Q-Cl, Ta-Akt-Trem (type protruzit)
R1 sk Skelevatskaj Formation			
PR1 sk2	SK2	4	Schists Q-Cl-Ser
PR1 sk1	SK1	3	Conglomerates, arkose, metasandstones, quartzite
PR1 nk Novokrivoroshkaj Formation			
PR1 nk	NKA	2	Amphibolites
PR1 nk	NKM	1	Migmatites



7.4 Lithology and Mineralization

The BIF (ferriferous quartzites) comprise magnetite, magnetite-hematite, and hematite varieties, the most economically significant being the unoxidized magnetite and magnetite-hematite varieties. The high grade ores consist mainly of iron oxides and hydroxides which form column-like, less commonly stock, lens-like, and more rarely, layer-like segregations and bodies within the BIF units, the characteristics of which vary from location to location within the basin. This high grade ore was formed by the leaching of quartz and oxidation of iron, silicated within the BIFs.

The geological structure of the deposit consists of metamorphic rocks of Novokrivorozhsky, Skelevatsky, Saksagansky and Gdantsevsky suites of the Proterozoic and granitoids of Dneprovsky complex of the Archaeozoic. The complex of metamorphic rocks is overlain by a cover of sedimentary carbonates of the Cenozoic period with a thickness from 9.7 to 21 m, averaging 16 m.

The main formations are:

- Novokrivorozhsky suite (nk) consists mainly in amphibolites; quartz-biotite-amphibiotic slates are widespread in a lesser degree. Thickness of suite rocks is about 120 m;
- Skelavatsky suite (sk) is stratified in three sub-suites: arkosic-quartzitic (sk1), phyllitic (sk2) and talc;
- Saksagansky (iron-ore) suite (sx) of the deposit is represented by four ferriferous and five slate layers.

Slate layers (sx1-5s) are combinations of quartz-sericite-biotite-amphibolite-peach stones with bands of barren quartzites with a thickness of 0.1 to 0.2 m. Barren quartzites make 40 to 60% of the volume of quartz-sericite-biotite-amphibolite-peach slate layers. Thickness of the layers is 2 to 80 m.



The first, second, fourth and fifth ferriferous layers are the basic ore bodies of the deposit.

- The first ferriferous layer (sx1f) represents a layer of ore deployed in linear folds of northwest strike. The wings of folds dip 50 - 60°. Within cross sections 1a to 7 as shown in Section 14, Figure 14.1, the layer of ore is stretched up to 2 km. The layer consists of silicate-magnetite and magnetite-silicate quartzites. Average mass fractions of total and magnetite iron are 31.04% and 17.54% respectively. The average thickness of the layer is about 45 m;
- The second ferriferous layer (sx2f) represents the layer of ore repeating an anticlinal bend of Tarapako-Lihmanovsky anticlines and is complicated by folding of younger ages. Strike of the layer is to the northwest. Wings of folds dip 50 to 60°. The extent of this layer strikes for 2 km. The layer is a combination of magnetite-silicate and silicate-magnetite quartzites. Average mass fractions of total and magnetite iron are 31.93% and 20.02% respectively. Average thickness of the layer is 73 m;
- The fourth ferriferous layer (sx4f) of the deposit is stretched on the western wing of Tarapako-Lihmanovsky anticline in the form of ore bodies separated by explosive tectonics. Their strike is to the northwest. Wings of folds dip 50 to 70°. The layer is a combination of magnetite-silicate and silicate-magnetite quartzites. The average mass fractions of total and magnetite iron are 32.66% and 20.42% respectively. The largest southwest and northwest ore bodies have horizontal thicknesses of several meters in the south and up to 180 m in the central part. The average thickness of the layer is about 80 m;
- The fifth ferriferous layer (sx5f) is developed in the western part of the deposit. It is represented by a series of ore layers located in the zone of the western break. Ore bodies consist basically of ferrous-micaceous-martite and magnetite-martite quartzites with an average mass fraction of 34.1% Fe_{tot}. The thickness of the ore bodies average no more than 25 to 30 m.

The overburden covering the metamorphic rocks of the ore body is represented by a flat laying carbonate formation and anthropogenic stockpiles. At the interface of the metamorphic rocks



and carbonates exists a discontinuous layer of supergene oxidized material varying from less than one to 25 meters.

7.5 Structural Geology

The Kryviy Rih series is folded into a complex synclinorium structure of synclinal and anticlinal folds with dips on the limbs of 45 to 80°, for the most part, with a keel-shaped synclinal closure plunging at up to 40° northwards. The limbs of the major synform have been intruded by Proterozoic granite and are cut by longitudinal faults or over-thrusts, resulting in the ore-bearing units being segregated along the north-south strike of the basin to form the: i) southernmost Ingulets, ii) the Saksagan or Main, iii) the Pervomaisk, iv) Annovsk, and the northern v) Zheltorechensk and Popel'nostovsk ore fields. The largest reserves of high grade ores are concentrated in the Saksagan ore field where the ore-bearing middle unit attains a thickness of up to 2000 m and contains up to eight BIF seams.

The high grade segregations are commonly localised on the limbs of the major folds where those limbs are deformed by transverse cross-folds and “crumpling”, accompanied by the development of cleavage and interstratal movements, strike-slip faulting, fracture intersections and in zones of fracturing, crushing and jointing. They form chains with larger or smaller accumulations, with the individual ore bodies apparently merging at depth in the keel of the syncline to form large ore columns coinciding with the fold keels.



8. DEPOSIT TYPES

The Shymanivske deposit in the KrivBass iron ore area belongs to the Banded Iron Formation type.

Banded Iron Formations (BIFs) are chemically precipitated sedimentary rocks. They are composed of alternating thin (millimeter to centimeter scale) red, yellow, or cream coloured layers of chert or jasper, and black to dark grey iron oxides (predominantly magnetite and hematite), and/or iron carbonate (siderite) layers. BIFs have greater than 15% sedimentary iron content and are of economic interest as they host the world's largest iron ore deposits and many gold deposits.

Algoma-type BIFs were deposited as chemical sediments along with other sedimentary rocks (such as greywacke and shale) and volcanics in and adjacent to volcanic arcs and spreading centers. Iron and silica were derived from hydrothermal sources associated with volcanic centers. Algoma-type iron formations are common in Archean greenstone belts, but may also occur in younger rocks.

Lake Superior-type BIFs were chemically precipitated on marine continental shelves and in shallow basins. They are commonly interlayered with other sedimentary or volcanic rocks such as shale and tuff. Most Lake Superior-type banded iron formations formed during the Paleoproterozoic period, between 1.8 and 2.5 billion years ago. Prior to this, Earth's primitive atmosphere and oceans had little or no free oxygen to react with iron, resulting in high iron concentrations in seawater. Iron may have been derived from the weathering of iron-rich rocks, transported to the sea as water-soluble Fe^{2+} . Alternatively, or in addition, both iron and silica may have been derived from submarine magmatic and hydrothermal activity. Under calm, shallow marine conditions, the iron in seawater combined with oxygen released during photosynthesis by Cyanobacteria (primitive blue-green algae, which began to proliferate in near-surface waters in the Paleoproterozoic) to precipitate magnetite (Fe_3O_4), which sank to the sea floor, forming an iron-rich layer.



9. EXPLORATION

Apart from drilling, (see Section 10), the previous exploration work consisted essentially of geophysical surveys. This work covers several periods:

1925-27 - First magnetometer surveys on the Likhmanovsky syncline.

Up to 1949 - Completion of geophysical surveys and production of a map of the magnetic field at 1:100,000 scale with geological interpretation.

1953-55 - The southern part of Tarapako-Likhmanovsky anticline and the adjacent part of Likhmanovsky syncline were covered by geophysical surveys. A magnetic survey was carried out on a 20x50 m grid and a gravity survey was carried out on a 40x100 m grid. In some places, the grid was reduced to 10x20 m.

1964 - Geophysical research was performed by the Chair of Geophysics of the Dneprovsky Mining Institute on the area of the Likhmanovsky syncline and parts of the Tarapako-Likhmanovsky syncline. The works specify the range of magnetic differences of ferriferous rocks by their output under the Cenozoic formation. It allowed for the mapping of the whole series of longitudinal and transversal faults accompanied by vertical and horizontal displacements.

1982-84 - Downhole geophysical surveys including electric, magnetic, radioactive, flowmeter, caliper and directional surveys were conducted. Ferriferous horizons, according to geophysical data differ from slate by lower values of gamma activity, surplus density, and magnetic perceptibility. The oxidized quartzites differ from unoxidized quartzites in their magnetic perceptibility. For the oxidized quartzites, magnetic perceptibility is very low whereas for unoxidized quartzites, it is rather high.

2011 – In early spring, Abitibi Geophysique from Val-d'Or, Quebec conducted a GPS-Integrated ground magnetic field survey and a ground gravity survey over the Shymanivske Property. The goals of this geophysical campaign were:



- To improve the geological understanding of the property (lithological discrimination and structural mapping);
- To delineate magnetic and gravity highs possibly related to magnetite and hematite mineralization (BIF);
- To assist in planning a follow-up drilling program. The results of their work are presented in a report titled “GPS-Integrated Magnetic Field and Ground Gravity Surveys” dated June 2011”.

In June 2011, Black Iron successfully completed a Twin Drillhole Program consisting of 22 drillholes totalling 6042 m. The primary purpose of the program was to collect material for metallurgical testwork by drilling a selection of drillholes as close as possible and at similar attitude to historic locations. The secondary goal of the drilling program was to validate historic drilling completed on the Property. The validation of previous drilling was required because documentation available concerning the historic drilling was incomplete. The details of the data verification work are explained in Section 12. The details of the metallurgical testwork are explained in Section 13.



10. DRILLING

10.1 General

Historical drilling was done on sections perpendicular to the strike of the formations with spacing varying from 40 to 130 meters along sections and from 80 to 300 meters along strike with vertical depths of 250 to 500 meters. The drilling totals about 40,000 meters spread across 215 holes.

10.1.1 Deviation Tests

Based on verification results of historic data in a 2005 study conducted by the Russian Company Geo Inter Consulting; creating the "Survey" file was problematic since downhole data could only be found for 31 drillholes during the preliminary investigation.

In an effort to try and find the missing drillhole data, the Russian Ministry of Natural Resources Science Centre, Yuzhukrgeologias conducted a study into the exploration data archives of Krivorozhskoj where additional information for 118 drillholes was found. They also concluded that the data was incomplete. As for 28 of these additional available drillholes, only collar azimuth of boreholes and the borehole inclination measurements with 25 m intervals were presented. Exact measurements of the drillholes azimuth were absent and on occasion, mistakes were found during the verification stage using graphical tools in the Micromine geological software. According to this archived report, "Yuzhukrgeologias" found a full set of data for only 90 drillholes out of the total 215.

Using these additional 90 drillholes along with knowledge and experience gathered during the data investigations of the "Soviet period work", Geo Inter Consulting developed a technique to "read" missing survey data from geological profiles for each missing drillhole projection. In addition to performing data verification using drillhole projections from geological profiles, Yuzhukrgeologia's experts manually entered survey points for the remaining drillholes using their developed technique to read missing survey data.



As a result of the method described above, survey data on all 215 drillholes was recovered in good shape for further interpretation and could be used for calculation of Resource Estimates. Survey data was presented for all 215 drillholes, but the data quality had various levels of reliability. During the early exploration-estimation stage, survey parameters were measured in 25 m intervals, but, these intervals varied during the more detailed exploration stage. Projections of such drillholes in geological profiles are specified in the form of the straight lines in the direction of the drillholes, where the "natural" inclination of the drillhole is not considered. In the compiled database, azimuth measurements are recorded for only 24 drillholes. In the absence of those values, data was supplemented with measurements from the projections method used in geological profiles.

The inclination angle reflects a deviation from the vertical direction where zero is horizontal, and the vertical directed downwards is -90° . Azimuth values corresponding to the inclination angle were converted to decimal point format.

10.1.2 Drillholes Collar Surveying

During the verification stage of historic data in 2005, a study was done by Geo Inter Consulting and the "Drillhole Collar" file was created based on the UTM WGS84 coordinate system. Initially, for historic resource estimation of the Shymanivske deposit, the data for only 130 drillholes out of 215 drillholes was received and used. The 130 drillholes were presented as results from the preliminary and detailed exploration drilling stages.

Geo Inter Consulting used drillhole collar data and scanned geological maps of the Shymanivske deposit (1:2000 scale) containing the location of all 215 drillhole collars in order to create geological profiles. The scanned geological maps were used to develop a grid pointing to the north, and they were further used to integrate and transform coordinates received from the WGS84 series of drillholes that were gathered during the detailed investigation. After additional checking on the position of a controlled group of drillholes, "reading" files were created with estimated points for the missing 85 drillholes from the early exploration stages. It is necessary to note, that additional checking on the accuracy of the drillhole locations on the maps for a



selected set of drillholes, produced high quality confidence and sufficient accuracy in interpretation. The missing coordinates from the selected set of drillholes were "removed".

Geo Inter Consulting analyzed data on borehole depth in the "Drillhole Collar" file, where they interpreted and entered data from the geological profiles. Absence of input data and mistakes with interpretations were additionally cross-checked with Micromine software.

The "Drillhole Collar" file contains data for all 215 drillholes of which, data for 130 drillholes was obtained from the preliminary and detailed investigations and the data for the remaining 85 drillholes from the early exploration-estimation stage were estimated using specialized computer programs. On a map with a scale of 1:2000, accuracy on the position of a drillhole collar is estimated within 1 mm, i.e. with an error of 2 m. It was concluded that the error in reading inclination for drillholes at a depth of 300-500 m with potential intensive "natural" deviations using old technology is rather insignificant in comparison to mistakes in defining the exact vertical position of the intervals that are crossing ore horizons at depths up to 500 m.

The "3D Orientation of Drillholes" file was created to represent the orientation of drillholes in 3-D space. This data was then used to create the orientation of the drillholes and "bind" them with data from other tables such as assays, lithology, survey, etc. Drillhole orientation coordinates are presented in 1 m intervals. Creation and calculation of the "3D Orientation of Drillholes" file was done using data input into the Micromine software database. This program calculated the "3D Orientation of Drillholes" file to represent a series of points through the set interval (for the Shymanivske deposit, 1 m intervals were accepted) along an orientation line of the drillhole. The file includes 40,277 points with 3-D coordinates.

10.1.3 Geotechnical Data on Drilling

The Shymanivske historic geotechnical data quality was compared against the Australian JORC resource evaluation standards and the results were reported by Geo Inter Consulting in 2005. The following is a quick summary of the key points from their Report.



The "Geotechnical tests" ("Geotech") file was created based on geotechnical tests presented in the final Report of the detailed investigation of the Shymanivske deposit. Data input was double-checked by different experts. Input errors were corrected and eliminated from the database and an "adjusted" file was generated. Then, experts from Geo Inter Consulting imported the "adjusted" file into geological programs for further analysis and modelling.

In the end, the "Geotech" file was created using results from 706 tests of Proterozoic rocks. Of the 706 tests, 86 were analyzed under the full geological program and 620 tests were analyzed under a reduced program where only volumetric weight, true density, porosity, moisture content, head iron and iron magnetite were defined. All reduced program testing was performed on core samples with a length of 0.1 m, and as a selection rule for full program testing, samples (section of a core) with lengths of between 1 m and up to 5 meters were collected. The full program testing was performed on all ore layers, except for the Skelevatskoj formation (PR1sk).

Geotechnical results received from the full and reduced program testing, in particular data on "volumetric weight", were then used for modelling and block model estimation. The data from the full program tests will be used for geotechnical design and modelling during the project development phase.

10.2 Historic Drilling

Historical drilling which was carried out by various Soviet governmental organizations ended in 1989. Historical drilling spanned over four periods:

- First period up to 1965:
 - 32 holes for a total of 6,818 meters and length of 10 to 400 meters were drilled on the ferriferous horizons;
 - 48 holes for a total of 1,624 meters and length of 22 to 45 meters were drilled to map the bedrock and its nature under the overburden cover.



- Second period 1965-1978:
 - 9 holes for a total of 2,580 meters drilled on the first and second ferriferous horizons;
 - Geological mapping, metallurgical testing of iron material from the sx4f and sx5f horizons and the first estimation of resources was conducted;
 - A Sovite style Pre-Feasibility Study (Zelskaya, L.N.) was completed.
- Third period 1982-1984:
 - 32 holes for a total of 9,902.6 meters was drilled for definition of the actual Shymanivske deposit between sections 1 and 7;
 - Geological modeling of the deposit to define the quality and morphology of the main ferriferous horizons sxf1, sxf2, sxf4 and sxf5 was completed;
 - Resource calculation and categorization.
- Fourth period 1985-1989:
 - 96 holes for a total of 18,113.1 m were drilled in profiles 1a, 1b, 1, 2, 2a, 3, 3a, 4, 4a, 5, 6 and 7 (oriented transversely to the strike of rocks) to further define the ore bodies;
 - Detailed studies of material quality and technological properties of minerals were conducted;
 - Evaluation of the value of overburden for alternate use as a construction material was conducted;
 - Another more detailed Soviet style “Feasibility Report” was conducted.

According to collar surveying and deviation surveys, most of the holes were drilled sub-perpendicularly to the dip of the mineralized beds, thus giving intersections close to the true thickness. The general orientation of the drillholes is east-south-east with an average azimuth of



117.7°N and an average dip of -84.13°. Out of the 217 drillholes listed above, 215 are incorporated into the database used to create the Resource Estimate.

Figure 10.1 shows the location of all historical drillholes in relation to the Property boundary and other topographic and geographic features such as historical waste dumps and existing roads on the Property.

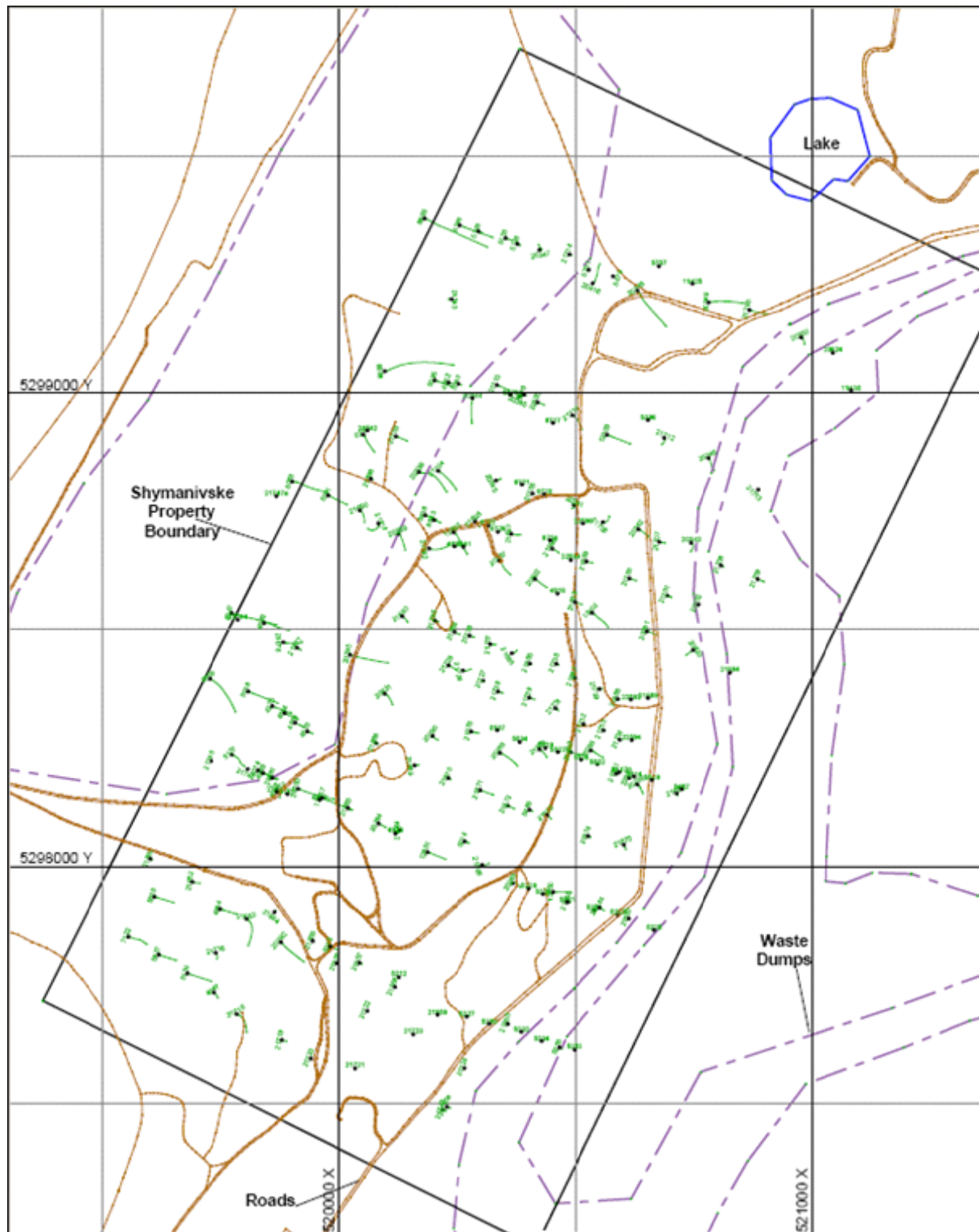


Figure 10.1: Shymanivske Drillhole Plan Map – Historical Diamond Drillholes



10.3 Black Iron Twin Drilling Program (2011)

As described in Section 9, Black Iron conducted a Twin Drillhole Program in 2011 to verify all historical data. The results of the 6042 m drill program spread across 22 holes are discussed in Section 12, by WGM.



11. SAMPLE PREPARATION, ANALYSES AND SECURITY

The sampling procedures used during the exploration project can be briefly described by the verification reports that were carried out several times by competent authorities on the premises of the core logging facilities during the 1980's. They are summarized as:

1. All measured stratigraphical horizons and mineral facies of rocks within horizons are described with necessary completeness. The mineral structure of quartzites is described: quantitative nature of composing mineral facies, their length, and angles of foliation of the rocks measured in relation to core axis, are specified, and correspond to actual data.
2. The core recovery is defined by measuring the percentage of broken core and is established correctly.
3. Analysis is carried out according to existing methodical instructions. Analyzed intervals were defined taking into account the measured mineral facies. Sampling was carried out by division of the core along its vertical axis and selecting from only one half of the split core.
4. The contacts from stratigraphical horizons are drawn based on logging documentation and graphical log charts for corresponding bore holes.

The Commission commented that field works were carried out methodically and correctly according to the requirements of Instructions from the GKZ of the USSR. The primary documentation corresponds to core material and can be used for report writing.

The author is not aware of any factors that could materially impact the accuracy and reliability of the sampling procedure and data collection. Furthermore, no documentation on parameters to establish sampling intervals according to rock types could be found.



Statistics obtained from the historical database show the following parameters:

- Number of samples analyzed, 5167;
- Average sample length, 4.27 m;
- Average core recovery, 82.71 %;
- Average sample weight, 13.08 kg.

All 5167 samples were analyzed for the following parameters:

- Total iron %;
- Magnetic content %;
- Core recovery m;
- Core recovery %;
- Sample weight kg.

Furthermore, 283 composite samples totaling 8,429 m were analyzed for the following parameters:

- Fe_{tot} %;
- Fe_{mag} %;
- Fe soluble %;
- FeO soluble %;
- FeO_{tot} %;
- P %;
- S %;
- Al_2O_3 %;
- SiO_2 %;
- CO_2 %;
- MgO %;
- Na_2O %;
- K_2O %;



- LOI;
- Fe_2O_3 %;
- CaO %;
- TiO_2 %;
- MnO %.

Also, 706 technical samples of 0.2 meters on average were measured for multiple parameters including the following:

- Bulk density g/cm^3 ;
- True specific gravity g/cm^3 ;
- Ultimate compressive strength in dry conditions kg/cm^2 ;
- Ultimate compressive strength in wet conditions kg/cm^2 ;
- Resistance to rupture kg/cm^2 ;
- Natural moisture content %;
- Young's modulus kg/cm^2 ;
- Poisson coefficient kg/cm^2 ;
- Water absorption %;
- Moisture content %;
- Fe_{tot} %;
- Fe_{mag} %.

Also, 263 samples averaging 17.7 meters were analyzed for the following elements at the ppm level:

- V, Ga, Ge, Cd, Co, Mn, Cu, Mo, As, Ni, Sn, Pb, Ti, P, Cr, Zn, Zr, Sr, Ba.

The quantity and quality process and methodology used for historic sample preparation and analysis is thorough. Based on feedback from a local geologist and a few other people involved in historic exploration work related to the Shymanivske deposit, the drill core and facilities for their treatment and storage were kept in good shape until the early 1990's when the Soviet



block collapsed. Shortly after, the drill core was dispersed and piled in various locations, the core shack facility was ultimately destroyed and drillhole casing was removed from the ground by locals looking for steel. During the site visit, one original drillhole casing was located and there was no visible drill core found.

11.1 Bulk Sample Preparation (Historical)

During the geological exploration work for each ferriferous level and ore type, the weight of the core that was recovered and selected as a laboratory technological sample varied from 190 to 900 kg. All samples of drilling core with a diameter of 59 mm and 76 mm were cut in half to keep all samples with the same weight.

From each level of unoxidized quartzites (sx1f, sx2f and sx4f), two samples were selected from silicate-magnetite and magnetite-silicate type, and from the fifth (sx5f), ferriferous horizon presented as interbeds of magnetite-martite, martite, and in lesser quantity, martite-magnetite-quartzites. At the exploration core shack, (between section 1a and 7), seven technological samples were selected, three from magnetite-silicate quartzites, three from silicate-magnetite and one oxidized quartzites from the sx5f horizon. Additionally, between these profiles, six more samples were collected, three from magnetite-silicate quartzites and three from silicate-magnetite quartzites.

For the entire deposit, a total of 13 samples were sent for technological testing and definition of ore characteristics.

11.2 Assaying

Historic small scale technological testing was performed for material composition analysis, structural-textural characteristics of quartzites, definition of recovery and their variability along the strike and by depth. The goal was to determine industrial types of ores and create geological and technical maps of the deposit.



A selection of small scale samples was based on results from chemical analyses of ordinary samples with 0-5 mm material size and drillhole core mapping. Length of samples varied with the length of the core samples and was between 4 and 35 m, with the average length of 15 m. With large drillhole core samples, some testing samples were selected with lengths of up to 15 m. The weight of small scale samples varied from 3 to 6 kg. In total, for the entire deposit, 375 of small scale samples were selected. The “Mekhanobrchermet” Institute performed recovery tests of ferriferous units.

The author could not verify the adequacy of sample preparation, security and analytical procedures however, by reading the documentation on these subjects, is of the opinion that they were made according to local industry standards.



12. DATA VERIFICATION

12.1 Review of the Twin Drillhole Program and QA/QC Results

Black Iron requested Watts, Griffis and McOuat Limited ("WGM") to review the "Twin Drillhole" sampling and assaying QA/QC results for the Shymanivske iron ore deposit (the "Property"), Krivorozskogo iron ore region ("Kryviy Rih Iron Belt") of the Dnepropetrovsk area, Ukraine. The Twin Drillhole Program, conducted by GEORESOURCES LLC, ("GEORESOURCES") a Ukrainian geotechnical contractor, consisted of 22 drillholes totalling 6,041.8 m and was completed on May 30th, 2011. A summary of the Twin Drillhole Program is given in Table 12.1.

The primary goal of the Twin Drillhole Program was to collect material for metallurgical testwork by drilling a selection of drillholes as close as possible and at similar attitude to historic locations; the secondary goal was to validate historic drilling completed on the Property. The validation of historic drilling was required because documentation available concerning the historic drilling was incomplete (and remains so). Although a drillhole and assay database (the 2005 Geo Inter Consulting DB) is available covering most known drilling on the Property and historic drill cross sections and plan maps are available showing the relative locations of the drillholes, much of the original Soviet documentation to completely validate the database has not been found.

Table 12.1: Summary of the Twin Drillhole Program

Drillhole ID	Easting WGS84	Northing WGS84	Elev	Azimuth	Dip	Depth (m)	Section	Date Started	Date Finished
BI12850-T	520452	5297946	63	94.00	-84	223.00	2	12-Apr-11	02-May-11
BI20293-T	519913	5298164	63	108.00	-86	85.00	2	28-May-11	18-Jun-11
BI5485-T	520403	5298119	61		-90	196.00	2A	07-Apr-11	20-Apr-11
BI21674-T	520527	5298064	65		-90	190.00	2A	28-Mar-11	21-Apr-11
BI21668-T	520078	5298261	65		-90	190.00	2A	17-May-11	27-May-11
BI21732-T	520517	5298301	66		-90	235.50	3A	23-Apr-11	13-May-11
BI21733-T	520559	5298287	62		-90	250.00	3A	08-Apr-11	22-Apr-11
BI21735-T	520202	5298519	68		-90	75.00	3B	29-May-11	27-Jun-11



Drillhole ID	Easting WGS84	Northing WGS84	Elev	Azimuth	Dip	Depth (m)	Section	Date Started	Date Finished
BI21689-T	520653	5298356	63	111.50	-87	200.00	3B	01-May-11	12-May-11
BI21687-T	520497	5298399	61		-90	251.80	3B	14-May-11	30-May-11
BI13302-T	520536	5298536	66	114.00	-85	313.40	4	20-Apr-11	06-May-11
BI20287-T	520340	5298646	54	112.00	-87	283.00	4	16-May-11	10-Jun-11
BI20289-T	520126	5298703	65		-90	351.00	4	09-May-11	04-Jun-11
BI20291-T	520651	5298496	67		-90	267.00	4	23-Apr-11	12-May-11
BI20342-T	520633	5298713	70	109.00	-87	313.00	5	03-Apr-11	19-Apr-11
BI21703-T	520121	5298909	86	111.50	-87	439.30	5	27-May-11	23-Jun-11
BI21707-T	520677	5298686	70		-90	332.00	5	09-May-11	23-May-11
BI21704-T	520209	5298836	64		-90	373.40	5	23-Apr-11	15-May-11
BI12009-T	520567	5298912	71		-90	330.00	6	12-May-11	26-May-11
BI21711-T	520493	5298953	68		-90	430.00	6	22-Apr-11	10-May-11
BI20347-T	520424	5299303	70		-90	266.00	7	26-May-11	23-Jun-11
BI20349-T	520782	5299192	79	107.00	-85	447.40	7	07-May-11	28-May-11
Total		22 Holes				6,041.8			

Drillhole locations are as planned and not final surveyed coordinates.

For Black Iron's Twin Drillhole Program, logging and sampling of collars, azimuths and dips were established by contract surveyor GEORESOURCES. Samples were collected on a nominal 3 m interval basis through all mineralization and was routinely assayed for Fe_{tot}, Fe_{mag}, FeO_{total}, silica, P and S at Mekhanobrchermet ("MCM"), based in Kryviy Rih, Ukraine. MCM is accredited under Ukrainian regulations and holds an International Organization for Standardization (ISO) 9001:2009 certification for quality management systems. The QA/QC program was designed by WGM and included field inserted Blanks, second half core Duplicates, and Certified Reference Standards. In-laboratory QA/QC included Duplicates, and the insertion of a Ukrainian Certified Reference Standard. The QA/QC program also included check assaying of selected sample pulps and drill core samples at SGS Lakefield located in Lakefield, Ontario, Canada. Selection and collection of these samples for SGS Lakefield was done by WGM and sample identities were not known to any party other than WGM.



WGM observed five historic drillhole casing collars during their Site Visits and locations for these casings were not identical to, but were generally close to (± 10 m) collar coordinates for historical drillhole collars as listed in the available database. The geology, (rock type distribution) and general patterns for Fe_{tot} and Fe_{mag} assays in the twin drillholes were remarkably similar to the geology and assay patterns for the historic drillholes as reported in the drillhole database, indicating that the collar locations and drillhole attitudes, and the geological logging, sampling and assaying completed by the Soviets and documented in the database, are generally reliable.

MCM assay results for in-field inserted Certified Reference Standards were precise and very close to certified reference values, indicating that a high level of assay accuracy was generally being achieved. Assays for field inserted second half core duplicates, which were blind to MCM, also confirmed MCM was achieving excellent assay precision. Results for Blanks, Duplicates, shoulder samples, and Certified Reference Standards and review of assay results with respect to drillhole lithology and mineralization, showed control materials performed well and that there were minimal sample mix-ups either in the lab or field. Assay results for the WGM selected drill core and duplicate pulps assayed at SGS Lakefield confirmed that MCM results for routine samples were precise and no sample mix-ups were indicated. It was noted that SGS Lakefield assays for Fe_{mag} were significantly higher than MCM assays. The results are displayed graphically in Figure 12.1 to Figure 12.6.

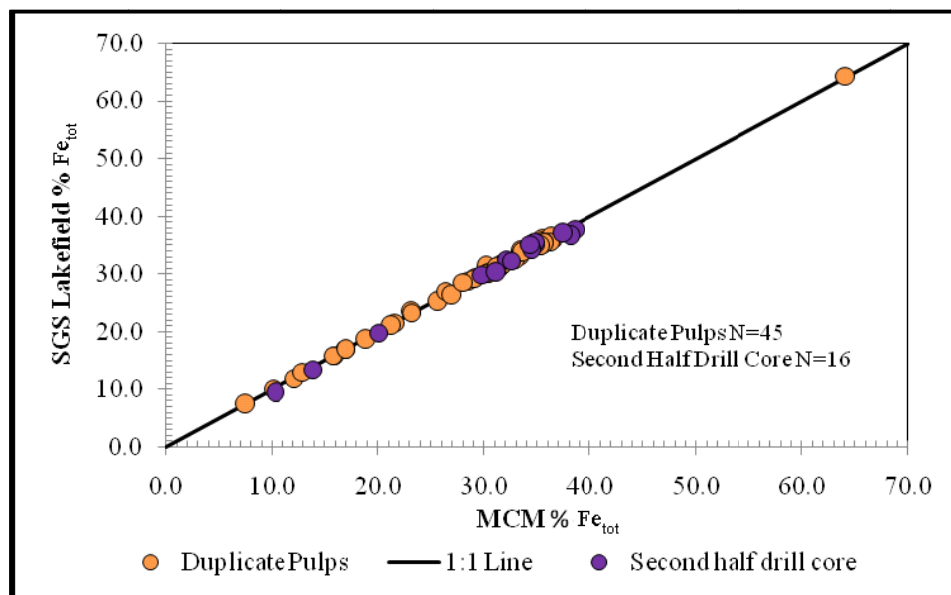


Figure 12.1: % Fe_{tot} at SGS Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples

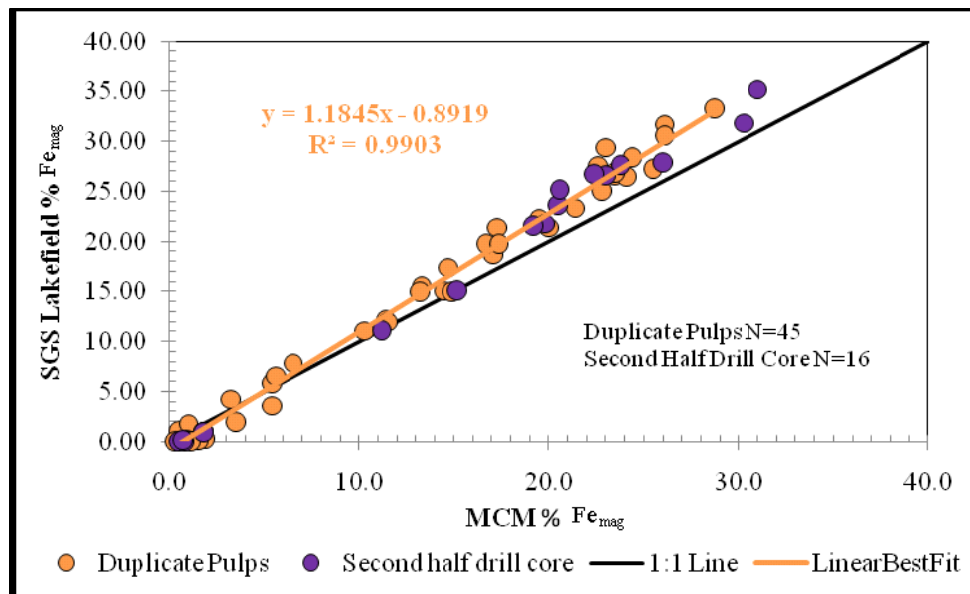


Figure 12.2: % Fe_{mag} at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples

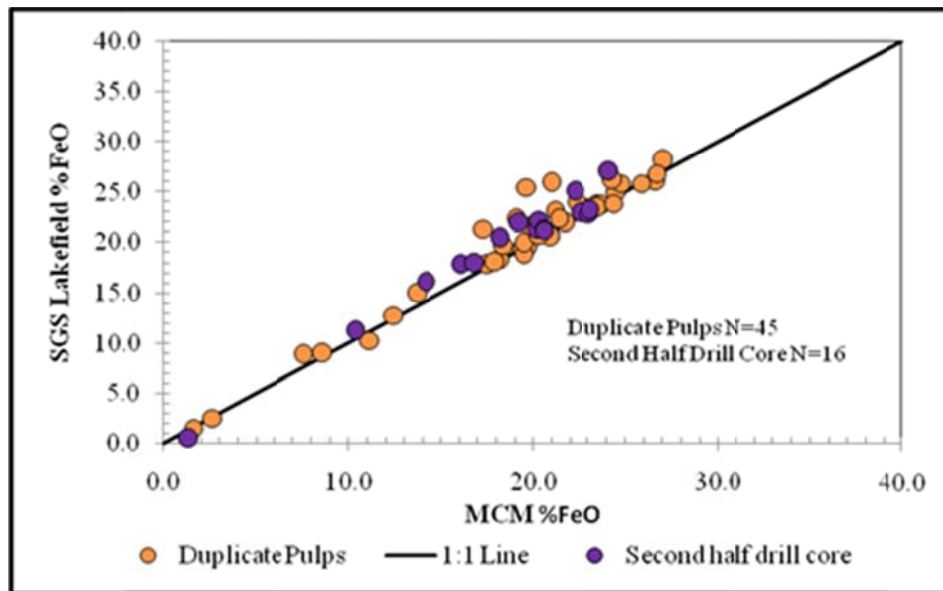


Figure 12.3: %FeO at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples

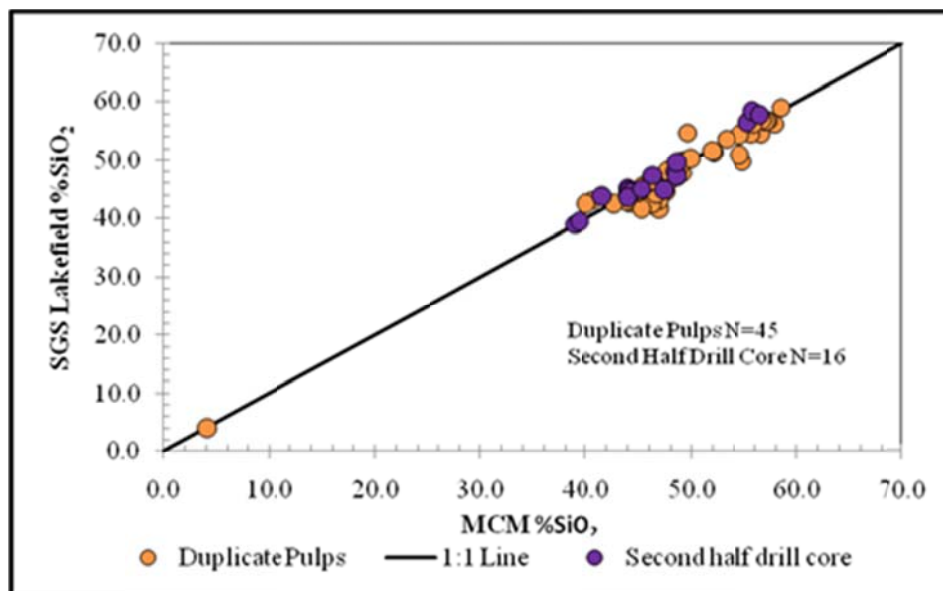


Figure 12.4: %SiO₂ at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples

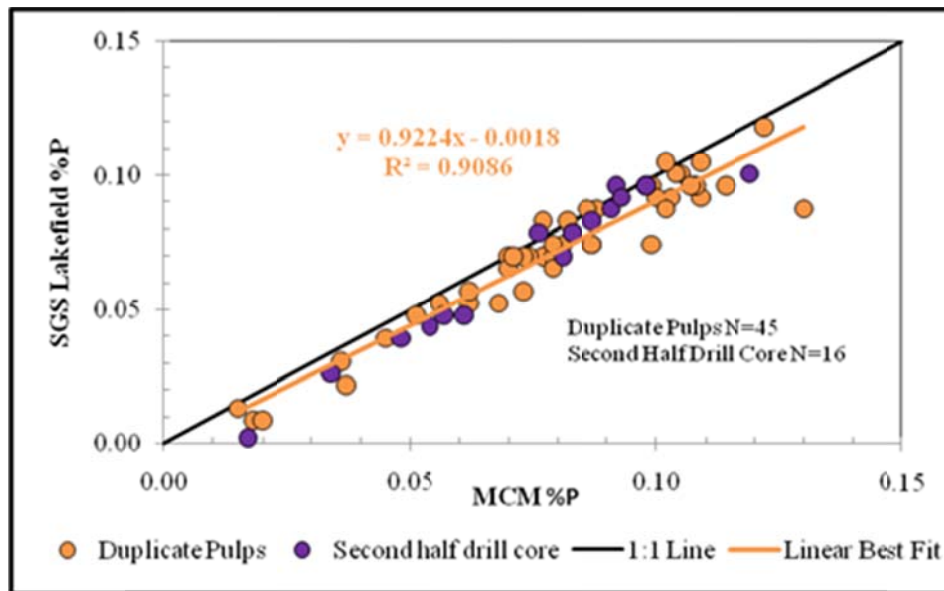


Figure 12.5: %P at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples

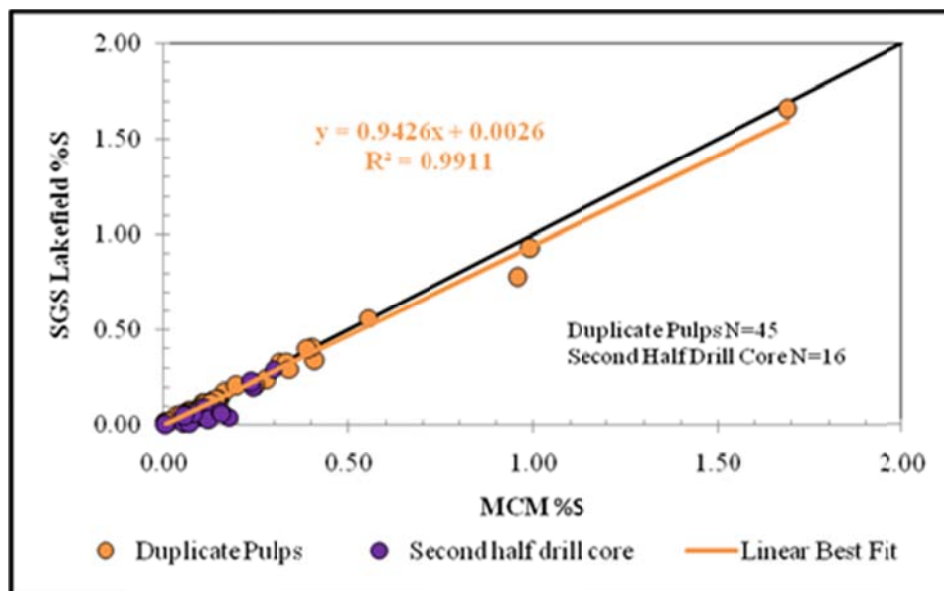


Figure 12.6: %S at SGS-Lakefield vs. MCM on WGM Duplicate Pulps and Second Half Drill Core Samples



Despite the generally high degree of similarity between historic and twin drillhole assays, some discrepancies were detected. For five of the drillholes, Fe_{tot} values are lower in the historic drillhole than in the corresponding twin drillhole. More significantly, Fe_{mag} values in most of the twin drillholes, as represented by MCM assays, appear to be slightly lower than in historic drillholes for corresponding and equivalent intersections. WGM believes that the differences between SGS Lakefield and MCM regarding Fe_{mag} are due to calibration of analytical instruments. WGM recommended that steps be taken to resolve the issues surrounding Fe_{mag} and the concerns and analytical results were shared with MCM. WGM understands that MCM acknowledged a possible calibration problem and towards resolving the issues concerning Fe_{mag} , they re-assayed 100 previously assayed samples using a new calibration standard. Fe_{mag} in the re-assays showed a high degree of correlation with MCM's original results and generally were slightly higher than original results, approaching, but not quite as high as results by SGS Lakefield.

Overall, WGM believes that the historic drilling results are reasonably validated by the twin drillhole results. It is reasonable to assume that the Fe_{mag} assays returned by MCM's new calibration are more accurate than original results because they are similar, but a little lower than those achieved by SGS Lakefield on WGM's independent samples. Assuming MCM's new calibration is valid, the Fe_{mag} values for the twin drillhole samples are then similar to historic results. WGM's recommendations include further independent and verification assaying to confirm Fe_{mag} results and others, to generally advance data quality.

12.2 Comments and Conclusions

Historic drillhole collar locations, as reported in the 2005 Geo Inter Consulting Ltd. database, appear to be reasonably accurate based on a review of Geo Inter Consulting's methods for capture of collar locations, geological and assay pattern similarity between results for twin and historic drillholes. It would be helpful if original Soviet collar coordinates could be located for all drillholes but this may not be possible. WGM remains unconvinced that original Soviet Pulkova collar coordinates are not available, for at least some of the drillholes. WGM believes that errors



in drillhole collar locations are probably small, but sees no reason why further verification should not be undertaken.

A search for all remaining historic collars should be undertaken and those located, should be surveyed and used to recheck historic collar locations against Soviet drillhole maps that are available. Where possible, the azimuths and dips for these casings should also be determined;

- Black Iron drillhole locations should be labelled and marked in the field as they are completed;
- A quick review of the traces for drillholes in plan view on Soviet documents shows that, for most of the historic drillholes, the projections are similar between the Soviet maps and the Geo Inter Consulting database, but for some holes, there are significant differences in azimuth between traces on maps and also with respect to a table in the Soviet Feasibility Study report that lists collar and downhole azimuths and inclinations. WGM understands that Geo Inter Consulting probably did not have the Soviet maps available, which show the drillhole traces in plan view when they compiled their database, and may not have been aware of the table from the Soviet report. WGM recommends that a detailed review and comparison between Soviet documentation and the Geo Inter Consulting database for each drillhole be undertaken, and corrections made to match downhole survey azimuth to Soviet documentation;
- Despite the above, lithologies and assay patterns in the twin drillholes agree very well with historic drillholes indicating collar locations for historic drillholes, and historic logging and sampling is reasonably reliable for the majority of the historic drillholes;
- The sample locations and assays for historic drillholes are well documented in available Soviet era reports. Random checks by WGM on the Soviet documentation indicates that the sample and assay data information matches those in Geo Inter Consulting's database assay table;
- For the twin drillholes, MCM has generated reasonably reliable data as shown by in-field, in-Primary and in-Secondary laboratory QA/QC;



- Although the patterns of highs and lows in assays are very similar between historic and the twin drillholes, certain assay biases appear to be present in the historic assays. For certain historic drillholes, % Fe_{tot} appears to be significantly biased low.
- Perhaps it would be helpful if drilling dates for each of the historic drillholes were available so drilling by campaign could be determined. This might make it clearer to determine which historic drillholes had low biased Fe_{tot} assays. The simplest way to examine this would be by reviewing drilling dates from core logs. However, very few of the historic drill core logs are available to allow for this analysis.
- For most of the drillholes that were twinned, % Fe_{mag} from initial MCM assays (original calibration) is 2% to 4% higher in the historic drillholes than for equivalent twin hole sampled intervals. However, assays by SGS Lakefield on WGM selected samples are generally higher in terms of Fe_{mag} than MCM routine assays, and this difference between MCM and SGS Lakefield Fe_{mag} assays is of similar magnitude to the difference between MCM and historic Fe_{mag} results. Therefore, it would appear that if the assaying for the Twin Drillhole Program samples had been done at SGS Lakefield rather than at MCM, the historic and twin drillhole results for % Fe_{mag} would be perhaps more closely align.
- After MCM was apprised of the results of the comparison of their Fe_{mag} results with the check assay work completed by SGS Lakefield on WGM's independently collected samples, MCM agreed that their Fe_{mag} results were perhaps biased low. MCM agreed with Black Iron that their instrumentation should be recalibrated and a selection of samples be re-assayed using the new calibration. The new results for Fe_{mag}, although still showing a high degree of precision with original results, average, overall, 1.6% Fe_{mag} higher than MCM's original determinations of Fe_{mag}. This result is similar, but the difference is not quite as high as the results suggested by SGS Lakefield. The upward adjustment is however sufficient to make MCM's assays of Fe_{mag} on the twin drillhole samples similar to historic results. WGM believes this adjustment and recalibration by MCM is probably reasonable, but recommends that more validation work be completed, including the blind resubmission of more samples to both SGS Lakefield, and MCM, and that Davis Tube tests also be completed on a



selection of samples to back up Fe_{mag} values determined by saturation magnetization analyzers.

- After the aforementioned validation assay work is completed and assuming it is successful, the historic and MCM (adjusted) assay results for Fe_{mag} will then be suitable for a Mineral Resource estimate. MCM will have to derive new values for Fe_{mag} or re-assay all samples and take any approach deemed necessary so that they can certify the revised values as accurately as possible and issue revised certificates of analysis showing the new values for Fe_{mag} . WGM would like MCM to further clarify their use of wet chemical determination of Fe_{mag} as applied to routine determinations;
- The historical results for Fe_{tot} may also be used for a new Mineral Resource estimate, but appear to be less reliable and biased low for certain drillholes. Regardless, Fe_{tot} is not a very valuable parameter for grade estimation for this type of deposit, due to its high component of silicate iron;
- Current data is limited for comparison of SiO_2 , P and S, between the historic and Twin Drillhole Program samples, but clear strong biases are not obvious. SGS Lakefield's analytical results for the bulk composites from the twin drillholes collected for metallurgical testwork probably represent the best information for confirming deleterious element contents;
- Specific Gravity (SG) / Density data for twin drillholes agrees in general with historic data, and MCM results for SG and density are proven accurate through determinations by SGS Lakefield. The new data however indicates that there are volumes of rock where weathering alteration may have reduced density and this has not been accommodated for in the historic Mineral Resource estimates; and;
- In WGM's opinion, the most significant issue pertaining to the use of the historic data (excluding any consideration of the reliability and suitability of the Soviet geological interpretation) for a new Mineral Resource estimate, probably are the questionable downhole and collar azimuths for certain drillholes. Also, as aforementioned, WGM recommends that collar locations for the historic holes be rechecked again by comparing



and fitting locations on Soviet maps against field located and surveyed casings, and checking elevations against available historic data



13. MINERAL PROCESSING AND METALLURGICAL TESTING

One of the main objectives of this PEA Study is to characterize the Black Iron Shymanivske ore deposit and to develop a Process Flowsheet (PFS) allowing for the economical development of the Project. The PFS should therefore aim to satisfy the following general project criteria:

- Minimize project capital cost;
- Minimize operating costs;
- Maximize marketing flexibility, i.e. produce and sell a concentrate at a quality level that can be used by Customers for pelletizing applications or to produce a quality pellet product.

The ore mineralogical and metallurgical characteristics will ultimately determine the PFS which in turn will determine the degree of compliance to the aforementioned general project criteria.

This section of the Report describes and presents the results of metallurgical testwork performed during the course of the present Study.

13.1 Historical Testwork

Historical testwork information is taken from a technical report entitled “Detail elaboration of ferriferous quartzites of Shymanivske deposit of Kryviy Rih iron ore basin of Dnepropetrovsk region – 1989”. This testwork was also summarized in the NI 43-101 Technical Report “Resource Estimate – Shymanivske Deposit in Ukraine” dated January 27, 2011.

Magnetic separation testing was carried out at the Mekhanobrchermet Institute on oxidized quartzite material obtained from diamond core drilling of the Shymanivske deposit. Several samples were ground to 98% passing 0.074 mm and then in a second pass to 95% passing 0.045 mm. The results are presented in Table 13.1



Table 13.1: Historical Magnetic Separation Results

Test Number	Grind Size (mm)	% passing	Indicators %					
			Weight Recovery (%)	Iron Recovery (%)	% Fe in Concentrate		% Fe in Tails	
					Head Fe (%)	Magnetite (%)	Head Fe (%)	Magnetite (%)
2	0.074	98	34.5	68.4	67.4	97.4	16.4	0.8
	0.045	95	34.0	68.0	68.0		16.5	
3	0.074	98	33.0	68.2	68.4	98.5	15.7	0.5
	0.045	95	32.3	67.6	69.3		15.8	
4	0.074	98	31.3	65.5	69.0	98.0	16.6	0.6
	0.045	95	30.9	65	69.4		16.7	
5	0.074	98	20.5	48.8	69.3	96.1	18.7	0.7
	0.045	95	20.3	48.6	69.6		18.8	
6	0.074	98	20.8	47.1	68.6	97.1	20.2	0.5
	0.045	95	20.6	46.9	69.0		20.3	
7	0.074	98	19.2	44.4	69.6	96.3	20.7	0.6
	0.045	95	19.0	44.1	69.9		20.8	
Burden	0.074	98	27.4	59.0	69.1	98.1	18.1	0.5
	0.045	95	27.2	58.8	69.4		18.2	
NKODPE Concentrate	0.074	98	34.5	65.8	68.0			

Based on these results, BBA developed the following iron and weight recovery versus magnetite relationships for lab scale magnetic separation tests producing concentrates ranging between 68 and 69% iron:

- Fe Rec. = $1.6064 \times \text{Magnetite} + 14.88$ $R^2 = 0.99$
- Wt. Rec. = $1.0024 \times \text{Magnetite} + 0.162$ $R^2 = 0.9999$

These relationships were updated using the metallurgical testwork carried out in 2011. The updated relationships used pit optimization to form the basis of this Preliminary Economic Assessment Study. The updated iron and weight recovery relationships are presented in Section 13.2.6 Process Flowsheet Development.



13.2 PEA Study Metallurgical Testwork

A metallurgical testwork program was developed by BBA Inc. in the early stages of the Study to characterize the Black Iron Shymanivske ore body. The objective of the testwork was to evaluate the ore's amenability to be processed by gravity separation and/or by magnetic separation in order to produce a commercially acceptable, quality product that would allow for the economical development of the Shymanivske Project. An important part of the testwork consisted of evaluating whether a gravity separation circuit prior to a magnetic separation circuit could contribute to an increase in iron and weight recovery.

The testwork results were then used in defining a conceptual Process Flowsheet which is described later in this section of the Report. A recommended program for subsequent testwork required for the next study phase of this Project is also presented later in this section.

The main metallurgical testwork was carried out at the Mekhanobrchermet (MCM) Institute in Kryviy Rih, Ukraine. The MCM's lab initial scope was to:

- Perform geological assays for a Twin Drillhole Program;
- Perform preliminary metallurgical testing on selected drill core composite samples;
- Perform mineralogical assessment on the selected composite samples.

The Twin Drillhole Program will be discussed in another section. This section will focus on metallurgical testwork.

In addition to the testwork carried out at MCM, grindability testing and QEMSCAN analysis were carried out at SGS Lakefield on sub-samples of the selected composite samples.

After the preliminary testing, further laboratory tests were carried out on several flowsheet configurations. The results from this testwork were used to develop the preliminary Process Flowsheet as well as preliminary mass and water balance, forming the basis of process design



for this Study. Preliminary sizing of major process equipment was also developed. The metallurgical testwork for this PEA is described in greater detail in the following sections.

13.2.1 Sample Selection and Preparation

In May of 2011, two composite samples were prepared using drill cores from the ongoing Twin Drillhole Program. Additional composite samples will be chosen for the subsequent Feasibility Study. Approximately 300 kg of material per composite sample was selected for metallurgical testing at the MCM laboratory. Approximately 30 kg of +25 mm pieces from each composite sample was sent to SGS Lakefield for grindability characterization. The remainder was ground to 10 mm and used for metallurgical testing. Table 13.2 shows the make-up on each composite sample.

Table 13.2: Composite Sample Make-Up

Composite No.	Drillhole	Interval (m)
1	BI20342-T	24.0 to 185.0
	BI21674-T	22.0 to 87.8
	BI5485-T	14.3 to 106.5
	BI21733-T	18.5 to 133.1
2	BI20342T	237 to 271
	BI21674T	128 to 152
	BI21733T	161.5 to 185.3
	BI5485T	173.5 to 201
	BI12850T	114 to 142.5
	BI13302T	216.5 to 260
	BI20291T	205 to 231

13.2.2 Head Assays

In general, the head assays of the two composite samples chosen for this Study are in line with the historical data of the Shymanivske deposit. The average magnetite content of the optimized pit for this Study is 25.4% and this was used as the basis for the mass balance and sizing of



equipment. The magnetite contents of the composite samples are slightly higher than the average optimized pit.

Table 13.3: Head Assays of Composite Samples

Composite No.	Fe _{tot} (%)	Fe _{mag} [*] (%)	Fe ₃ O ₄ (%)	FeO (%)	Fe ₂ O ₃ (%)	P (%)	S (%)
1	33.4	20.8	28.8	21.0	4.6%	0.089	.12
2	31.6	19.2	26.5	21.1	3.4%	0.092	.104

*- Fe associated with Magnetite

The Shymanivske deposit points to a potential issue with regard to sulfur while all other major contaminants typically of concern including phosphorus, alumina and manganese, are all well below steel mill threshold limits. A major portion of the sulphur is likely to report to the concentrate. This may pose a problem with respect to meeting concentrate specification or SO₂ emissions at the pellet plant. It was estimated that the SO₂ concentration of pellet plant off-gas would be at least 600 ppm. If SO₂ emission levels must be reduced, it is recommended that a trade-off study be carried out between reducing sulphur content in the concentrate by flotation versus SO₂ emission reduction by gas scrubbing in the pellet plant.

13.2.3 Mineralogical Analyses

Composite samples 1 and 2 were ground to 0.25 mm and sub-samples were submitted for mineralogical analyses. The samples are characterized as silicate-magnetite variety. Size-by-size mineralogical analyses are presented in Table 13.4 and Table 13.5. Composite sample 1 contains about 28% magnetite, 7% hematite-martite, 4% carbonates and 33% silicates. The silicates contain about 21% Fe, which represent about 20% of the total iron. Composite sample 2 contains about 25% magnetite, 5% hematite-martite, 2% carbonates, and 40% silicates. The iron contained in the silicates represents about 29% of the total iron. The iron silicates are not recoverable due to the low iron content.



The magnetite levels increase with increasing fineness and the bulk of the magnetite is found in the minus 44 micron range. Based on QEMSCAN analyses, less than 5% of the iron oxides are locked for all size ranges and less than 20% are locked in size fractions greater than 212 μm .



Table 13.4: Mineralogical Analysis of Composite Sample 1 by Size Fraction

Size Fractions, mm	Wt. (%)	Mineral Weight Percent % (M) andIron Content Therein (Fe)															
		Magnetite		Hematite, Martite		Carbonates		Silicates		Iron Sulphide				Quartz	Apatite	Total	
										Pyrite		Pyrrotine					
-0.25+0		27.9	20.2	7.5	4.5	4.3	1.2	33.4	7.16	0.11	0.05	0.14	0.09	26.15	0.5	100.0	33.2
+0.25	8.0	17.5	12.7	4.2	2.5	3.0	1.4	38.5	8.48	0.10	0.05	0.11	0.07	36.09	0.5	100.0	25.2
-0.25+0.16	5.1	19.1	13.8	5.2	3.1	3.1	1.2	37.7	8.07	0.11	0.05	0.14	0.08	34.15	0.5	100.0	26.3
-0.16+0.07	27.2	25.4	18.4	7.5	4.5	2.9	1.3	31.6	6.96	0.09	0.04	0.17	0.10	31.94	0.4	100.0	31.3
-0.07+0.056	6.6	38.8	28.1	6.3	3.8	3.7	1.2	24.5	5.26	0.10	0.05	0.14	0.09	26.06	0.4	100.0	38.5
-0.056+0.044	8.4	41.0	29.7	4.2	2.5	4.9	1.3	23.5	5.17	0.09	0.04	0.14	0.09	25.87	0.3	100.0	38.8
-0.044+0	44.7	28.2	20.4	9.2	5.5	3.7	0.8	36.5	7.84	0.10	0.05	0.17	0.11	21.53	0.6	100.0	34.7



Table 13.5: Mineralogical Analysis of Composite Sample 2 by Size Fraction

Size Fractions, mm	Wt. %	Mineral Weight Percent (M) andIron Content Therein (Fe), %															
		Magnetite		Hematite, Martite		Carbonates		Silicates		Iron Sulphide				Quartz	Apatite	Total	
										Pyrite		Pyrrhotine					
		M	Fe	M	Fe	M	Fe	M	Fe	M	Fe	M	Fe	M	M	M	Fe
-0.25+0		25.0	18.1	4.7	3.3	2.12	0.9	41.74	9.17	0.07	0.03	0.17	0.10	25.7	0.5	100.0	31.6
+0.25	5.8	13.5	9.8	2.9	2.0	2.83	1.3	49.10	10.71	0.07	0.03	0.10	0.06	31.0	0.5	100.0	23.9
-0.25+0.16	6.1	15.7	11.4	3.6	2.5	2.85	1.3	45.38	10.01	0.07	0.03	0.10	0.06	31.8	0.5	100.0	25.3
-0.16+0.07	24.2	23.9	17.3	2.9	2.0	2.57	1.2	41.35	9.00	0.07	0.03	0.11	0.07	28.6	0.5	100.0	29.6
-0.07+0.056	10.2	31.6	22.9	6.0	4.2	3.23	0.9	34.67	7.58	0.06	0.03	0.14	0.09	23.9	0.4	100.0	35.7
-0.056+0.044	7.9	36.2	26.2	3.7	2.6	1.75	0.7	37.11	8.15	0.05	0.03	0.19	0.12	20.7	0.3	100.0	37.8
-0.044+0	45.8	24.9	18.0	3.9	2.7	2.69	1.3	47.01	10.33	0.07	0.03	0.23	0.14	20.6	0.6	100.0	32.5



13.2.4 Shaking Table and Davis Tube Test Results – Mekhanobrchermet

A series of gravity and magnetic separation tests were conducted at the Mekhanobrchermet laboratory in Kryviy Rih, Ukraine. The main purpose of these preliminary tests was to establish the appropriate particle fineness for magnetic separation and to determine whether the ore is amenable to gravity separation. This would allow BBA to develop a conceptual Process Flowsheet. The gravity tests were performed on a lab scale shaking table while the magnetic separation tests were performed on a Davis Tube apparatus. The results of these tests are summarized in the following sections.

13.2.4.1 Shaking Table

Gravity separation tests were carried out on composites 1 and 2 using a laboratory scale shaking table at grind sizes of minus 0.8 mm and 0.5 mm. The product was subdivided into three fractions; heavy fraction, middlings, and tails. The results are given in Table 13.6 and Table 13.7.

Table 13.6: Gravity Separation for Composite 1-Shaking Table Results

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Size of Grinding – Minus 0.8 mm									
Heavy	9.7	19.3	29.4	66.3	61.3	29.0	0.051	0.146	5.84
Middling	70.6	67.6	64.6	31.9	18.5	20.6	0.083	0.130	46.36
Tails	19.7	13.1	6.0	22.3	6.2	19.1	0.140	0.091	54.72
Total	100.0	100.0	100.0	33.3	20.2	21.1	0.091	0.124	44.08
Size of Grinding – Minus 0.5 mm									
Heavy	10.6	21.2	31.5	66.1	59.7	28.6	0.052	0.142	6.0
Middling	68.2	64.9	61.8	31.4	18.2	20.3	0.076	0.124	47.08
Tails	21.2	13.9	6.7	21.6	6.3	16.5	0.139	0.095	55.56
Total	100.0	100.0	100.0	33.0	20.1	20.4	0.087	0.120	44.52



Table 13.7: Gravity Separation for Composite 2-Shaking Table Results

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Size of Grinding – Minus 0.8 mm									
Heavy	9.1	18.5	29.6	64.5	60.9	28.4	0.067	0.103	8.30
Middling	69.7	66.4	63.4	30.3	17.0	21.2	0.084	0.112	48.24
Tails	21.2	15.1	7.0	22.6	6.2	19.0	0.147	0.062	54.92
Total	100.0	100.0	100.0	31.8	18.7	21.4	0.096	0.100	46.02
Size of Grinding – Minus 0.5 mm									
Heavy	9.6	19.8	31.4	65.3	62.1	28.8	0.061	0.098	7.24
Middling	69.5	66.6	62.6	30.3	17.1	20.9	0.085	0.121	47.60
Tails	20.9	13.6	6.0	20.5	5.4	19.9	0.155	0.046	57.04
Total	100.0	100.0	100.0	31.6	19.0	21.4	0.097	0.103	45.70

For both composite samples at both particle fineness, about 70% of the feed reports to the middling fraction which contains about 30% Fe. The Fe content of the middlings was too low to be recombined with the heavy fraction in order to produce an acceptable concentrate grade. In all cases, the heavy fractions contained about 65% iron or greater, but represented about 10% or less of the feed by weight. This weight recovery was too low for gravity separation to be viable on its own.

The middling and tails fractions from these tests were recombined and subjected to further upgrading by magnetic separation. The results of these tests are covered in Section 13.2.4.3.



13.2.4.2 Davis Tube Test

Composites samples 1 and 2 were subjected to magnetic separation tests using Davis Tube. The tests were performed at various grind fineness, ranging from 80% 0.074 mm to 95% minus 0.044 mm. The purpose of these tests was to:

- Establish the appropriate grind fineness;
- Assess weight, iron, and magnetite recoveries;

The results of these tests are presented in Table 13.8 and Table 13.9 and in Figure 13.1.

Table 13.8: Magnetic Separation for Composite 1 – Davis Tube Results

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Size of Grinding – 80% Minus 0.074 mm									
Mag	41.0	73.0	98.5	59.1	49.0	27.1	0.045	0.120	14.66
Non-Mag	59.0	27.0	1.5	15.2	0.5	14.3	0.105	0.096	64.36
Total	100.0	100.0	100.0	33.2	20.4	19.5	0.080	0.106	44.0
Size of Grinding – 80% Minus 0.056 mm									
Mag	38.3	71.0	98.5	61.2	52.7	27.8	0.039	0.146	12.2
Non-Mag	61.7	29.0	1.5	15.5	0.5	16.1	0.106	0.112	64.88
Total	100.0	100.0	100.0	33.0	20.5	20.6	0.080	0.125	44.7
Size of Grinding – 80% Minus 0.044 mm									
Mag	36.3	70.6	97.8	64.0	55.5	28.3	0.032	0.130	9.16
Non-Mag	63.7	29.4	2.2	15.2	0.7	15.9	0.104	0.093	64.84
Total	100.0	100.0	100.0	32.9	20.6	20.4	0.079	0.106	44.6
Size of Grinding – 95% Minus 0.044 mm									
Mag	35.5	69.5	98.5	65.4	57.7	28.6	0.037	0.161	7.56
Non-Mag	64.5	30.5	1.5	15.8	0.5	16.8	0.118	0.098	63.98
Total	100	100	100	33.4	20.8	21	.089	0.12	44



Table 13.9: Magnetic Separation for Composite 2 – Davis Tube Results

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Size of Grinding – 80% Minus 0.056 mm									
Mag	31.8	63.3	98.2	62.9	59.3	27.3	0.041	0.245	10.28
Non-Mag	68.2	36.7	1.8	17.0	0.5	18.2	0.116	0.038	62.30
Total	100.0	100.0	100.0	31.6	19.2	21.1	0.092	0.104	45.76
Size of Grinding – 80% Minus 0.044 mm									
Mag	30.4	63.5	98.2	66.2	62.0	28.9	0.030	0.249	6.70
Non-Mag	69.6	36.5	1.8	16.6	0.5	17.4	0.115	0.031	62.00
Total	100.0	100.0	100.0	31.7	19.2	20.9	0.089	0.097	45.19
Size of Grinding – 95% Minus 0.044 mm									
Mag	28.1	61.1	97.7	68.3	65.35	27.9	0.025	0.259	4.28
Non-Mag	71.9	38.9	2.3	17.0	0.6	17.8	0.120	0.030	61.70
Total	100.0	100.0	100.0	31.4	18.8	20.6	0.093	0.094	45.56

The results show that the Shymanivske ore would require a grind fineness of at least 95% passing 0.044 mm, which is consistent with historical results. Significantly higher Fe and weight recoveries were achieved with composite 1. This may be mostly attributed to the fact that it contained higher magnetite content than composite 2 and that a significantly lower concentrate grade was produced (65.4% Fe for composite 1 versus 68.3% Fe for composite 2). The results for composite 2 were in line with historical results, but slightly higher weight and iron recoveries than expected.

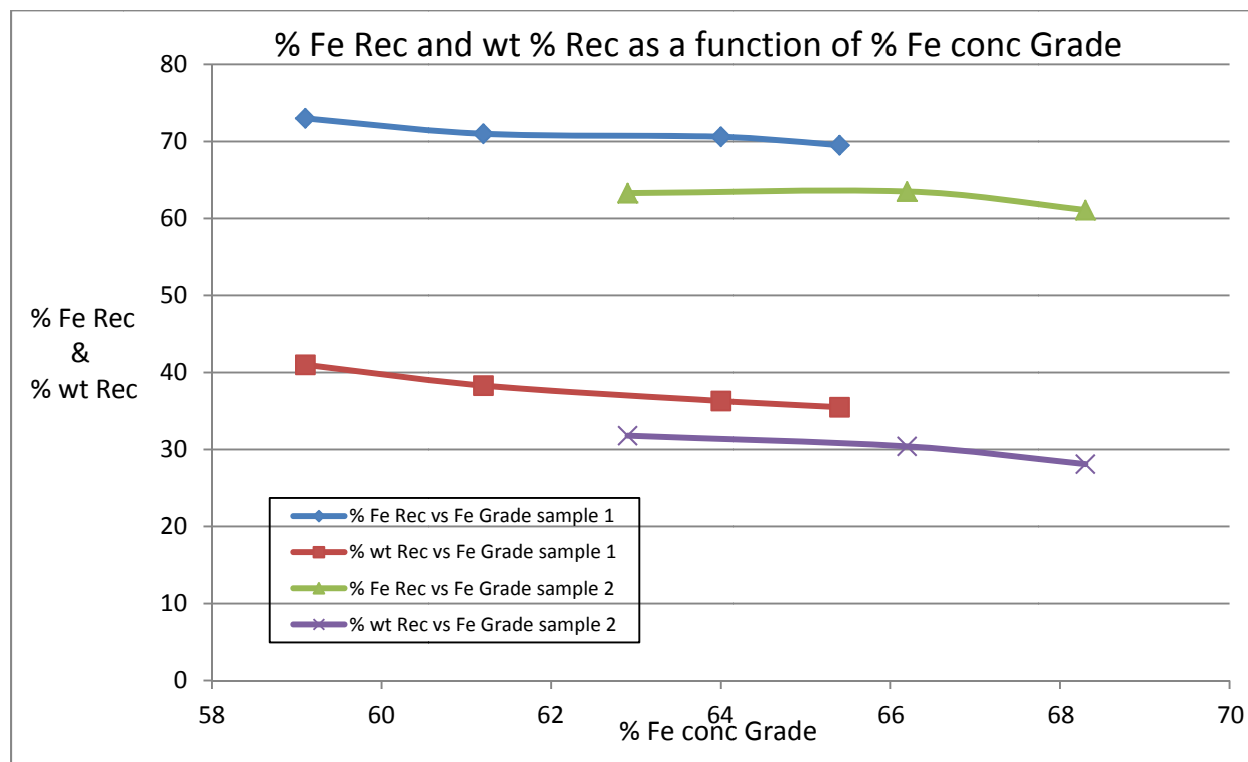


Figure 13.1: Weight and Iron Recovery versus Iron Grade for Composite Samples 1 and 2

13.2.4.3 Shaking Table and DT versus DT Alone

As mentioned in Section 13.2.4.1, the combined middling and tails fractions from the shaking table tests were subjected to further upgrading by magnetic separation. The results for composite 1 are shown in Table 13.10.

**Table 13.10: Magnetic Separation by Davis Tube on Combined Gravity Middlings and Tails**

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Combined Middling and Tails Fraction of Gravity Test.									
Grind Size – 95% Minus 0.044 mm									
Mag	26.5	59.1	97.7	64.9	56.8	28.1	0.038	0.205	8.5
Non-Mag	73.5	40.9	2.3	16.2	0.5	16.3	0.118	0.088	65.04
Total	100	100	100	29.1	15.4	19.4	0.097	0.119	50.06

The overall results for gravity and magnetic separation versus magnetic separation alone are shown in Table 13.11.

Table 13.11: Magnetic Separation Only Versus Gravity and Magnetic Separation

Products	Yield (Weight Recovery)	Fe Recovery	Magnetite Recovery	Fe _{tot}	Fe _{mag}	FeO	P	S _{tot}	SiO ₂
Size of Grinding – 95% minus 0.044 mm									
Mag Sep. Only	35.5	69.5	98.5	65.4	57.7	28.6	0.037	0.161	7.56
Gravity + Mag.Sep.	34.3	67.8	98.4	65.3					

Table 13.11 shows that gravity separation provides no additional benefit in terms of weight, iron, and magnetite recovery, and therefore, it is recommended that the Black Iron flowsheet consist of magnetic separation solely.

13.2.4.4 Laboratory LIMS Cobbing Tests

QEMSCAN analyses of composites samples 1 and 2 indicated that magnetite content increases with accumulative fineness, and good magnetite liberation can be achieved even at the coarser size ranges. Laboratory magnetic separation tests were performed using an Eriez wet magnetic separator (LIMS type) to determine if an effective cobbing step can be carried out at coarser



grind sizes. The results of cobbing steps carried out at -20 mesh (0.841 mm) and -35 mesh (0.420 mm) on composite sample 2 are presented in Table 13.12 and Table 13.13.

Table 13.12: Magnetite Distribution of Cobbing Step at -20 Mesh (0.841 mm)

Stream	Weight		Distribution %		
	kg	%	SiO ₂	Fe	Satmagan
Cobber Conc.	1063.6	66.6	49.3	85.7	96.4
Cobber Tails	533.4	33.4	50.7	14.3	3.64

Table 13.13: Magnetite Distribution of Cobbing Step at -35 Mesh (0.420 mm)

Stream	Weight		Distribution %		
	kg	%	SiO ₂	Fe	Satmagan
Cobber Conc.	859.7	64.7	46.8	85.1	95.2
Cobber Tails	489.4	35.2	53.2	14.9	4.75

The results show that there is not a significant difference between grind sizes of -20 mesh (0.841 mm) and -35 mesh (0.420 mm). The results also show that an effective cobbing step with at least 95% magnetite recovery can be carried out at the coarser grind sizes while eliminating at least 30% feed weight.

13.2.5 Ore Grindability

Approximately 30 kg of plus 25 mm material from each composite sample was sent to SGS Lakefield Research for grindability characterization. The following tests were carried out:

- SAG Mill Comminution (SMC);
- Bond Rod Mill Grindability Test;
- Bond Ball Mill Grindability Test at 100 and 325 Mesh (0.149 mm and 0.044 mm, respectively).



The results of these tests are summarized in Table 13.14 and Table 13.15.

Table 13.14: Grindability Test Result Summary

Sample Name	Relative Density	JK Parameters		RWI kWh/t	BWI (kWh/t)	
		Axb	t _a		100 M	325M
Composite 1	3.5	35.2	0.26	16.7	13.1	15.7
Composite 2	3.36	28	0.22	16.4	12.2	16.4

Table 13.15: SMC Test Summary

Sample Name	A	b	Axb	t _a	DWI kWh/m ²	M _{ia}	M _{ih}	M _{ic}	Relative
Comp. 1	76.5	0.46	35.2	0.26	9.84	20.4	16.3	8.4	3.5
Comp. 2	100	0.28	28.0	0.22	11.9	24.7	20.5	10.6	3.36

These results were used to perform preliminary sizing and power evaluation of the grinding circuit. The SMC results were used to perform JKSimMet simulations of the SAG mill grinding circuit.

The target production for this Project is at least seven million tonnes of concentrate per year. To achieve this, the SAG circuit would have to process 3,200 tph of run-of-mine ore. It was decided that the largest SAG mill size that would be used for this Project is 10.97 m x 6.1 m, which has a power draw of 13,600 kW. Conservatively, this would be the largest mill without requiring a wrap-around motor. A wrap-around motor would significantly increase cost and project risk. Based on this constraint, the JKSimMet simulations showed that two 10.97 m x 6.1 m SAG mills with a pre-crusher and a pebble mill would be required to process 3,200 tph of run-of-mine ore. The SAG mill product size would be 963 µm. The SAG mill power requirement would be 11,930 kW per mill and the pre-crusher power would be 1,280 kW per pre-crusher. The maximum throughput that can be achieved without the pre-crushers and pebble crushers would be 2,600 tph.



It is recommended that additional grindability testing be carried out during the Feasibility Study to better assess the equipment sizing, power requirements and grinding circuit configuration.

The additional tests would include:

- Drop-Weight Tests (DWT) – minimum of three tests;
- SMC Tests – minimum of 12 tests;
- Bond Low Energy Impact Test for crusher sizing;
- Bond Rod Mill Grindability Tests – minimum of 12 tests;
- Bond Ball Mill Grindability Test – minimum of 12 tests;
- Abrasion Tests;
- MacPherson Tests.

A trade-off study may also be required to evaluate the use of larger SAG mills with wrap-around motors versus smaller SAG mills with pre-crushing and pebble crushing.

13.2.6 Process Flowsheet Development

The results from the above-mentioned testwork, as well as historical test data, were used to develop a preliminary Process Flowsheet (PFS) for the Black Iron Shymanivske ore deposit. In developing the Process Flowsheet, the following considerations were taken into account:

- Historical and recent testwork showed that very high magnetite recoveries can be achieved by magnetic separation;
- Recovery by magnetic separation requires a grind size of at least 95% passing 44 µm to achieve a concentrate grade of 68% Fe or greater;
- The bulk of the waste (60% of the total feed) can be removed by magnetic separation at a grind size of 80% passing 74 µm;
- An effective magnetic cobbing step can be carried out at -20 mesh (0.841 mm) while eliminating at least 30% of the total feed weight;



- Recent test data indicated that gravity concentration is not a viable option;
- In order to reduce capital cost, the largest size major equipment commonly used would be considered.

Furthermore, recent Davis Tube results and ongoing laboratory flowsheet selection tests indicate that weight and iron recoveries are slightly higher than those of the historical tests. For example, recent laboratory flowsheet tests showed that for composite sample 2, weight recovery of close to 30% can be achieved while recovering 62% of the iron and 96% of the magnetite. This recent data was used to update the weight and iron recovery relationships and adjust them for a concentrate grade of 67% Fe, which is the target concentrate grade to produce an acid pellet containing 65% Fe.

The updated relationships are as follows:

$$\text{Fe Rec.} = 1.7728 * \text{Magnetite} + 16.42$$

$$\text{Wt. Rec.} = 1.1354 * \text{Magnetite} + 0.1796$$

These are projected relationships based on limited recent data. They must be validated during the Feasibility Study with significantly more composite samples, especially since MCM needed to recalibrate their Fe_{mag} assay technique as described in Section 12.

13.2.7 Proposed Flowsheet

The proposed Process Flowsheet (PFS) for this PEA is presented in the simplified process block diagram in Figure 13.2. The crushing and grinding circuit consists of one gyratory crusher, two SAG mills with pre-crushers and pebble crushers. The SAG mill product P_{80} is 963 μm . The magnetic separation circuit consists of 12 single-stage cobbing separators, 12 rougher separators, and 12 finishing separators. There are two regrind ball mills, one for each SAG mill line, with a product P_{80} of 74 μm . Six Vertimills grind the rougher concentrate from 74 μm to a final P_{80} of 24 μm . The finishing concentrate is filtered prior to being sent to the pellet plant. The main pellet plant product will be an acid pellet at a grade of 65% Fe.

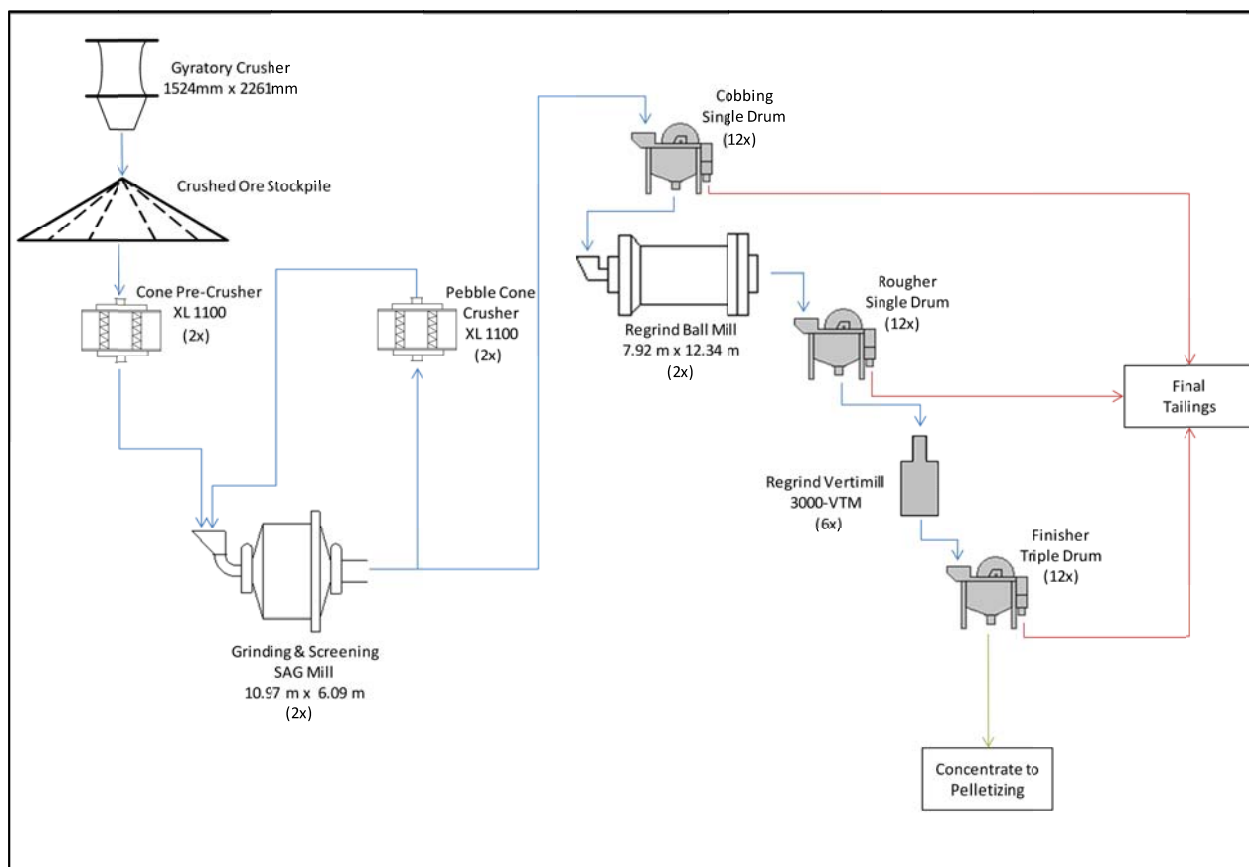


Figure 13.2: Simplified Process Block Diagram.

13.2.8 Recommended Testwork for Feasibility Study

Additional testwork will be required for the Feasibility Study, which includes Davis Tube testing on selected drill core intervals to develop reliable weight, iron, and magnetite recovery relationships, grindability testing, variability testing, pilot scale testing for engineering design data, filtration and thickening tests, rheology tests, and water treatment tests. The major testwork planned to be performed early in the Feasibility Study is shown in Table 13.16.

**Table 13.16: Major Testwork Planned for Feasibility Study**

Testwork	
1. Drill Cores for Geological Assaying	
1.1	DT tests on selected intervals
1.2	Selection of composite samples for SPI, SMC, (min. 15)
2. Grindability - HQ full Drill Core – 3 Drillholes	
2.1	Drop-Weight
2.2	SPI
2.3	CWI
2.4	RWI
2.5	BWI (100 mesh, 325 mesh)
2.6	SAG Design
3. Test for AG Mill Sizing - HQ Full Drill Core	
3.1	MacPherson
4. Variability Test	
4.1	SPI – 60 tests
4.2	SMC – on 15 composite samples
4.3	BWI – on 15 composite samples
4.4	RWI – on 15 composite samples
4.5	Abrasion tests – on 15 composite samples
5. Simulation	
5.1	JKSimMet
5.2	SGS Minovex (CEET)
6. Process Development	
6.1	Sample preparation
6.2	Davis Tube tests on composite samples
6.3	Lab scale flowsheet confirmation tests
6.4	Lab scale pellet testing on selected composites
7. Pilot Scale Testing	
7.1	Sample preparation
7.2	Pilot scale testing of grinding and magnetic separation circuit
7.3	Pilot scale pellet testing for engineering design data
8. Concentrate Filtration Test	
9. Sedimentation Test	
9.1	Tailings Thickener Sedimentation Tests
10. Ultimate Tailing Rheology	
10.1	Tailings Shear Stress; Density & Viscosity
11. Water Clarification and Treatment	
11.1	Tailing Effluent Ageing
11.2	Water Treatment Test



14. MINERAL RESOURCE ESTIMATES

The resource block model for the Shymanivske deposit was updated by Farshid Ghazanfari, P.Geo. Chief Geologist of Black Iron and reviewed and verified by Hugues de Corta, P.Geo., who conducted the original resource estimate, as an independent Qualified Person who has no relationship with Black Iron other than producing this Report.

The Mineral Resources disclosed regarding the Shymanivske Project has been prepared using only historical technical data. The accuracy and validity of the historical data was verified and is explained in detail in Section 12 of this Report by WGM.

Although the author cannot verify the quality assurance and quality control processes and methods used in compiling the historical technical data, the author believes that the historical technical data is relevant to the overall potential of the Shymanivske Project and in establishing updated Mineral Resources.

14.1 Disclosure

It is important to note the following when considering the Mineral Resource estimates:

- A **Mineral Resource** is a concentration or occurrence of diamonds, natural, solid, inorganic or fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.
- An **Inferred Mineral Resource** is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is



based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes.

- An **Indicated Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient enough to allow the appropriate application of technical and economic parameters and to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes that are spaced closely enough for geological and grade continuity.
- A **Measured Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, physical characteristics are so well established that they can be estimated with confidence sufficient enough to allow the appropriate application of technical and economic parameters to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes that are spaced closely enough to confirm both geological and grade continuity.
- A **Mineral Reserve** is the economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate at the time of reporting that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when the material is mined.
- Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.



- The author is not aware of any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political, mining, metallurgical, infrastructure and other relevant factors or other relevant issues that may affect the present estimate.
- All Mineral Resources at the Shymanivske deposit have been classified as Measured, Indicated and Inferred.
- The Mineral Resources in this report were estimated using the Canadian Institute of Mining, Metallurgy, and Petroleum (CIM) Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council December 11, 2005.

14.2 Database

The Gemcom (version 6.2) database, which was created for previous resource estimation in January 2011, has been used for the purpose of updating the current resource estimate. This database, created by data input, consisted of tables containing data retrieved from the following Excel files: “ASSAY, LITHO, COLLAR, SURVEY, COORD, BULK ASSAY, GEOTECH and Summary_Ore_Characteristics”. The Gemcom drillhole database consists of 215 diamond drillholes. These holes are dispersed along the iron mineralization, approximately 2,150 m of strike length and 900 m of width in the Shymanivske deposit.

The database was validated with Gemcom’s internal validation tools. The author conducted a series of basic validation tests in Gemcom and found no significant errors in the database.



14.3 Parameters for Solid Construction and Topographic Surfaces

Two geology level maps and a surface topographic map in DXF format were directly imported into the GEMS Project. Furthermore, the two geology level maps and 13 sections with drillholes location and geologic interpretation were scanned and digitized. Figure 6.1 in Section 6 shows the geology at level +50 m. The position and the name of the 13 sections are also presented.

The sections crosscut the strike of the formations and are oriented at 111.5°N. Some are interpreted down to the -550 level while others stop at the -250 level. They are unevenly spaced as can be seen in Figure 14.1 and Figure 6.1.

The interpreted lithological units were digitized on each section as closed perimeters to be exported into the GEMS Project. They were used as the base for solid geological domains construction. The lithological domains are mainly the ones used in the 1989 estimate, except for the unification of subunits as they were not differentiated on the lithological sections. They are listed with their characteristics in Table 14.1. The ore zone solids were built by extruding the polygons at mid-section, which were drawn on the sections for each lithological domain as shown in Figure 14.2.

The two wireframe surfaces were extracted from the 2005 database for the topography surface and overburden contacts. Similar surfaces were used in a previous NI 43-101 Report (H. de Corta, 2011). An updated topography wireframe, derived from a gridded digital elevation model from the 2011 ground gravity survey replaced the previous topography surface.



Table 14.1: Lithologic Domains

Domains	Rock Code	Waste/Ore	Density from 2005 Database (g/sm ³)	Litho
FOX	121	o	3.00	Altered Ore
OX	21	w	2.50	Altered Waste
NKA	2	w	2.80	Amphibolites
NKM	1	w	2.70	Migmatites
GD1_2S	20	w	2.52	Sandstones
SK2	4	w	2.85	Schists
SK3	3	w	2.85	Conglomerates
SX1F	8	o	3.40	Magnetite-Quartzite
SX1S	6	w	3.07	Quartzite-Schists
SX1T	5	w	3.07	Quartz-Chlorite Dyke
SX2F	11	o	3.42	Magnetite-Quartzite
SX2S	9	w	3.08	Quartzite-Schists
SX4F	14	o	3.39	Magnetite-Quartzite
SX4S	12	w	3.13	Quartzite-schists
SX5F	18	o	3.31	Martite-Magnetite-Qz
SX5S	15	w	3.17	Quartzite-Schists

Note: Densities for FOX, OX, NKM and NKA are from geological knowledge since no data were provided.

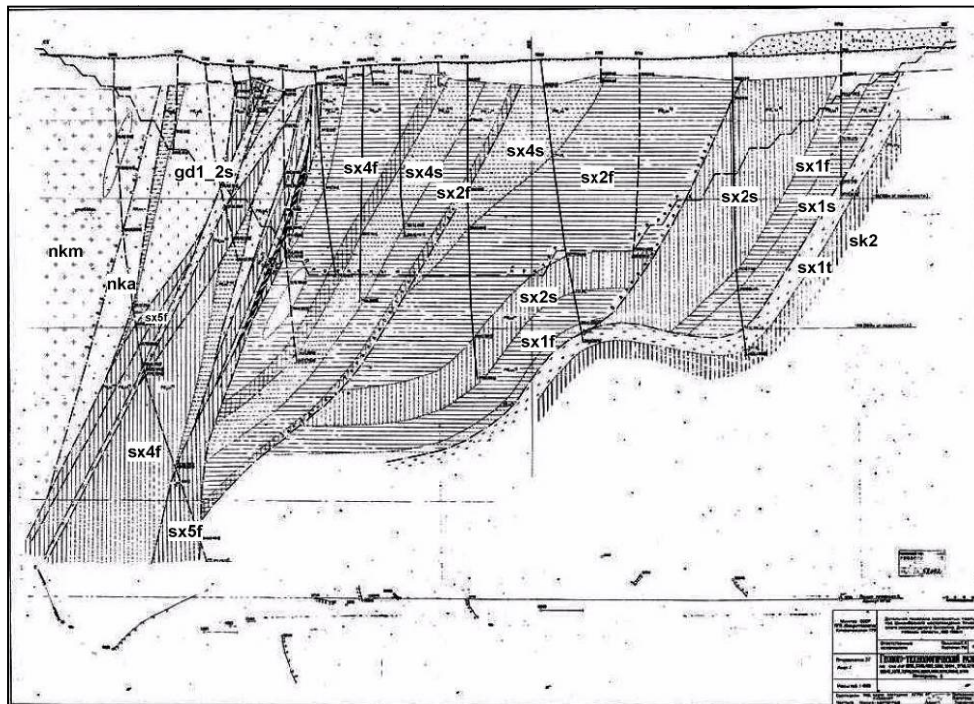


Figure 14.1: Typical Cross Section of the Deposit

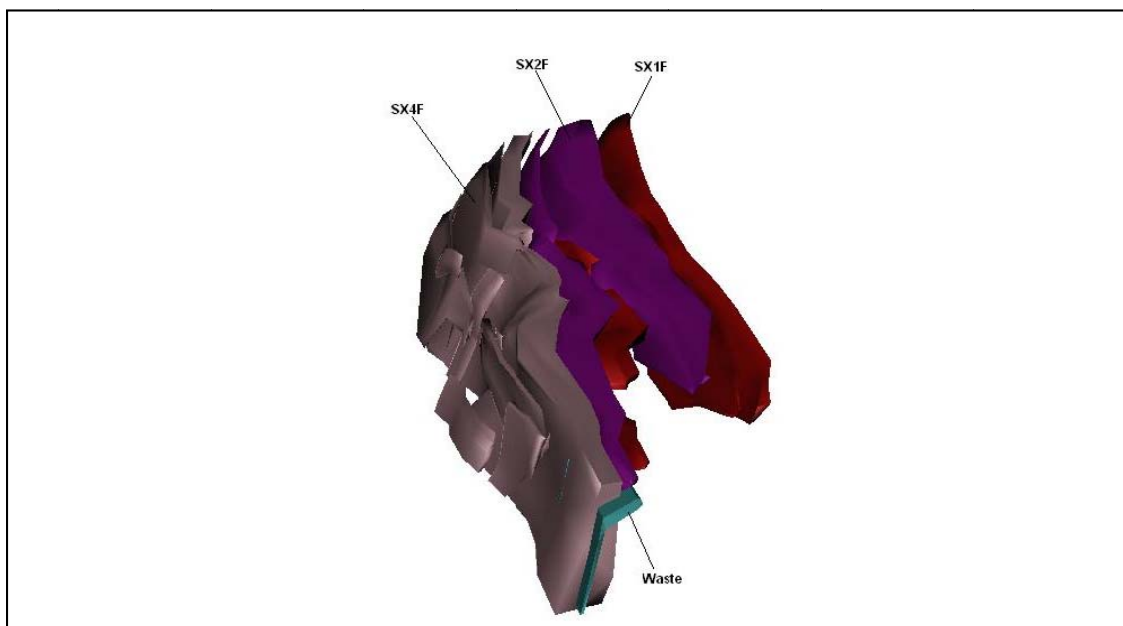


Figure 14.2: Solid Models Seen from the Upper South-West

14.4 Block Model

The block model shown in Figure 14.3 was built to encompass the Property area, as well as any historical projected pit area, down to the -550 m level. The block model geometry is:

Columns:	195
Rows:	250
Levels:	68
Origin	(in WGS84 units, upper southwest corner):
X:	519317.5
Y:	5297200
Z:	130
Rotation:	0
Block size:	10 m x 10 m x 10 m

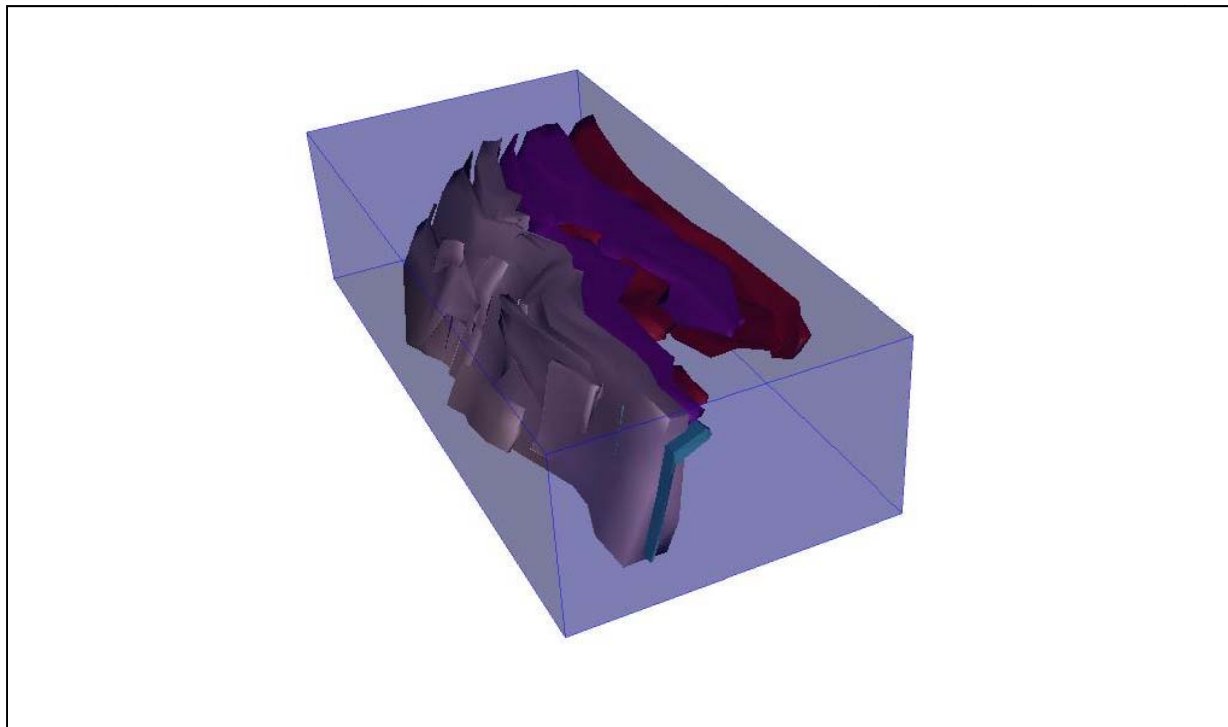


Figure 14.3: Block Model (Pale Blue) with the Three Mineralized Domains Shows From the Upper South-West (SX1F, 2F and 4F)



14.5 Population Statistics

The univariate statistical analysis was performed using Snowden's Supervisor software and %Fe_{tot} and %Fe_{mag} values were extracted from the Gemcom database for all three major ore domains. Both univariate statistics and variogram analysis were completed for the drillhole data. The log normal histograms are shown in Figure 14.4 through Figure 14.6 with univariate statistical data for the raw assays. These values are representative of the uncut and non-composited assay data in the sx1f, sx2f and sx4f domains.

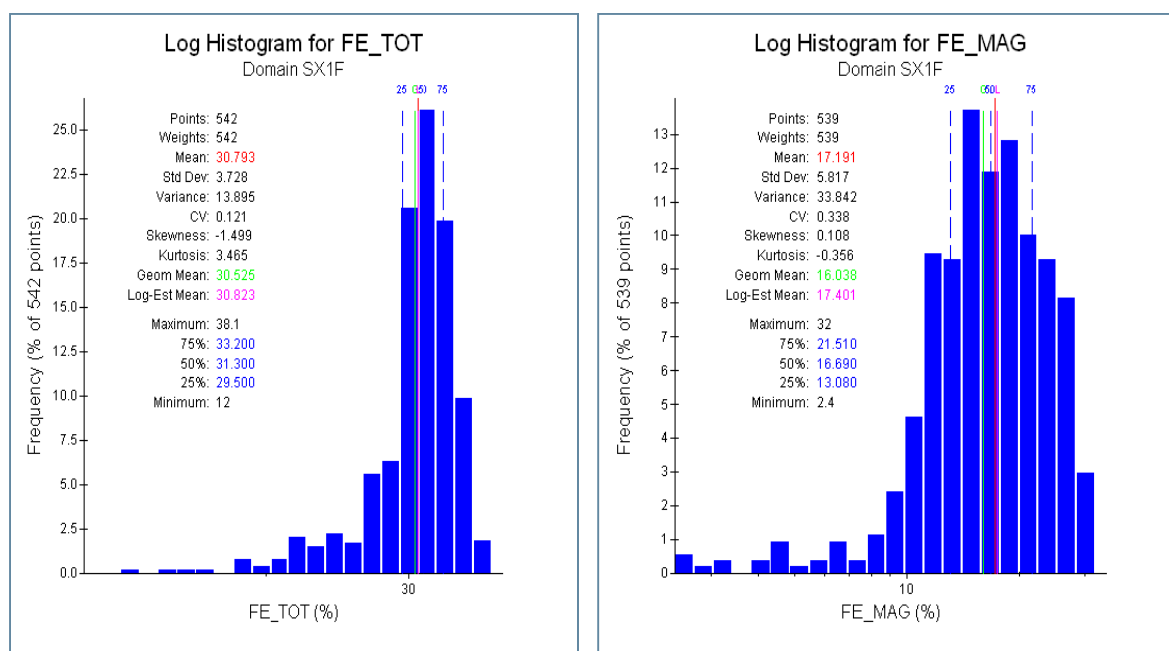


Figure 14.4: Log Normal Histogram for sx1f Ore Domain

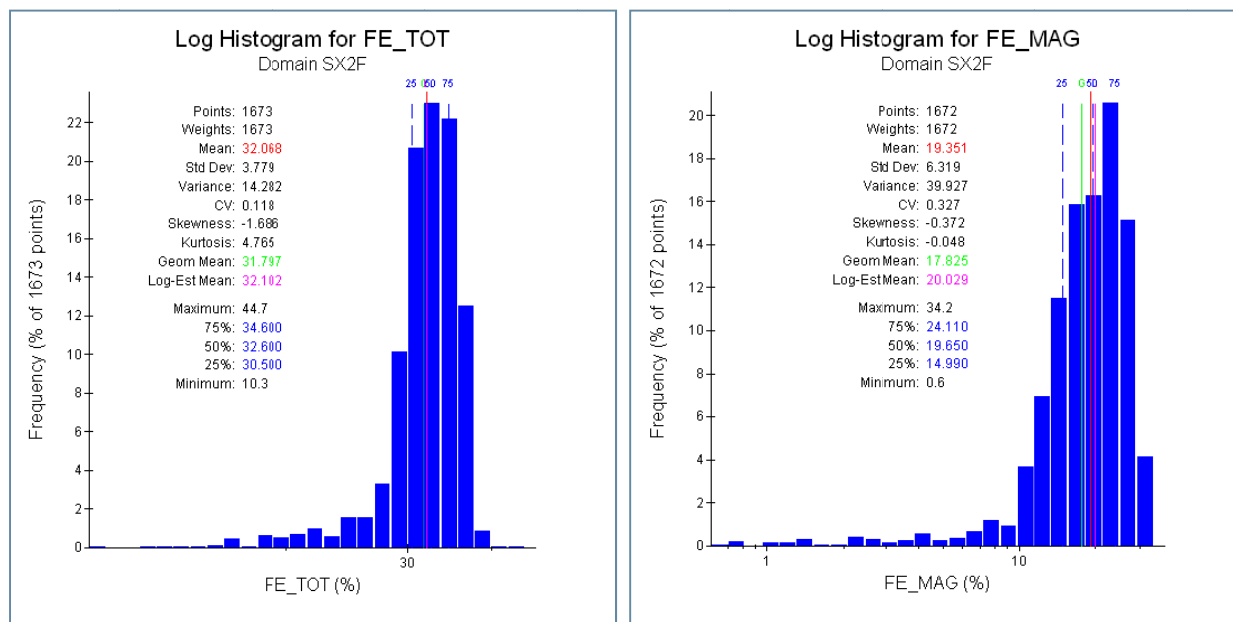


Figure 14.5: Log Normal Histogram for sx2f Ore Domain

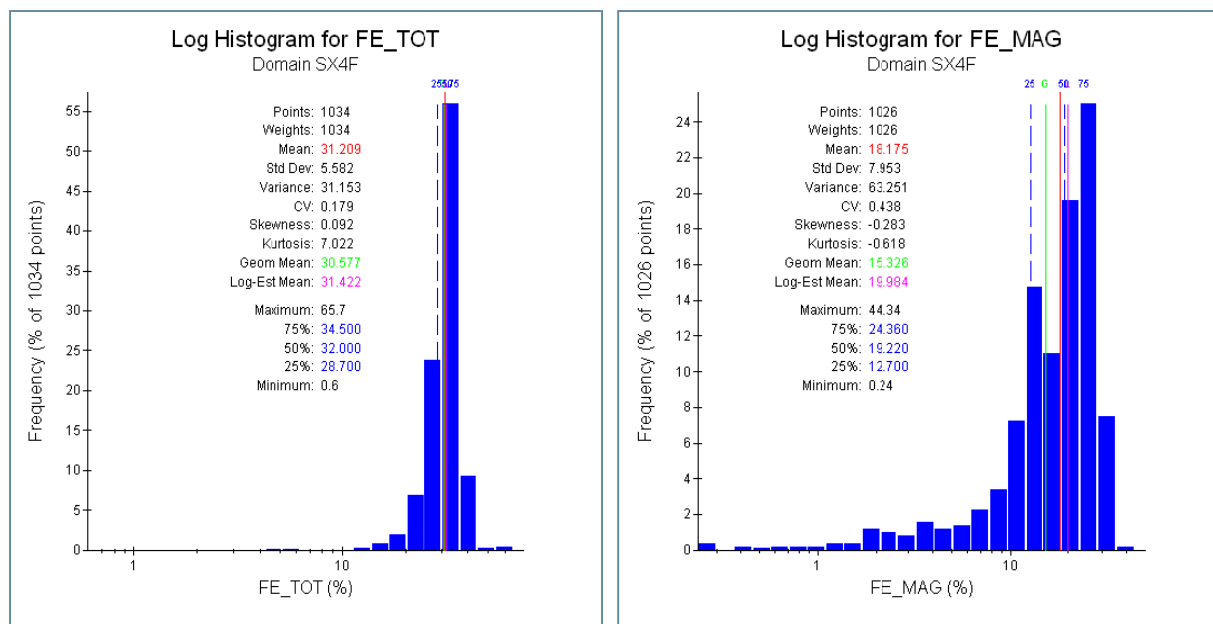


Figure 14.6: Log Normal Histogram for sx4f Ore Domain



14.6 Compositing

The original assay intervals have different lengths and required normalization to a consistent length. A 3 m composite length was chosen to ensure that more than one composite would be used for grade interpolation for each block in the model. Regular down the drillhole compositing was used. No grade capping was applied to assay data for both Fe_{tot} and Fe_{mag} . For the purpose of resource estimation, only composites greater than 30 cm accounted for grade interpolation. This was done to prevent short sample bias. Grade capping, also sometimes referred to as top cutting, is commonly used in the Mineral Resource estimation process to limit the effect (risk) associated with extremely high assay values, but considering the nature of the mineralization and the continuity of the zones, there is no grade capping or top cut applied to Fe_{tot} and Fe_{mag} .

14.7 Density Assignment

Specific gravity was measured and reported in previous Russian reports dating back to 1985 and 1989. The measured data for about 710 samples is available for selected drillholes in different intervals and for each rock type. A review of this data indicates it is valid and consistent with lithology. A compiled version of similar density data measurements was summarized in 2005 by the Russian consulting group Geo Inter Consulting, as reported in Table 14.1.

As shown in Table 14.1, all three major ore zones have similar density values of around 3.4 g/cm^3 . Therefore, a density value of 3.4 g/cm^3 was defaulted for all three major ore zones and was used for the purpose of resource estimation reports and all volumetric reports.

14.8 Search Ellipses

Experimental variograms were prepared for the all three major ore domains using the composited assay dataset for Fe_{tot} . The variograms were constructed by applying an average strike (N21E) of the deposit and the two other mutually orthogonal directions. Single structure spherical models were used to fit experimental directional variograms that are illustrated in Appendix A. The variograms are traditional and are log transformed. Based on these



variograms, three directions of continuity (strike range, dip range and across dip range) were determined for all three major ore domains (see Table 14.2 and Table 14.3). Gemcom ADA (Azimuth-Dip-Azimuth) angles were extracted from the positive axis rotation (around X) to apply to the search ellipsoid for interpolating grade (see Table 14.2 and Table 14.3).

These search radiuses are determined by the maximum range of the variograms for the first pass which applied to the first search ellipsoid and then extended empirically for the second search. The blocks created from the second pass search radius can then be considered for classification in the Inferred category.

Table 14.2: ID² Interpolation Parameters, First Search Ellipsoid

Domain	Principal Azimuth (°)	Dip (°)	Intermediate Azimuth (°)	Intermediate Continuity (m, X)	Maximum Continuity (m, Y)	Minimum Continuity (m, Z)	Max. No. Per Hole	Min. No. Samples	Max. No. Samples
SXF1-1	16.96	8.65	272.6	85	140	20	2	3	10
SXF1-2	353.5	9.85	260.43	85	140	20	2	3	10
SXF1-3	8.93	7.43	274.8	85	140	20	2	3	10
SXF2-1	193.3	4.98	100.5	110	210	70	2	3	10
SXF2-2	196.6	8.65	92.57	110	210	70	2	3	10
SXF4	111.5	60	21.5	160	260	55	2	3	10

Table 14.3: ID² Interpolation Parameters, Second Search Ellipsoid

Domain	Principal Azimuth (°)	Dip (°)	Intermediate Azimuth (°)	Intermediate Continuity (m, X)	Maximum Continuity (m, Y)	Minimum Continuity (m, Z)	Max. No. Per Hole	Min. No. Samples	Max. No. Samples
SXF1-1	16.96	8.65	272.6	340	350	80	None	2	10
SXF1-2	353.5	9.85	260.43	255	350	100	None	2	10
SXF1-3	8.93	-7.3	274.8	255	280	60	None	2	10
SXF2-1	193.3	4.98	100.5	330	420	140	None	2	10
SXF2-2	196.6	8.65	92.57	330	420	140	None	2	10
SXF4	111.5	60	21.5	320	520	110	None	2	10



14.9 Grade Interpolation

The Shymanivske Project Mineral Resource estimates were completed using a block modelling method and for the purpose of this Study, the grades have been interpolated using the Inverse Squared Distance ("ID²") estimation technique. The Inverse Distance method ("ID²") uses the inverse of the distance (to the selected power) between a composite and the block as the weighting factor.

All ore domains were interpolated for Fe_{tot} and Fe_{mag} by ID². Ellipsoid search anisotropy was applied with search volume limits along the X, Y, and Z directions set at the range of the variograms and then at two or three times the range. The orientation of the search ellipsoid was the same as that of the variogram model.

The minimum and maximum number of samples used to estimate a block in the first pass was set at three and ten respectively, based on the drilling density and degree of confidence. The maximum number of samples to be selected per drillhole was limited to two (Table 14.2 and Table 14.3).

A coding precedence was applied to resolve overlap in boundary interpretations between the different mineralized domains. Where solids overlap, Gemcom assigned a domain code according to a precedence order (Table 14.4).

Table 14.4: Solid and Domain Precedence for Block Modelling of the Shymanivske Deposit

Precedence Order	Rock Type	Rock Code	Geology
1	Waste	4	Schists
2	SX4F	400	Magnetite-Quartzite
3	SX2F-P1	201	Magnetite-Quartzite
4	SX2F-P2	202	Magnetite-Quartzite
5	SX1F-P1	101	Magnetite-Quartzite
6	SX1F-P2	102	Magnetite-Quartzite
7	SX1F-P3	103	Magnetite-Quartzite



14.10 Mineral Resource Classification

Mineral Resource classification is based on certainty and continuity of geology and grades, and is driven by drilling density and accumulated level of knowledge and confidence with resources. Areas more densely drilled are usually better known and understood than areas with sparser drilling, which would be considered to have greater uncertainty, and hence lower confidence.

The historic drilling was not evenly distributed in the deposit since most of the drilling was concentrated in the central part of the ore body. Therefore; the majority of the measured category is concentrated in the central part of ore body. Towards the north and south of the Shymanivske deposit, the density of drilling decreases significantly. Therefore, these areas are categorized as Indicated and Inferred. Table 14.5 shows different distance parameters which were used to classify resources in the Shymanivske deposit. The distance criteria came from a range of variograms and also visual judgment based on the density of drilling in different plans and cross sections.

The classification of the block model took place in a two-step process. In the first step, blocks were assigned a tag based on search ellipse criteria. The second step was to manually construct category wireframes by looking at the distribution of tagged blocks and by applying other geological and drilling criteria. The wireframes were first constructed from 3-D rings on the vertical cross sections and then meshed together to define the 3-D solids. Finally, all blocks falling inside the category wireframes were assigned to Measured, Indicated and Inferred categories. The initial tagging by search ellipses was only used to help in the definition of the wireframes.

Table 14.5: Distance Criteria for Classification of Resources Based on Range of Variograms and Density of Drilling

Class	Down Dip (m)	Along Strike (m)
Measured	75-100	100-150
Indicated	100-150	100-150
Inferred	>200	>200



The Mineral Resource estimate was classified in accordance with CIM Definition Standards (2005), taking drillhole spacing, data quality (and confidence therein), variogram confidence, search volume and grade interpolation into account. The author considers there to be sufficient historic drilling and sampling information, and that this information is sufficient to classify the Mineral Resources into the Measured, Indicated and Inferred categories. The Inferred resources category are classified as Mineral Resources without positive proof (no hard evidence) for which quantity and grade can be estimated from limited sampling and geological evidence based on reasonably presumed continuity of the geology and grade. The degree of geological confidence in the Inferred estimate is insufficient to allow for validation of technical and economic parameters. Inferred Mineral Resources must be excluded from estimates used as a basis for feasibility studies or other studies related to economic viability. The Indicated and Measured categories of Mineral Resources are based on physical evidence with enough geological knowledge and certainty to allow for the application of technical and economic parameters to perform an economic evaluation and determine the viability of the deposit.



14.11 Mineral Resource Reporting

The Mineral Resource for the Shymanivske deposit in Measured, Indicated and Inferred categories with a COG of %Fe_{tot} is presented in Table 14.6 and Table 14.7.

Table 14.6: Mineral Resource Estimate for Shymanivske Deposit in Measured and Indicated Categories (COG of 15% Fe_{tot})

Category	Zone	Tonnes (Million)	%Fe _{tot}	%Fe _{mag}
Measured	SX1F	48.0	30.35	16.76
	SX2F	186.8	31.55	19.63
	SX4F	71.5	31.44	18.58
Total		306.3	31.34	18.94
Indicated	SX1F	7.1	32.21	19.11
	SX2F	32.1	31.22	19.10
	SX4F	27.2	32.63	21.38
Total		66.4	31.90	20.03
Total Measured & Indicated		372.7	31.44	19.13

Table 14.7: Mineral Resource Estimate for Shymanivske Deposit in Inferred Category (COG of 15% Fe_{tot})

Category	Zone	Tonnes (Million)	%Fe _{tot}	%Fe _{mag}
Inferred	SX1F	76.4	30.13	17.63
	SX2F	98.5	30.88	17.59
	SX4F	305.4	29.92	17.20
Total		480.3	30.15	17.35

14.12 Sensitivity Analysis

The Mineral Resources for the Shymanivske iron ore deposit were estimated cumulatively for consecutive grade groups by the Inverse Squared Distance ("ID²") method. This allows for the results to be reported cumulatively for different COG categories and presented in a sensitivity analysis. Table 14.8 and Table 14.9 below; present the results of a sensitivity analysis of the Measured, Indicated and Inferred Mineral Resources with respect to the COG.

**Table 14.8: Sensitivity Table, Measured and Indicated Resource in Shymanivske Deposit**

COG	Volume	Density	Tonnage	Fe _{tot}	Fe _{mag}
	M ³ x 1000	t/m ³	t x 1000	(%)	(%)
30%	83,822	3.40	284,996	32.66	20.42
27.5	99,830	3.40	339,424	32.08	19.69
25	105,734	3.40	359,495	31.76	19.39
22.5	107,972	3.40	367,104	31.60	19.25
20	109,187	3.40	371,234	31.49	19.17
17.5	109,536	3.40	372,422	31.45	19.14
15	109,609	3.40	372,669	31.44	19.13
10	109,643	3.40	372,786	31.43	19.13
Total	109,643	3.40	372,786	31.43	19.13

Table 14.9: Sensitivity Table, Inferred Resource in Shymanivske Deposit

COG	Volume	Density	Tonnage	Fe _{tot}	Fe _{mag}
	M ³ x 1000	t/m ³	t x 1000	(%)	(%)
30%	84,721	3.40	288,052	32.67	19.90
27.5	110,120	3.40	374,406	31.80	18.57
25	124,600	3.40	423,641	31.19	18.04
22.5	133,873	3.40	455,167	30.69	17.68
20	138,939	3.40	472,394	30.35	17.48
17.5	140,757	3.40	478,575	30.20	17.39
15	141,279	3.40	480,348	30.15	17.35
10	142,063	3.40	483,014	30.06	17.28
Total	142,063	3.40	483,014	30.06	17.28

14.12 Interpretation and Conclusions

The Shymanivske deposit, located in the Kryviy Rih area of Ukraine is part of an iron formation belt (KrivBass Belt) which hosts several iron ore deposits and active mining operations. It covers an area 2 km long by 1.2 km wide. It has been explored since the middle of the twentieth century by geophysical methods, drilling and metallurgical testing. It consist of four mineralized



units, three of which (SX1F, SX2F and SX4F) are Magnetite-Quartzite and the other one (SX5F), Magnetite-Martite.

Mineralization on the Property comprises meta-taconite, similar to deposits of the Labrador Trough in the Canadian Shield. The mineralized units are folded and faulted and dip gently to the north-east. The drilling was done on sections perpendicular to the strike of the formations with spacing varying from 40 to 130 meters along sections and from 80 to 300 meters along strike with vertical depths of 250 to 550 meters. The total amount drilled is 39,979 meters spread over 215 holes.

The present resource estimate was done using the 2005 compiled database based on historical drilling. This database has already been used in previous estimates.

The results for all three unoxidized horizons (sx1f, sx2f and sx4f) are listed in Table 14.10:

Table 14.10: Mineral Resource Estimate for Shymanivske Iron Ore deposit (COG Of 15% Fe_{tot})

Category	Tonnes (Million)	Fe _{tot}	Fe _{mag}
Measured	306.3	31.3	18.9
Indicated	66.4	31.9	20.3
Inferred	480.3	30.2	17.4

*Tonnage and grade numbers rounded to first decimals

A COG of 15% Fe_{tot} was determined to be appropriate at this stage of the Project. It was chosen based on a preliminary review of the parameters that would likely determine the economic viability of a large open-pit operation, and compares well to similar projects and to projects that are currently at a more advanced stage of study.

The total Inferred Resource tonnage for the oxidized horizon (sx5f) was calculated at 111.5 Mt at 33% Fe_{tot} and 4.3% Fe_{mag} in a previous estimate by author Hughes de Corta in 2011, but not shown in the current estimate. It is possible this material will come back into the resource categories once the metallurgical testwork is repeated using modern techniques.



There is sufficient drilling to demonstrate mineralized continuity, shape and density at this level. Grade accuracy has been assumed based on the historic data verification, sampling program and QA/QC measures.

The density of drilling is uneven as it is more concentrated in the middle of the deposit and in the upper levels. The part of the deposit located between sections two and six (Figure 6.1 in Section 6) is well covered and can be allocated to Measured and Indicated resources, while the extremities and lower levels would need more defining to be transferred from Inferred to Indicated resources. A more defined pattern of drilling should be used going forward, and wherever possible, the drillhole should be drilled to pass through the entire mineralized zone.

The Shymanivske deposit has undergone various degrees of folding and faulting. The search ellipse sizes and orientations for the grade interpolation need to be adjusted based on new drilling and model interpretation.

Due to the lack of outcrop on the Shymanivske Property, the impact of the faulting and thrusting in the structural interpretation of the ore body is debatable. Most of the previous drilling, including the Twin Drillhole Program, are vertical or sub-vertical in nature. Drilling in flatter angle holes gives more information about location of faulted blocks and existences of several projected faults within the ore body from south to north. Black Iron recently completed the Twin Drillhole Program and initiated the second phase of a 22,000 m exploration/infill drilling program on the Shymanivske Property. This program includes several flat angle holes, which intersect different parts of the three major mineralized horizons and structures which separate these zones.

Although the mineralized domain and resources stretch up to the 550 m level (about 620 m below surface), it doesn't mean that all Inferred resources at a greater depth are economically extractable or can be upgraded to Mineral Reserve. Mineral Resources are not Mineral Reserves and their economic viability has not been demonstrated with certainty by this Study. For further engineering and economic studies, the following recommendations would help improve the quality of the block model:



- confirm and revise the existing geological interpretation with infill and definition drilling;
- the COG should be applied to the Fe_{mag} versus Fe_{tot} values to take into account the selected magnetic separation processing scenario;
- constrain recourse reporting and estimation by pit design/optimization;
- incorporate all rock units with corresponding bulk density values.



15. MINERAL RESERVE ESTIMATES

The definitions of “Mineral Resource” and “Mineral Reserve” have been outlined in Section 14 of this Report and conform to the definitions adopted by the Canadian Institute of Mining, Metallurgy and Petroleum as the CIM Definition Standards on Mineral Resources and Mineral Reserves.

For studies at the Pre-Feasibility and Feasibility levels, the CIM guidelines require that only material categorized as Measured or Indicated be classified as a reserve. Considering that this present Study is at a Preliminary Economic Assessment level, these guidelines require that all material classified as Measured, Indicated, or Inferred be reported as a Mineral Resource.

In-pit resources are reported in Section 16 of this Report.



16. MINING METHODS

16.1 Resource Block Model

The original block model for the Preliminary Economic Assessment for the Black Iron Project was prepared and provided to BBA by Black Iron Inc. The block model was supplied to BBA in the form of a Comma Separated Value file (CSV), on September 22nd, 2011, under the name “*Shymanevski BM-Oct22.csv*”. The variables contained in the original model are listed in Table 16.1.

Table 16.1: Block Model Items

	Model Item Description
Model Item	Shymanivske Model
X	Easting Coordinate
Y	Northing Coordinate
Z	Elevation Coordinate
Rock Type	Rock Codes for Ore Zones
Density	3.4t/m ³ as default for volumetric (default Black Iron Inc.) Waste: 2.9t/m ³ (default BBA) Overburden: 1.9t/m ³ (default BBA)
Percent	Percent of ore within each estimated block
Fe _{tot}	Total Fe
Fe _{mag}	Magnetic Fe
Rescat	Resource Classification (1=Measured) (2=Indicated) (3=Inferred)



The block model was imported into MineSight software as a project control file (PCF), with no modification to the given information. The model was checked to ensure the validity and integrity of the transfer into the MineSight program.

Following the confirmation of the validity of the block model, BBA created and coded additional model items as follows:

- Topography Percent (percent of block below topographical surface);
- Overburden Percent (percent of block between topographical and bedrock surface);
- Magnetite: $Fe_{mag} \div 0.72359$;
- Weight Recovery: $1.1354 \times \text{magnetite} + 0.1796$.

16.1.1 Model Coordinate System

The block model prepared and provided by Black Iron, is regularized and has an unrotated coordinate system. The block sizes are 10 m (x-coordinate) x 10 m (y-coordinate) x 10 m (z-coordinate). A three dimensional (3-D) representation of the block model at a COG of 5% total iron percent (Fe_{tot}) is shown in Figure 16.1. The example shown is an extraction from the Black Iron model.

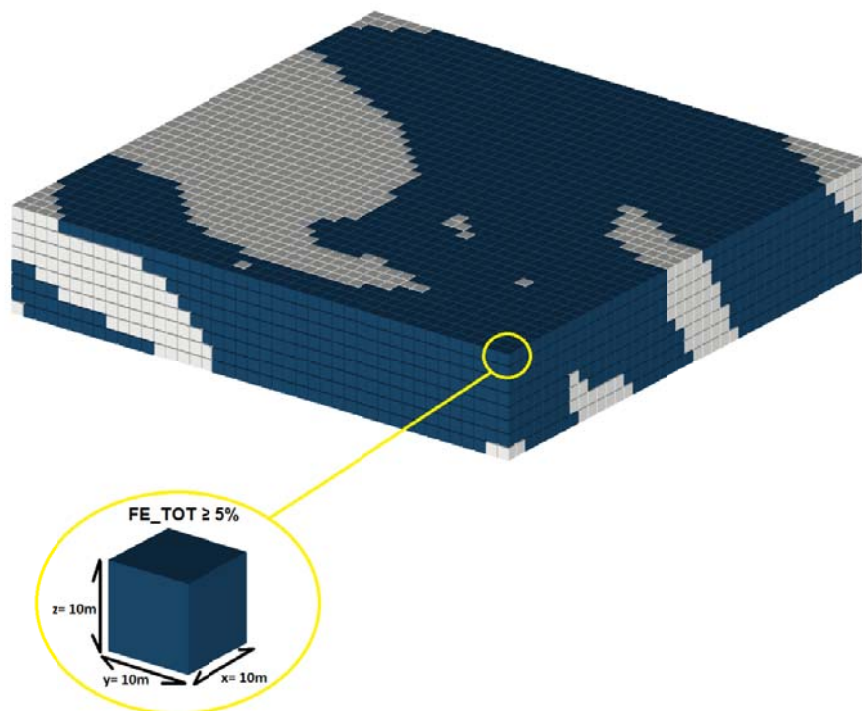


Figure 16.1: Block Model Coordinate System

16.1.2 Model Densities

The block model included the density for ore and waste material. The density for the ore is regulated at 3.39 t/m^3 . The waste density is constant in the model and was defaulted by BBA as 2.90 t/m^3 . For the overburden density, BBA assigned a default value of 1.90 t/m^3 .

16.2 Pit Optimization

Pit optimization was carried out for the Black Iron Project using the true pit optimizer algorithm Lerchs-Grossman 3-D ("LG 3-D") in MineSight. The LG 3-D algorithm is based on the graph theory and calculates the net value of each block in the model, i.e. profit minus loss. With all mining costs, processing costs, processing recoveries, weighted recovery values and overall pit slope, the pit optimizer searches for the pit shell with the highest undiscounted cash flow. All blocks classified as Measured, Indicated and Inferred material are included in the Resource Estimate.



16.2.1 Pit Optimization Parameters

Table 16.2 summarizes the pit optimization parameters used for the Preliminary Economic Assessment. The costs indicated were based on historical data obtained from previous reports and benchmarking of similar active mining operations in the region as well as on BBA experience. Concentrate prices were set conservatively at \$85 CAD/t for the pit optimization. The mining operating cost figures used in the pit optimization align well with the final values determined by this PEA.

The overall pit slope is 47° and falls within the conservative range of the overall pit slopes of active mines in the region. This slope is on average, a few degrees shallower than the geotechnical recommendations provided by internal Consultants, in order to allow for operational factors to be incorporated in the engineered pit design, i.e. safety berms, haulage ramps.

Table 16.2: Pit Optimization Parameters

Parameter	Value	
	Operating Costs	
Mining Cost (Ore, Waste)	2.10	\$/t mined
Mining Cost (OB)	1.05	\$/t mined
Processing Cost	5.03	\$/t milled
General and Administration (G&A)	0.71	\$/t milled
	Sales Revenue	
Product Price	85	\$/CA/t FeCon
Exchange Rate	1.10	CAD/USD
	Indirect Costs	
Port	5.20	\$/t FeCon
Rail	6.00	\$/t FeCon
Weighted Recovery	1.1354 x magnetite +0.1796	%
	Pit Parameters	
Pit Slope	47	Degrees



It is important to note that no additional surface or subsurface constraints were imposed when running the pit optimization. One concern, when running the optimizer, was to remain at a distance of 30 m-50 m away from the ArcelorMittal private rail located on the western side of the Shymanivske deposit. The natural dip of the deposit allowed for minimal stripping to be taken along the western strike of the pit optimization.

Geotechnical, hydrogeological and hydrological work planned for the Feasibility Study will better define these parameters.

16.2.2 Cut-Off Grade Calculation

The MineSight Economical Planner - MSEP program was used to calculate economical break-even COG to define the pit shell and boundaries and classify the material within the pit limits as ore or waste. To check grade sensitivity within the pit shell, several in-pit COG runs were performed. Based on constant knowledge enhancement and frequent updates in information, a number of pit optimization runs were performed using various physical constraints to determine the best pit optimization. Finally, the pit optimization run with no physical constraints was selected. This choice increased stripping and impacted pit economics with additional material that had to be removed from the YUGOK waste dump. The milling COG used for the Black Iron Project was taken at 15% Fe_{tot} based on preliminary calculations and historic numbers, however, more definitive COG calculations with reduction in cost measures will be required to further improve pit economics.

16.2.3 Pit Optimization Results

Using the technical and economic parameters described previously, the LG 3-D algorithm was run, and produced an optimum pit shell for the Shymanivske deposit. The two-dimensional (2-D) view and the three-dimensional (3-D) view of the Black Iron pit optimization can be seen on Figure 16.2 and Figure 16.3. The pit optimization does not include additional material from the YUGOK waste dump.

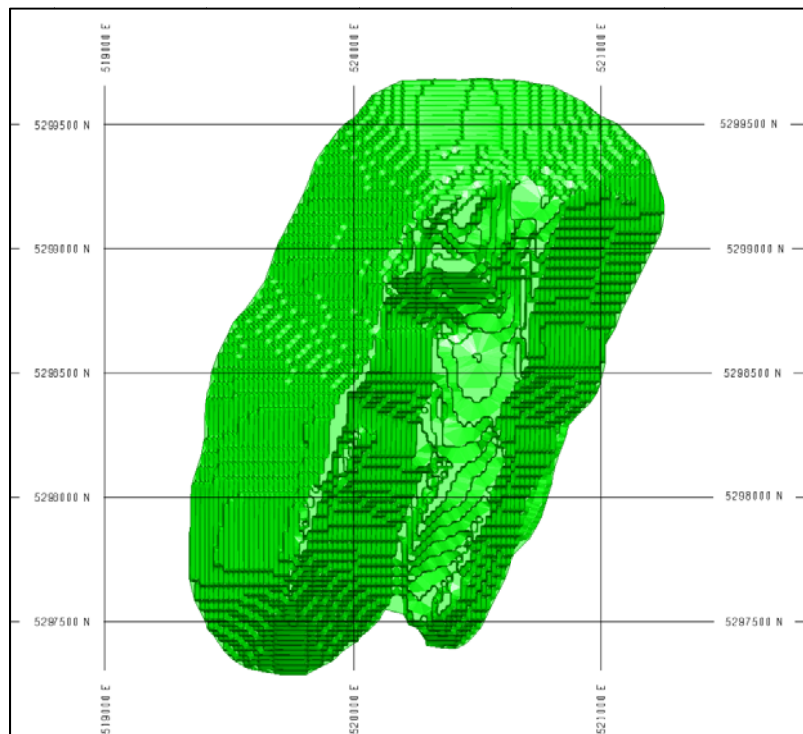


Figure 16.2: Black Iron Pit Optimization Plan View

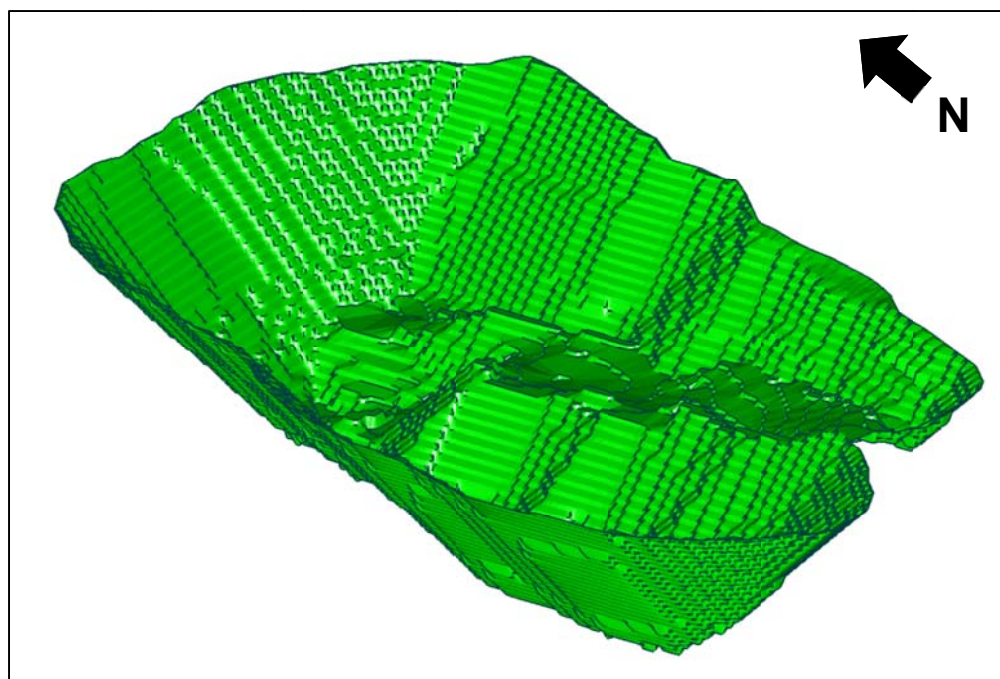


Figure 16.3: Black Iron Pit Optimization 3-D View



The results of the pit optimization for Black Iron for this Study are shown in Table 16.3.

Table 16.3: Black Iron Pit Optimization Results

Black Iron - LG Pit Optimization Total Resource Estimate (COG 15% Fe _{tot} -%)				
Category	Tonnage (kt)	% Fe _{tot}	Wt.Rec%	Fe Con. (kt)
Measured	304,015	31.34	29.91	90 930
Indicated	65,409	31.92	31.62	20 681
Inferred	359,772	30.95	28.62	102 976
Total	729,196	31.20	29.43	214 587
	Waste (kt)			
Rock	1,142,150			
OB	180,322			
		Total S/R		
Total Stripping	1,322,473	1.81		

16.3 Engineered Pit Design

The detailed mine design is carried out using the LG 3-D optimized pit shell as a base. Operational factors that are required for a mine are added during the engineered pit design phase. These features include a haulage ramp, safety berms, bench face angles (BFA), inter-ramp angles (IRA), and bench height.

16.3.1 Pit Slope Design Criteria

The preliminary pit design developed in this Study was based on recommendations from external and internal Consultants, historical data from the 1989 Report and Canadian/Ukrainian benchmarking of similar projects.

The conceptual pit design slopes, which BBA used for their engineered pit design, are listed in Table 16.4. Since there was insufficient information provided for the local distribution of the different rock types BBA has used one constant BFA, and IRA for most of the mine.

**Table 16.4: Pit Design Parameters**

Parameters for Design		Units
Single Ramp	22	M
Double Ramp	35	M
Grade	10.00	%
Inter-Ramp Angle (IRA)	50.00	°
Bench Face Angle (BFA)	80.00	°
Approximate Berm Width	20.00	M
Bench Height	15.00	M
Benching	Double Bench	

Since the mine is designed to intersect the YUGOK waste rock pile on the north-eastern side of the pit, new slopes were determined for that side of the pit starting from a 60 m elevation and climbing up to an approximate elevation of 180 m. At an elevation of 60 m, the toe of the YUGOK dump is pushed back 50 m. This step back and push back is designed to comply with the safety requirements and environmental closure plans. Once the 50 m pushback is complete, all subsequent lifts follow the parameters listed below:

- Bench Face Angle (BFA): 35°;
- Inter-Ramp Angle (IRA): 14°;
- Bench Lift Height: 30 m;
- Resulting Berm: 78-82 m.

The shallower slope is shown clearly in the 3-D image of Figure 16.4 and in the section views represented in Figure 16.8 and Figure 16.9.

The width of the in-pit haulage ramp measures 35 m to accommodate uninterrupted double-lane traffic. The final few benches at the bottom of the pit are designed with a width of 22 m in order to reduce the stripping ratio. The maximum ramp grade used is 10%.



16.3.2 Engineered Pit Design Results

Both of the 2-D and 3-D views of the Black Iron pit design are shown in Figure 16.4. The Black Iron engineered pit design is also shown in various section views (Eastings and Northings), alongside the pit optimization, in Figure 16.5 to Figure 16.10. In the Northing views, it is easy to see where the engineered pit design slope was made shallower. The parameters were made to fit with the environmental closure requirements for the portion of the pit intersecting the YUGOK waste rock pile. This was done to show realistic stripping of that area of the mine.

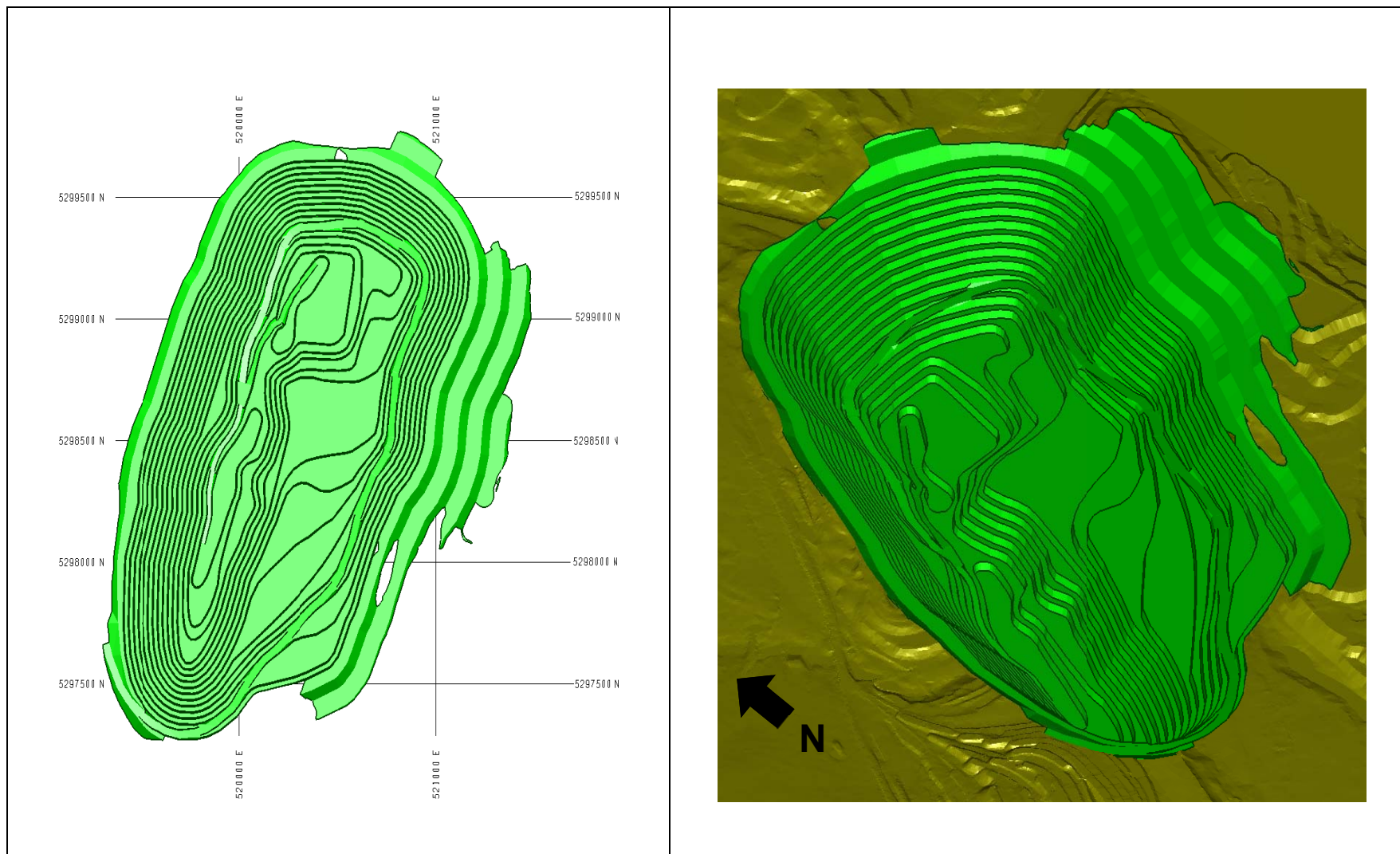


Figure 16.4: Black Iron Engineered Pit Design, Plan View and 3-D View

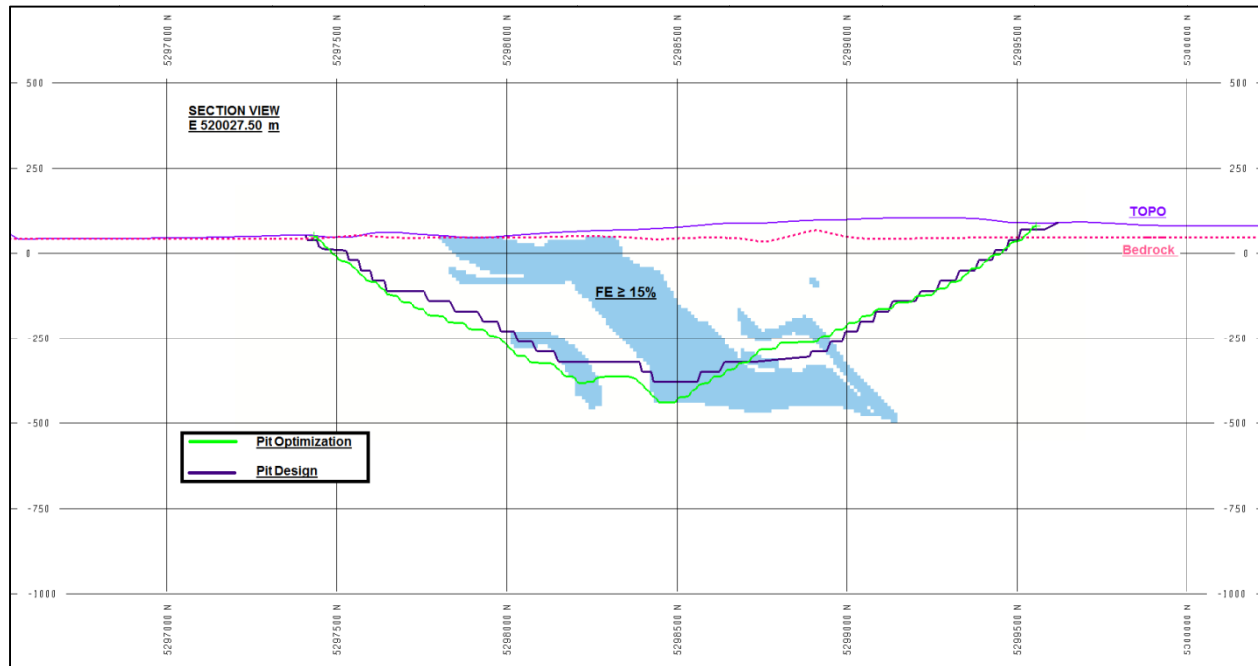


Figure 16.5: Black Iron Pit Section View E 520,027.50 m

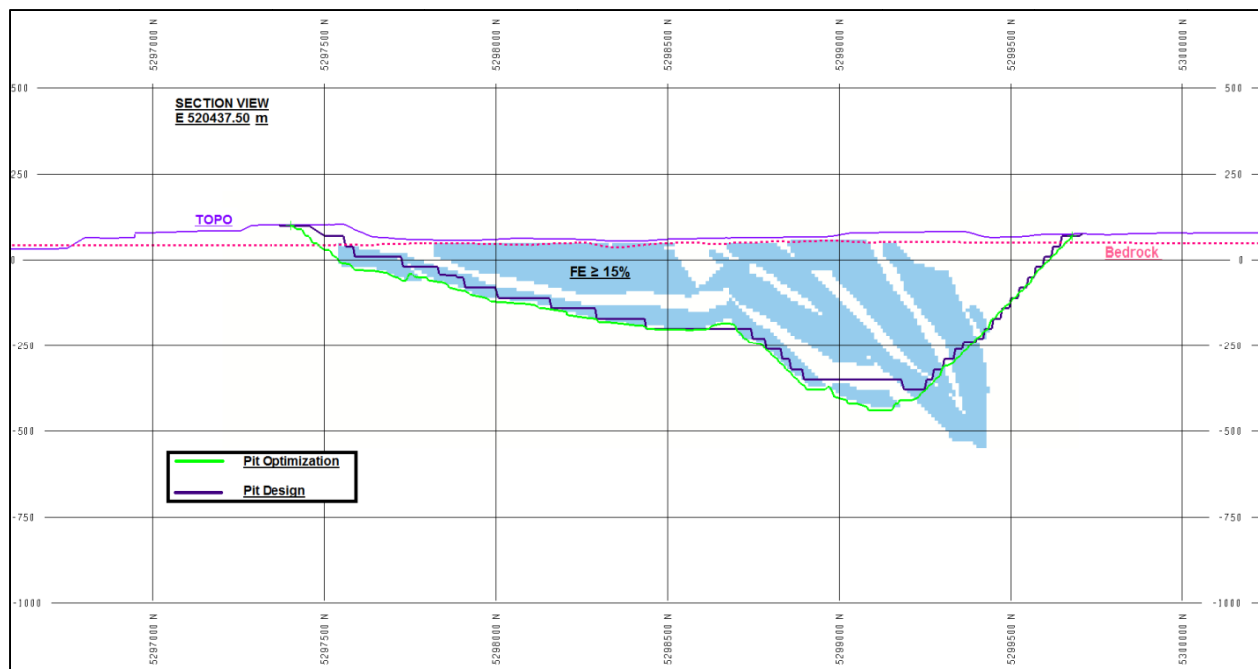


Figure 16.6: Black Iron Pit Section View E 520,437.50 m

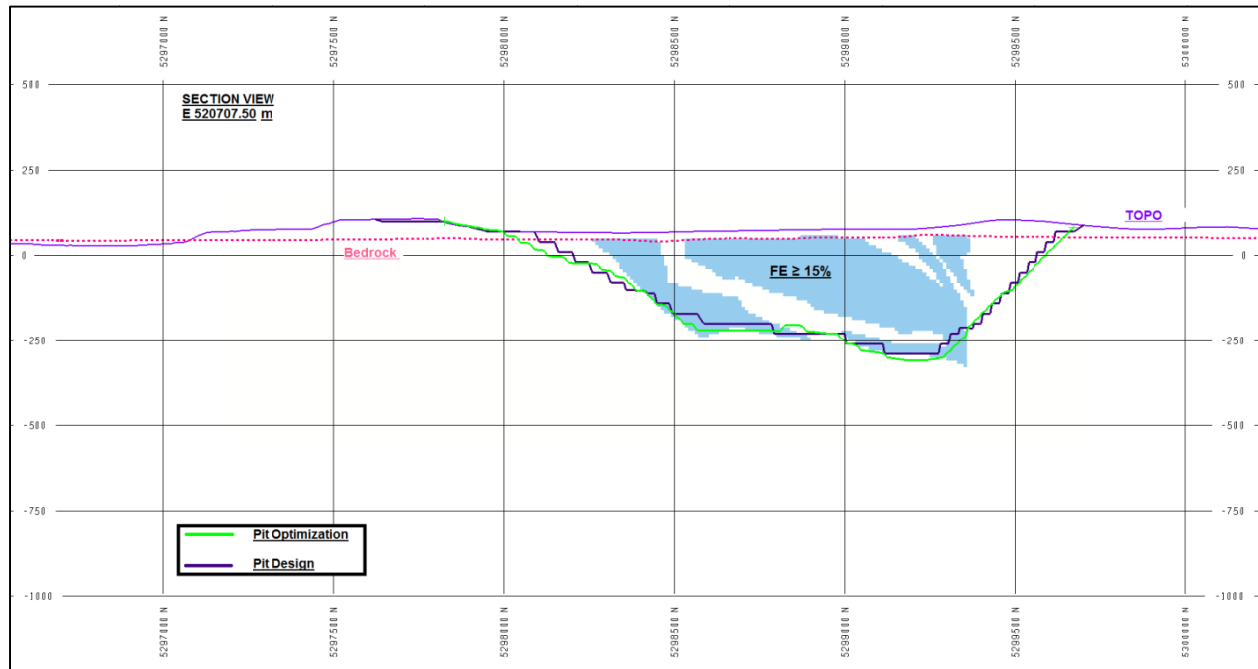


Figure 16.7: Black Iron Pit Section View E 520,707.50 m

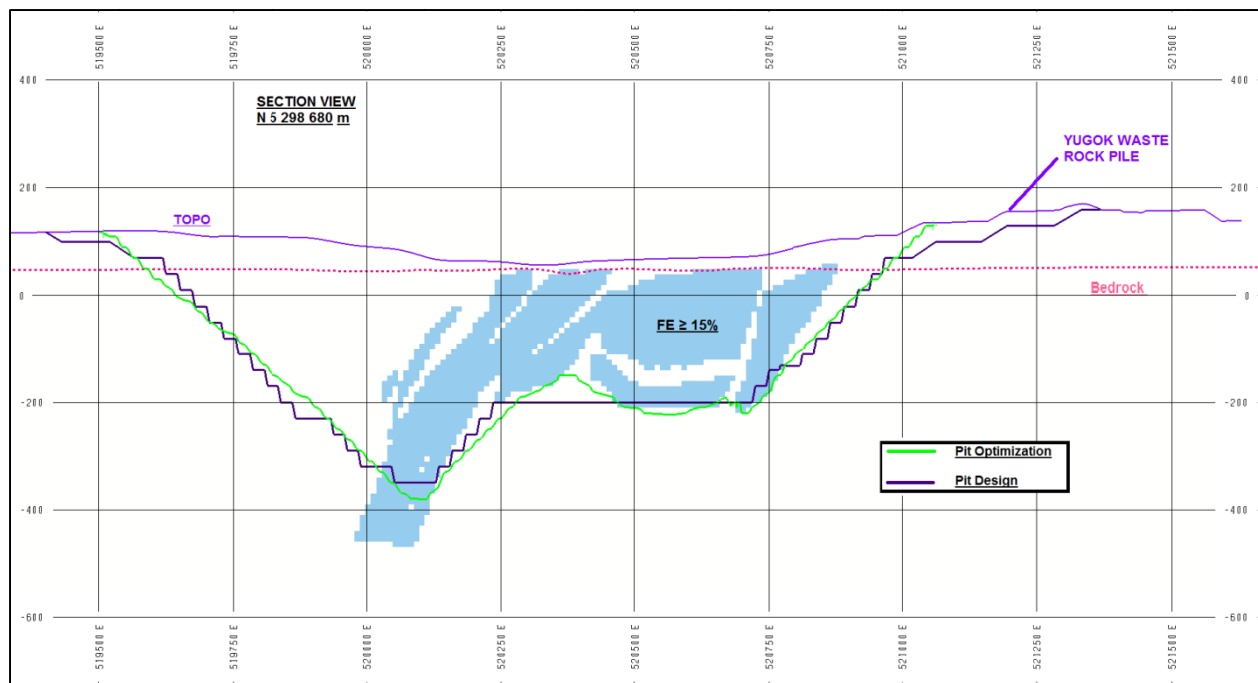


Figure 16.8: Black Iron Pit Section View N 5,298,680 m

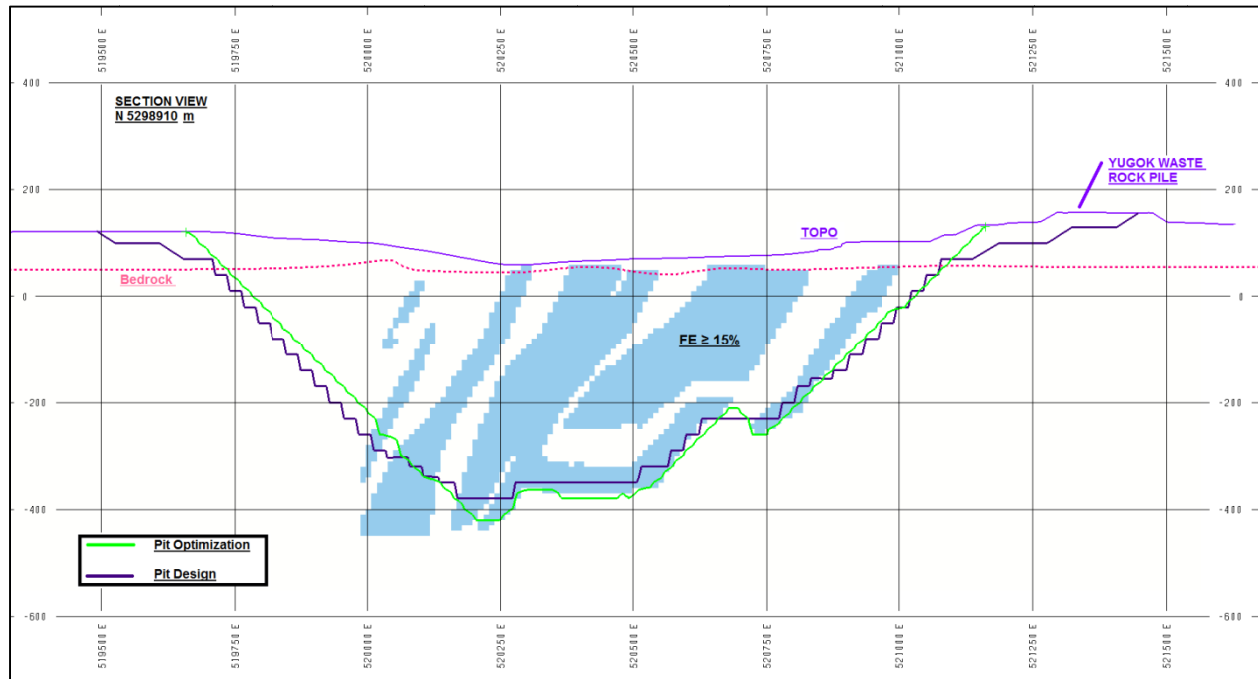


Figure 16.9: Black Iron Pit Section View N 5,298,910 m

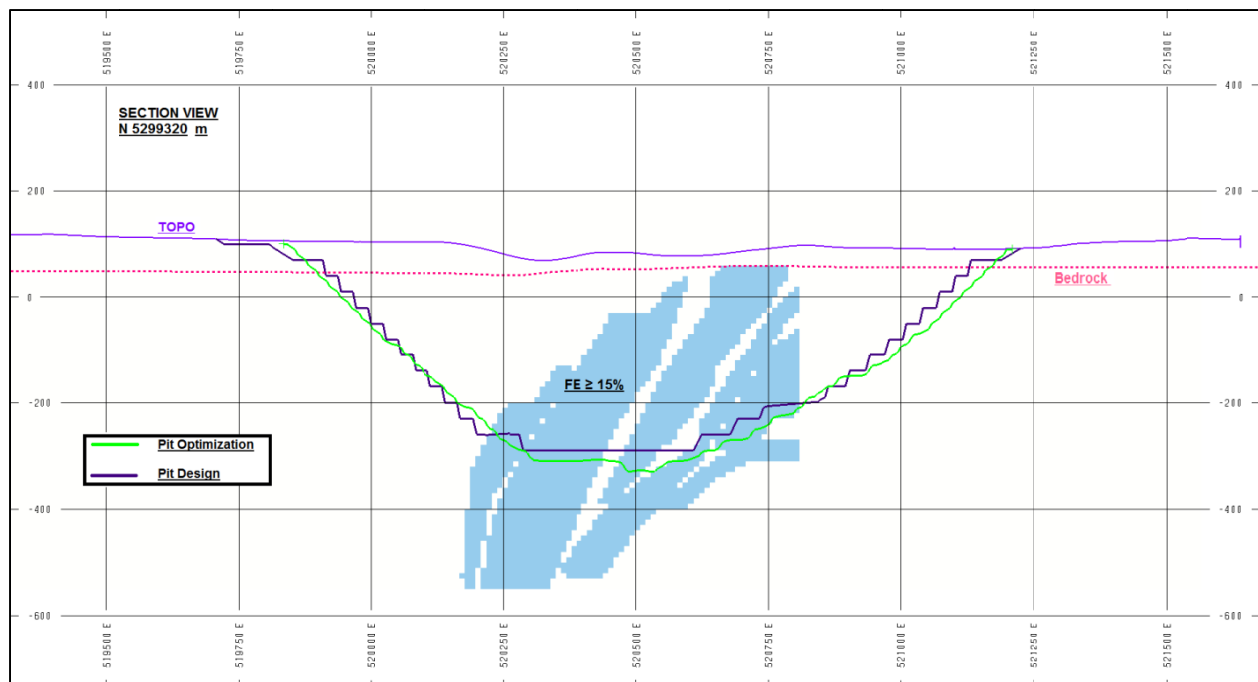


Figure 16.10: Black Iron Pit Section View N 5,299,320 m



16.4 In-Pit Resource Estimate

The resources for the engineered pit design are based on the parameters described previously. As discussed in Section 14 of this Report, CIM guidelines require that for a Preliminary Economic Assessment, all material classified as Measured, Indicated, or Inferred shall be reported as an in-pit resource.

The mining resources were calculated for the Black Iron engineered pit design at an in-pit COG of 15% Fe_{tot}. The mining resources calculated in the present Study for the Black Iron pit are as presented in Table 16.5, and total 681.46 Mt, with an average grade of 31.30 % Fe_{tot}. The total waste including YUGOK waste contained in the pit is 1,366.54 Mt, which includes 94.06 Mt of overburden. This results in a stripping ratio of 2.01 including removal of waste from the existing YUGOK dump.

Table 16.5: Black Iron In-Pit Resource Results

Black Iron – Engineered Pit Design Total Resource Estimate - (COG 15% Fe _{tot} %)				
Category	Tonnage (kt)	% Fe _{tot}	Wt. Rec%	Fe Con. (kt)
Measured	297,121	31.41	30.01	89 175
Indicated	64,788	31.92	31.66	20 515
Inferred	319,549	31.50	28.76	91 918
Total	681,458	31.30	29.58	201 608
	Waste (kt)			
Rock	1,272,480			
OB	94 062			
		Total S/R		
Total Stripping	1,366,541	2.01		



16.5 Development of the Mine Plan and Mining Operations

As outlined in Section 13.2.6 of this Study, process development was based only on the Shymanivske ore deposit as the nearly adjacent Zelenivske deposit has yet to be sufficiently drilled to have a compliant resource. Consequently, for this Study, the mine plan and mining operation strategy was developed only for the Shymanivske pit.

Table 16.6 presents the tonnages of material moved annually for the mining plan developed in this Preliminary Economic Assessment. Material moved is classified as Waste, Overburden (OB) and ore. The annual stripping ratio is also indicated. Totals for the life of mine (LOM), estimated at 28.3 years, are also presented. The mine plan is developed to support operational requirements for the production of 7.3 Mt/y of concentrate.

Opportunity exists to significantly reduce the strip ratio in the early years of the mine by phasing its development such that non intrinsic waste is deferred for movement in future years. Phasing of the pits will be completed as part of the Feasibility Study and should further improve the project economics.

**Table 16.6: Tonnages of Material Moved Over the LOM for Production of 7.3 Mt/y of Concentrate**

Open Pit Production		Waste (tonnes)	OB (tonnes)	Ore Mined (tonnes)	Waste + OB Mined (tonnes)	Stripping Ratio	Total Tonnes Mined
2014	PP 2	8,903,760		0	8,903,760		8,903,760
2015	PP 1	173,924	25,300,000	0	25,473,924		25,473,924
2016	Yr 1	54,514,753	10,000,000	23,890,000	64,514,753	2.70	88,404,753
2017	Yr 2	41,300,000	36,000,000	23,900,000	77,300,000	3.23	101,200,000
2018	Yr 3	72,319,150	500,000	23,700,000	72,819,150	3.07	96,519,150
2019	Yr 4	66,426,743	7,500,000	23,800,000	73,926,743	3.11	97,726,743
2020	Yr 5	63,050,392	14,761,703	23,701,257	77,812,095	3.28	101,513,352
2021	Yr 6	68,569,189		23,705,707	68,569,189	2.89	92,274,896
2022	Yr 7	65,723,153		23,845,517	65,723,153	2.76	89,568,670
2023	Yr 8	64,930,000		23,800,000	64,930,000	2.73	88,730,000
2024	Yr 9	59,236,194		23,858,405	59,236,194	2.48	83,094,599
2025	Yr 10	50,168,195		24,351,744	50,168,195	2.06	74,519,939
2026	Yr 11	48,273,997		24,260,358	48,273,997	1.99	72,534,355
2027	Yr 12	41,000,046		24,071,696	41,000,046	1.70	65,071,742
2028	Yr 13	40,116,402		23,960,238	40,116,402	1.67	64,076,640
2029	Yr 14	39,364,429		24,136,357	39,364,429	1.63	63,500,786
2030	Yr 15	37,836,205		23,981,830	37,836,205	1.58	61,818,035
2031	Yr 16	35,876,398		23,953,115	35,876,398	1.50	59,829,513
2032	Yr 17	34,406,537		23,999,827	34,406,537	1.43	58,406,364
2033	Yr 18	33,741,221		23,736,160	33,741,221	1.42	57,477,381
2034	Yr 19	32,366,926		24,201,479	32,366,926	1.34	56,568,405
2035	Yr 20	31,656,529		23,872,450	31,656,529	1.33	55,528,979
2036	Yr 21	30,482,999		24,111,318	30,482,999	1.26	54,594,317
2037	Yr 22	29,100,000		23,983,988	29,100,000	1.21	53,083,988
2038	Yr 23	26,820,343		24,093,761	26,820,343	1.11	50,914,104
2039	Yr 24	26,128,776		24,064,307	26,128,776	1.09	50,193,083
2040	Yr 25	25,559,041		24,156,852	25,559,041	1.06	49,715,893
2041	Yr 26	24,457,667		24,084,944	24,457,667	1.02	48,542,611
2042	Yr 27	23,379,189		24,084,711	23,379,189	0.97	47,463,900
2043	Yr 28	20,829,259		24,194,632	20,829,259	0.86	45,023,891



16.5.1 Waste and Overburden Dumps

The waste rock and overburden mined from the Shymanivske pit will be dumped at two locations, as indicated on the general site plan presented in Section 18 of this Report. The two locations are designated as the Waste Rock Dump and the Overburden and Waste Dump. For this Study, the maximum waste rock dump height was determined in collaboration with YGR to be 150 m. This height was deemed adequate for the purpose of mine closure and rehabilitation. The design parameters for the waste dumps, as provided by YGR/BBA, are as follows:

- Face angle: 35°;
- Overall slope: 14°;
- Bench height: 30 m;
- Waste Berm width: 85 m;
- Overburden Berm width: 50 m;
- Maximum height 150 m.

Based on an average swell factor of 30%, the Waste Rock Dump has an estimated storage capacity of 914 Mt (in-situ tonnage) and the Overburden and Waste Dump has an estimated storage capacity of 158 Mt (in-situ tonnage) for the footprint indicated. Both waste piles are designed to meet the Ukrainian mine closure design criteria. A more detailed description of the waste rock dump design is provided in Section 20.6.1 of this Report.

The starting mine truck travel distances from the Shymanivske pit to the Waste Rock Dump and Overburden and Waste Dump dumps are approximately 7.7 km and 4.1 km respectively. These parameters have been used in the selection of mine equipment. Opportunity may exist to bring the ore crusher closer to the Shymanivske pit which will reduce the haul truck requirements and ultimately both capital and operating costs; this should be investigated further in the FS.

To support the mine production and achieve the final pit boundaries, 111 MT of the YUGOK waste dump will have to be pushed back and re-sloped to meet the existing dump closure design criteria. Sufficient waste rock will be mined during the pre-production period and the first



few years of mining to secure adequate ore access for the production years to follow. Some waste material generated during the pre-production period may be used as construction material; however, this requires further detailed evaluation during the next study phases and as the construction plan is developed.

16.5.2 Mine Operations and Mining Equipment Requirements and Selection

Mining operations will be conducted 24 hours per day, seven days per week and 365 days per year. Following drilling and blasting, run-of-mine (ROM) ore will be delivered to a primary crusher located approximately 2,300 m west of the pit.

The requirements for primary mining equipment consisting of drills, haul trucks, loaders and shovels, have been estimated based on haul distance, equipment availability, utilization and overall productivity data. Availability profiles for major equipment have been estimated using Vendor benchmarks, similar projects in BBA's database, as well as operating experience.

The truck fleet consists of Komatsu 930E trucks having a payload capacity of 290 metric tonnes. Up to 41 trucks will be required to support the mine plan and schedule. The operating truck requirements were determined using the appropriate operating time parameters, fill factors, cycle times, and tonnes to be moved per material type. The truck fleet size was calculated using the applicable equipment availability factor and was subsequently rounded to the nearest truck. The truck fleet size on a yearly basis was then smoothed out to better represent an actual operation. Phasing of the pit development during the Feasibility Study may result in further smoothing of the strip ratio over time and a reduction in peak truck requirements.

The proposed shovel fleet consists of one Bucyrus 495HD electric cable shovel, one Bucyrus 395HR electrically-driven hydraulic shovel and one Komatsu PC5500 hydraulic backhoe excavator. The annual shovel productivity was determined using the appropriate operating time parameters, fill factors, material properties, and bucket capacities. The shovel fleet chosen is such that all ore is moved by the 395HR and any remaining 395HR capacity is used to move waste or overburden material. Early in the mine life, a PC5500 is assigned to overburden



removal and later assists with the movement of various materials during main equipment downtimes. The 495HD is selected primarily for waste removal. Overall, the shovel fleet requirements are calculated so as to ensure that the total shovel requirements, in equivalent shovel units, are met.

The primary equipment fleet will have a minimum of one front-end loader with a lifting capacity of 45 t/bucket, (CAT994 or similar), for supplementary loading and stockpile management. The flexibility of the loader with its fast response time in replacing a shovel or for a particular blending requirement, justifies its use.

The three drills required are electric, with a capacity to drill 12" diameter blast holes with high pull-down pressure (Bucyrus 49HR or similar).

To carry out the routine road maintenance and various other functions within the mine, the following secondary equipment was selected:

- Track-Dozers: Three CAT D-10 with ripper and one CAT D-9 are used to maintain the waste dumps as well as perform the general work within the mine;
- Front-End Loaders: Two CAT 844's are used for road maintenance, blast hole stemming and snow removal. The units will be complete with quick-release couplings to allow easy changes from one attachment to another. Attachments include a bucket designed for blast hole stemming and a snow removal bucket;
- Graders: Two CAT 16G's are used to maintain the roads on the entire mine site;
- Water Truck: Four CAT 777F water trucks with a capacity of 20,000 liters will be used for site dust abatement.

To support the mine as well as site maintenance, a fleet of auxiliary equipment has been selected and is included as part of the mining equipment. The complete list of primary, secondary and auxiliary equipment considered in this Study, showing equipment requirements



on an annual basis, is presented in Table 16.7. The annual mine truck requirements, based on the mine plan, are shown in Figure 16.11.

A radio communication system will link all the vehicles and assure that the equipment is effectively managed and truck dispatching is controlled.



Table 16.7: Mining Equipment List

Mine Equipment																																
Equipment Type	Utility	PP2	PP1	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15	Yr 16	Yr 17	Yr 18	Yr 19	Yr 20	Yr 21	Yr 22	Yr 23	Yr 24	Yr 25	Yr 26	Yr 27	Yr 28	
Shovel (Ore) (Bucyrus 395HR)	100%		-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
Shovel Komatsu PC5500	90%		1	1	1	1	1	1	1	1												2	2	2	2	2	2	2	2	2	2	
Shovel (Waste) (Bucyrus 495HD)	100%		-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
Wheel Loader (CAT994)	90%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	
Haul Truck (Komatsu 930E)	100%	2	8	33	37	41	41	41	41	41	41	40	36	36	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	33	
Blasthole Drill (Bucyrus 49HR)	100%		1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	
Total Primary Equipment		3	11	40	44	48	48	48	48	48	47	46	42	42	40	40	40	40	40	40	40	40	41	40	40	40	40	40	40	40	40	39
Wheel Dozer (Caterpillar 844)	90%		-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	
Track Dozer (Caterpillar CAT D9)	90%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Track Dozer (Caterpillar CAT D10)	100%		2	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Motor Grader (Caterpillar 16M)	90%	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Water Truck 20,000 gallons(Caterpillar CAT777F)	40%		1	3	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Total Secdondary Equipment		2	6	11	12	12	12	12	12	12	11	11	11	11	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12	12
Air Track Drill (200 HP 80 to 100mm)	30%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Wheel Loader (Caterpillar 988H)	80%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Service Truck (250 HP 22,000 GVW)	70%	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
Forklifts 15 tones	50%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Forklifts 2.5 tones	50%		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Mine Ops.	80%	2	6	6	6	6	6	6	6	5	5	5	4	4	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Maint.	80%		5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Eng.,Survey.,Geol.,	50%		3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Ore Cotrol, Samplers	50%		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Pickup 3/4 Ton (4x4 crew cab Chevrolet 2500) Blasting	50%		2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Pickup 1 Ton (4x4 crew cab Chevrolet 2500) Flatbed	60%		1	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Pickup 1 Ton (4x4 crew cab Chevrolet 2500) Service Body	60%		1	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Water truck fill station	50%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Light Plant (1000 w. diesel generator)	60%	1	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	
Dewatering Pump (250 HP electric submersible)	60%		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mobile Pump (125 HP diesel)	40%		1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Portable Generator 600kw	60%		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Total Auxiliary Equipment		4	36	37	41	41	42	42	42	41	41	40	39	39	34	34	33	32	30	30	30	30	30	28	26	26	26	26	26	26	26	25
Total Mine Equipment		9	53	88	97	101	102	102	102	101	99	97	92	92	84	84	83	82	80	80	80	80	83	80	78	78	78	78	78	78	78	76

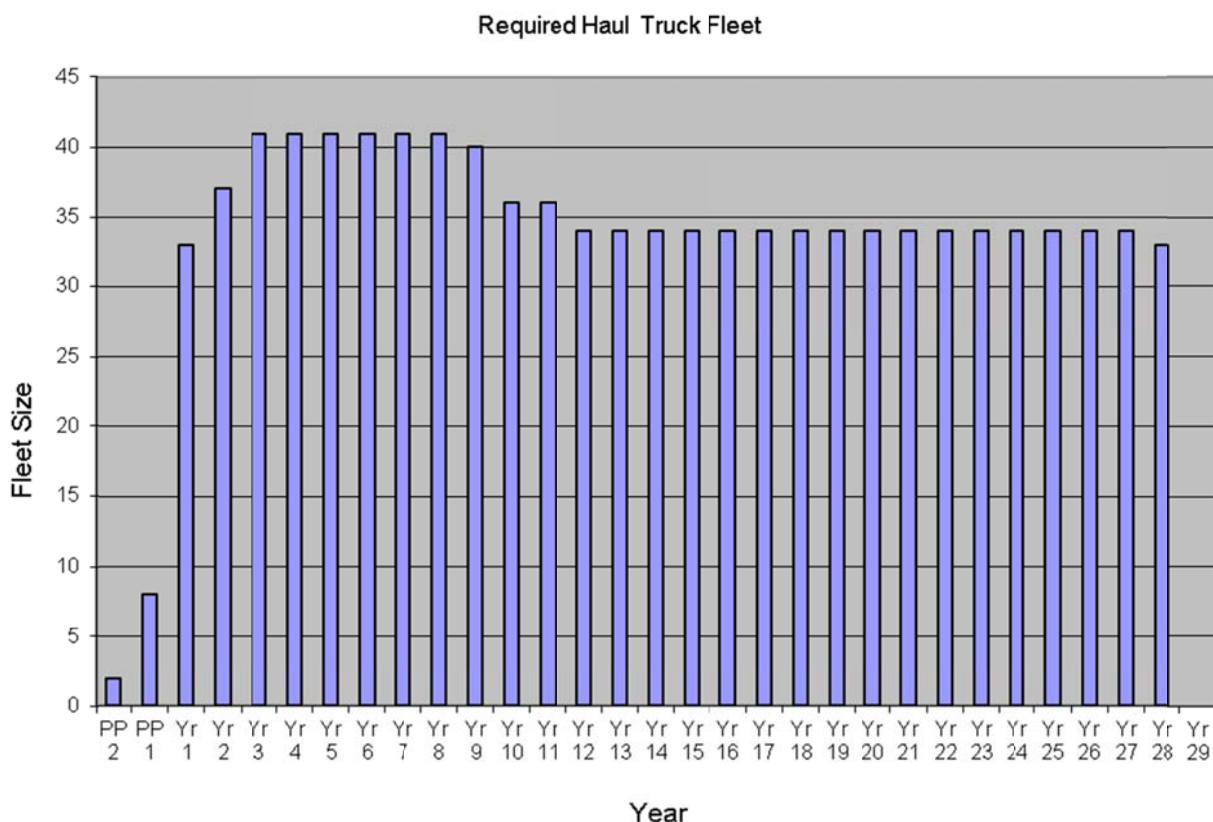


Figure 16.11: Annual Mine Truck Fleet Requirements

16.6 Drilling and Blasting

The preliminary selection of drilling equipment and drill pattern design takes into consideration the damage control on final pit walls, minimization of blasting costs and control of material size and distribution. Due to the close proximity of the Shymanivske pit to residential areas, rail and power lines, good control of blasting practices including pre-split and trim blasting will be implemented. The final pit distance from the main infrastructure, pit slopes, concept of double or triple benching and final design for pre-split and trim blast patterns will be based on the geotechnical testing and assessment.

A high energy bulk emulsion explosive with electronic detonators should be used for application in wet or dry conditions with an in-hole density of 1.25 g/cc. The cost advantage and operational



simplicity of using only bulk emulsion explosives is based on reduction of the explosive plant and requirement of trucks for product mixing.

The drilling and blasting activities should be directed by mine operations personnel who will be responsible for the development of drilling and blasting procedures, management of misfires, drill site preparation and cleanup and supervision of the explosive provider. The explosive plant, supplying and delivering of explosives in the hole through the project mine life, will be outsourced. Table 16.8 presents the drilling and blasting design parameters used in this Study. These parameters provide the basis for estimating drilling and blasting operating costs presented in Section 21 of this Report.

Table 16.8: Drilling and Blasting Design Parameters

	Ore	Waste
Material Density	3.4	2.9
Hole Diameter (mm)	305	305
Bench Height (m)	15	15
Subdrill (m)	1.5	1.5
Hole Depth (m)	16.5	16.5
Stemming (m)	5.0	5.0
Total charge length (m)	11.5	11.5
Emulsion density (kg/m ³)	1250	1250
Burden (m)	9.5	11.5
Spacing (m)	9.5	11.5
Explosive per hole (kg)	1049	1049
Volume blaster per hole (m ³)	1354	1984
Tonnes blaster per hole (t)	4603	5753
Powder factor (kg/t)	0.228	0.182



16.7 Fuel and Electricity

The fuel consumption for mining equipment operating on diesel fuel was estimated based on benchmark (liters per hour of operation) data for each piece of equipment in the equipment list as presented in Table 16.9. The electric power consumption was also estimated based on Vendor datasheets for each piece of equipment operating on electricity as presented in Table 16.10.

16.8 Manpower Requirements

The manpower requirements for the mine area, as estimated by BBA, are presented in Table 16.11 and Table 16.12.



Table 16.9: Mining Equipment Estimated Fuel Consumption

		Total Primary Equipment (L/year)	Total Secondary Equipment (L/year)	Total Auxiliary Equipment Fuel (L/year)	TOTAL FUEL COSTS (\$)
2013	PP 2	3,950,891	717,815	329,969	3,981,196
2014	PP 1	13,378,571	1,393,014	2,584,756	13,823,464
2015	Yr 1	66,127,448	4,641,792	2,648,881	58,473,891
2016	Yr 2	73,033,107	4,868,416	2,747,992	64,233,338
2017	Yr 3	78,955,455	4,813,093	2,687,848	68,858,231
2018	Yr 4	78,750,375	4,757,770	2,741,259	68,693,372
2019	Yr 5	78,213,011	4,702,447	2,723,040	68,206,816
2020	Yr 6	77,825,774	4,647,124	2,710,027	67,843,974
2021	Yr 7	77,503,810	4,591,801	2,640,150	67,487,831
2022	Yr 8	75,982,136	3,973,783	2,620,904	65,768,343
2023	Yr 9	73,892,696	3,973,783	2,553,264	64,050,336
2024	Yr 10	66,390,296	3,973,783	2,487,024	58,022,290
2025	Yr 11	66,390,296	3,973,783	2,487,024	58,022,290
2026	Yr 12	60,510,296	3,735,301	2,186,496	52,909,867
2027	Yr 13	60,510,296	3,735,301	2,186,496	52,909,867
2028	Yr 14	60,510,296	3,735,301	2,130,432	52,865,214
2029	Yr 15	60,510,296	3,735,301	2,095,392	52,837,307
2030	Yr 16	60,510,296	3,735,301	2,060,352	52,809,399
2031	Yr 17	60,510,296	3,735,301	2,060,352	52,809,399
2032	Yr 18	60,510,296	3,735,301	2,060,352	52,809,399
2033	Yr 19	60,510,296	3,735,301	2,060,352	52,809,399
2034	Yr 20	63,396,053	4,572,897	2,060,352	55,774,866
2035	Yr 21	63,415,500	4,572,897	1,969,248	55,717,794
2036	Yr 22	63,405,134	4,572,897	1,801,056	55,575,581
2037	Yr 23	63,414,070	4,572,897	1,801,056	55,582,699
2038	Yr 24	63,411,672	4,572,897	1,801,056	55,580,789
2039	Yr 25	63,419,206	4,572,897	1,801,056	55,586,790
2040	Yr 26	63,413,352	4,572,897	1,801,056	55,582,127
2041	Yr 27	63,413,333	4,572,897	1,801,056	55,582,112
2042	Yr 28	61,670,282	4,572,897	1,702,944	54,115,717

**Table 16.10: Mining Equipment Estimated Electricity Consumption**

		Ore Shovel (395HR) 1,860 kW	Waste Shovel (495HD) 2,230 kW	Blasthole Drill (Bucyrus 49HR) 880 kW	Dewatering Pump (150 HP electric submersible) 590 kW	Total Electrical Consumption (kW/Year)	Total Electrical Costs (\$)
2013	PP 2	0	0	0		0	0
2014	PP 1	0	0	1,372,166	8,496	1,380,662	100,788
2015	Yr 1	14,419,836	17,288,298	20,466,864	2,635,884	54,810,882	4,001,194
2016	Yr 2	14,338,368	17,190,624	20,351,232	5,271,768	57,151,992	4,172,095
2017	Yr 3	14,175,432	16,995,276	20,119,968	5,271,768	56,562,444	4,129,058
2018	Yr 4	14,012,496	16,799,928	19,888,704	5,271,768	55,972,896	4,086,021
2019	Yr 5	13,849,560	16,604,580	19,657,440	5,271,768	55,383,348	4,042,984
2020	Yr 6	13,686,624	16,409,232	19,426,176	5,271,768	54,793,800	3,999,947
2021	Yr 7	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2022	Yr 8	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2023	Yr 9	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2024	Yr 10	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2025	Yr 11	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2026	Yr 12	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2027	Yr 13	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2028	Yr 14	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2029	Yr 15	13,523,688	16,213,884	19,194,912	5,271,768	54,204,252	3,956,910
2030	Yr 16	13,523,688	16,213,884	19,194,912	2,635,884	51,568,368	3,764,491
2031	Yr 17	13,523,688	16,213,884	19,194,912	2,635,884	51,568,368	3,764,491
2032	Yr 18	13,523,688	16,213,884	19,194,912	2,635,884	51,568,368	3,764,491
2033	Yr 19	13,523,688	16,213,884	19,194,912	2,635,884	51,568,368	3,764,491
2034	Yr 20	0	0	19,194,912	2,635,884	21,830,796	1,593,648
2035	Yr 21	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2036	Yr 22	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2037	Yr 23	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2038	Yr 24	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2039	Yr 25	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2040	Yr 26	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2041	Yr 27	0	0	12,796,608	2,635,884	15,432,492	1,126,572
2042	Yr 28	0	0	12,796,608	2,635,884	15,432,492	1,126,572



Table 16.11: Mine Area Hourly Personnel

Hourly Mine Personnel																														
	PP2	PP1	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15	Yr 16	Yr 17	Yr 18	Yr 19	Yr 20	Yr 21	Yr 22	Yr 23	Yr 24	Yr 25	Yr 26	Yr 27	Yr 28
Shovel / Loader Operator	4	8	16	16	16	16	16	16	16	12	12	12	12	12	12	12	12	12	12	12	12	16	16	16	16	16	16	16	16	16
Haul Truck Operator	8	32	132	148	164	164	164	164	164	164	160	144	144	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	132
Drill Operator		4	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	8	8	8	8	8	8	8	8	8
Wheel Dozer Operator		0	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	12	12	12	12	12	12	12	12	12
Track Dozer Operator	4	12	16	16	16	16	16	16	16	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Grader Operator	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Water Truck Operator/ Snow Plow/ Sanding		2	6	8	8	8	8	8	8	8	8	8	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Other Auxilliary Equipment	4	20	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	30	30	30	30	30	30	30	30
Dewatering	2	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
General Labour	2	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Janitor	2	2	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hourly Open Pit Operations Total	29	94	240	258	274	274	270	274	274	266	262	244	244	230	230	230	230	230	230	230	230	240	232	232	232	232	232	232	232	228
Field Gen Mechanics		3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Field Welder	1	3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Field electrician	1	3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Shovel mechanics	1	3	8	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Shop Mechanic	1	3	6	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Shop Electrician		3	6	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Mechanic Helper		3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Welder-machinist		3	6	6	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Lube/Service Truck	1	3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Millwright	1	3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Electronics Technician	1	3	10	11	12	12	12	13	14	10	10	11	11	11	11	12	12	11	11	11	11	12	11	11	11	11	11	11	11	11
Janitor	1	2	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tool Crib Attendant	1	2	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hourly Mine Maintenance Total	9	41	104	128	136	138	140	149	157	118	118	132	131	125	125	133	132	129	129	129	129	132	129	127	126	126	127	126	126	122
Hourly Personnel Total	38	135	344	386	410	412	410	423	431	384	380	376	375	355	355	363	362	359	359	359	359	372	361	359	358	358	359	358	358	350



Table 16.12: Mine Area Salaried Personnel and Total Headcount

Salaried Mine Personnel																															
	PP1	PP2	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15	Yr 16	Yr 17	Yr 18	Yr 19	Yr 20	Yr 21	Yr 22	Yr 23	Yr 24	Yr 25	Yr 26	Yr 27	Yr 28	
Mine Superintendant			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
General Mine Foreman		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Mine Shift Foreman	1	4	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	
Drill & Blast Foreman			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	
Blaster		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Dispatcher		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Training Foreman		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	
Production / Mine Clerk		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Secretary	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Salaried Open Pit Operations Total	2	13	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	24	21	
Maintenance Superintendant			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Maintenance General Foreman		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Maintenance Planner		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
Mechanical/Industrial Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mine Maintenance Foreman		2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	1	
Mine Maintenance Trainer		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Maintenance Clerk		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Salaried Mine Maintenance Total	0	6	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	9	6
Chief Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Senior Mine Planning Engineer (Long Term)			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Planning Engineer (Short Term)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Geotechnical Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Blasting Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Env./Water Management Eng.			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mining Engineering technician		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
Mine Surveyor	1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	
Assistant Surveyor	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
Technical Services Admin Assist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Salaried Mine Engineering Total	3	8	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	13	13	13	9	
Chief Geologist			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1</					



17. RECOVERY METHODS

Section 13 of this Report described the metallurgical testwork and how the results were used to derive the preliminary Process Flowsheet (PFS) and mass balance. The PFS and mass balance constitute the basis for determining the recovery method of iron from the Shymanivske ore to obtain an iron ore concentrate of suitable grade to produce profitable acid pellets. In this section of the Report, a process design basis is established and is used to further develop the PFS mass and water balance and to develop the process design criteria, including the preliminary selection and sizing of major process equipment. It should be noted that equipment sizing is preliminary and is generally based on a combination of the following:

- Testwork results;
- Handbook references;
- BBA's experience on other projects (reference projects);
- Vendor information.

General processing plant descriptions of various areas are provided and several preliminary plant General Arrangement (GA) drawings were developed. This information serves as input information for the development of the Capital and Operating Cost Estimates presented in Section 21.

17.1 Process Design Basis

The process design is based on an annual concentrate production capacity of 7.3 Mt of pellet feed on a dry basis. The lab test results, given in Section 13, were used to develop the PFS and preliminary mass and water balances which form the base criteria for the process design. In addition, the required size and quantity of major processing equipment were calculated based on the aforementioned criteria, briefly summarized for the concentrator in Table 17.1.

**Table 17.1: Concentrate Production Target and Nominal and Design Rates**

PROCESS DESIGN BASIS			
	Annual (Nominal)	Nominal	Design
	M t/y	t/h	t/h
Grinding Capacity (Fresh Feed)	24.7	3,133	3,200
Concentrate Production	7.3	926	947
Tailings Generated	17.4	2207	2,253
Concentrate Weight Recovery %	29.6		
Concentrate Iron Recovery %	62.6		
Concentrate Iron Grade %	67		
Plant Utilization %	90		
Ore Iron Head Grade %	31.7		
Ore Fe _{mag} Grade %	18.4		

The SAG mill grinding capacity was fixed at 1,600 t/h of fresh feed per mill. This throughput was calculated based on the specific grinding energy of the ore and maximum energy available for the largest commonly used SAG mill without a wrap-around motor. The concentrate weight recovery was based on the weight recovery relationship presented in Section 13.2.6 and was determined to be 29.6% at an average magnetite content of 25.4%. Given the relatively low weight recovery, two grinding lines with a total throughput of 3,200 t/h is required to obtain sufficient concentrate. Table 17.1 shows that for 29.6% weight recovery, 24.7 M t/y of ore needs to be processed to obtain 7.3 M t/y of concentrate which generates 17.4 M t/y of tailings on a dry basis. The concentrator utilization of 90% was based on modern day plant design and performance.

The concentrate grade was fixed at 67% Fe to allow for a pellet plant to produce an acid pellet of 65% Fe grade. While the processing plant is designed for an annual dry concentrate production of 7.3 Mt, a total of 7.6 Mt of dry pellets can be produced if all the concentrate is used for pelletizing. The increase in weight of approximately 3.4% is mostly a result of the magnetite oxidizing to hematite in the induration furnace and also in part from the addition of bentonite. The iron recovery was calculated based on testwork results from



MCM, presented in Section 13, detailing various options and scenarios of magnetic separation.

17.2 Process Flowsheet and Mass and Water Balance

The PFS, including mass and water balances are shown in Figure 17.1, Figure 17.2, and Figure 17.3 for the concentrator and in Figure 17.4 for the pellet plant. The mass and water balances are given as design values and take into consideration the plant utilization. These balances were derived from the block diagram presented in Section 13 (Figure 13.2) plus aforementioned process design criteria and were used to establish further design criteria and size major process equipment.

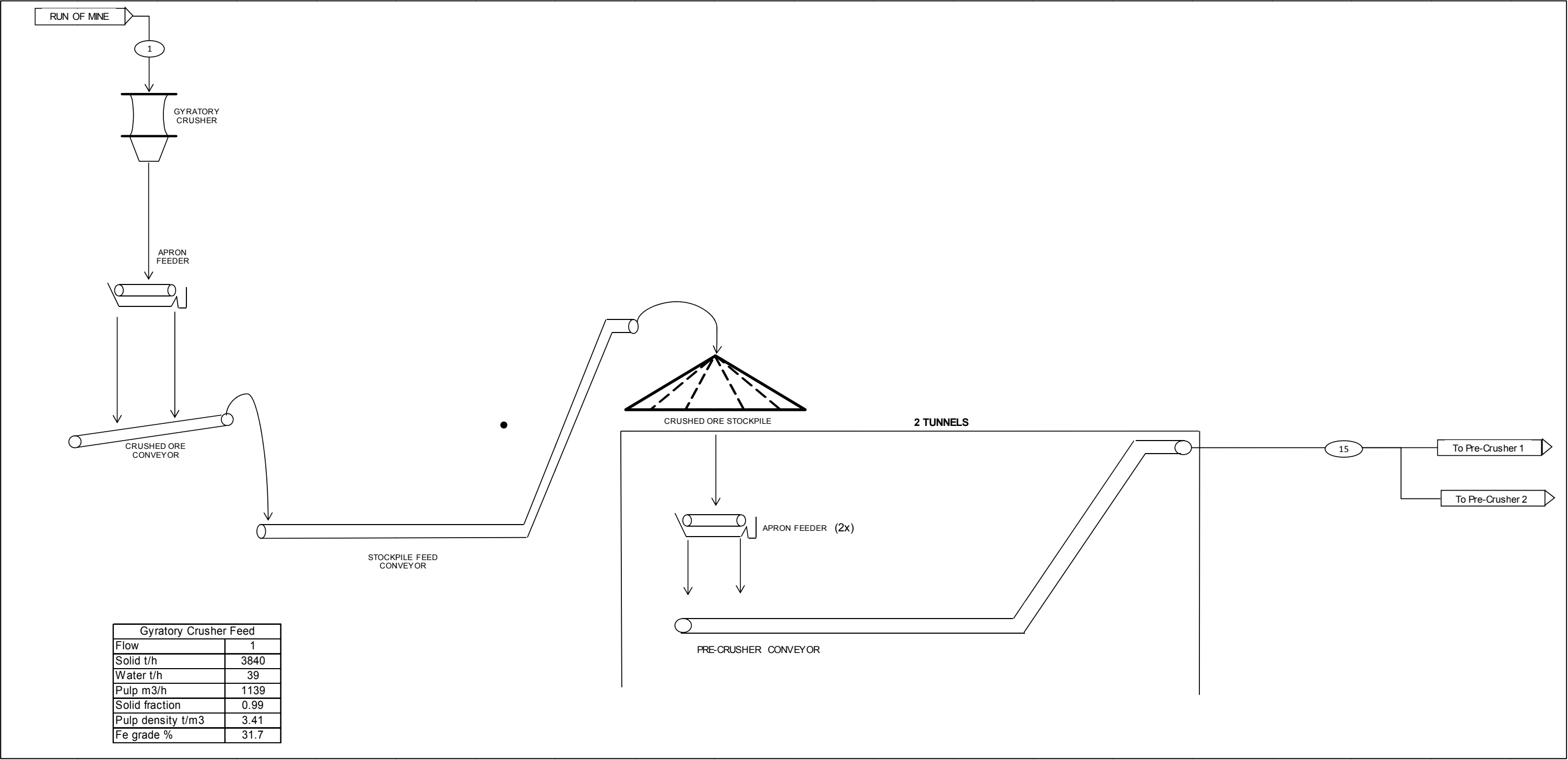


Figure 17.1: Process Flow Diagram Crushing, Stockpiling and Conveying

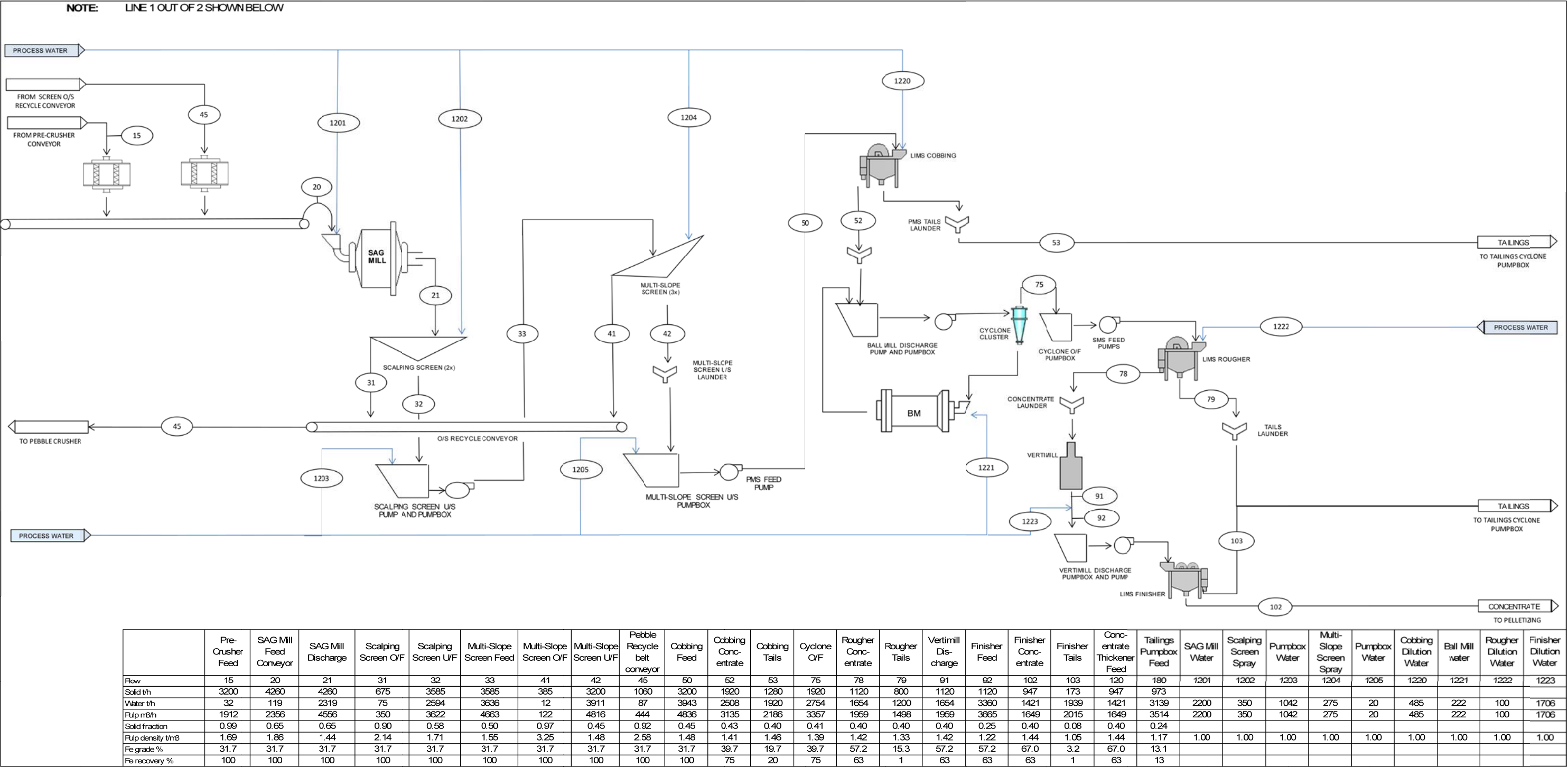


Figure 17.2: Process Flow Diagram Grinding and Separation



WATER DISTRIBUTION FLOWSHEET
ASSUMING NO RAIN OR SNOW MELT IN TAILINGS POND

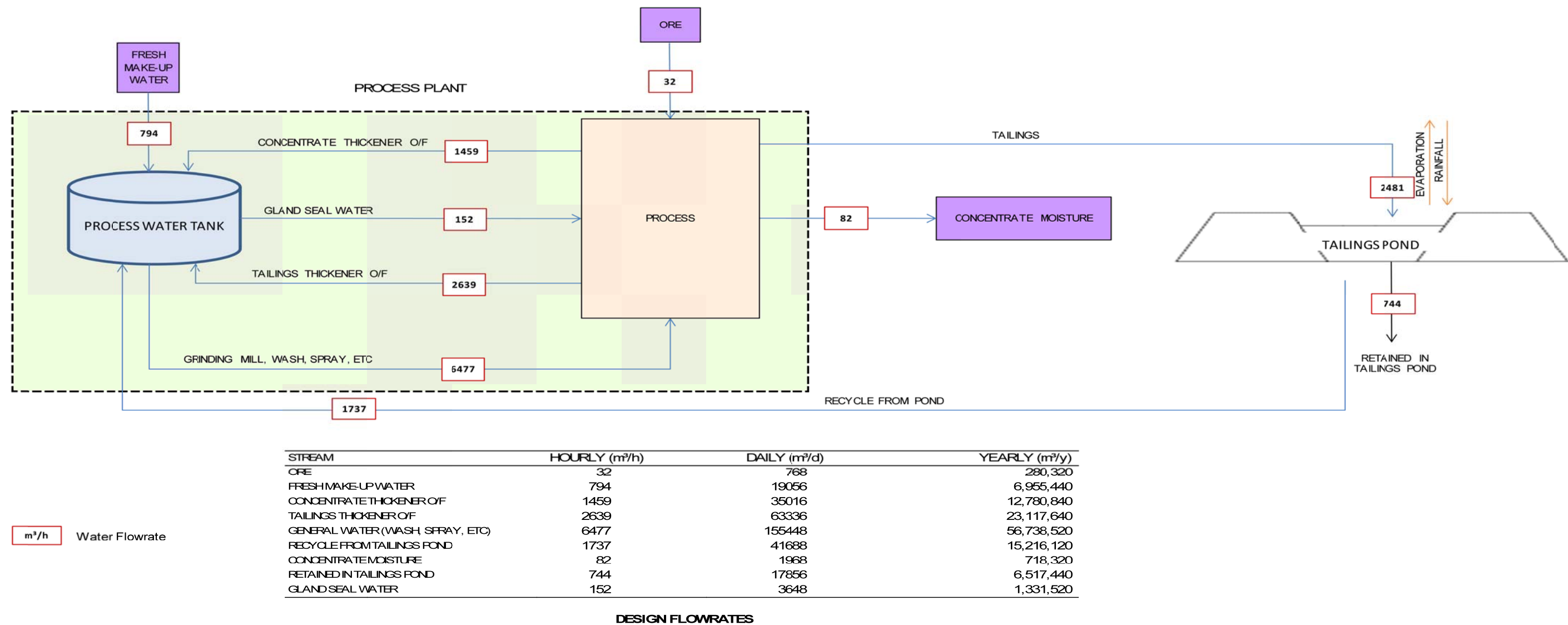


Figure 17.3: Process Flow Diagram Water Distribution

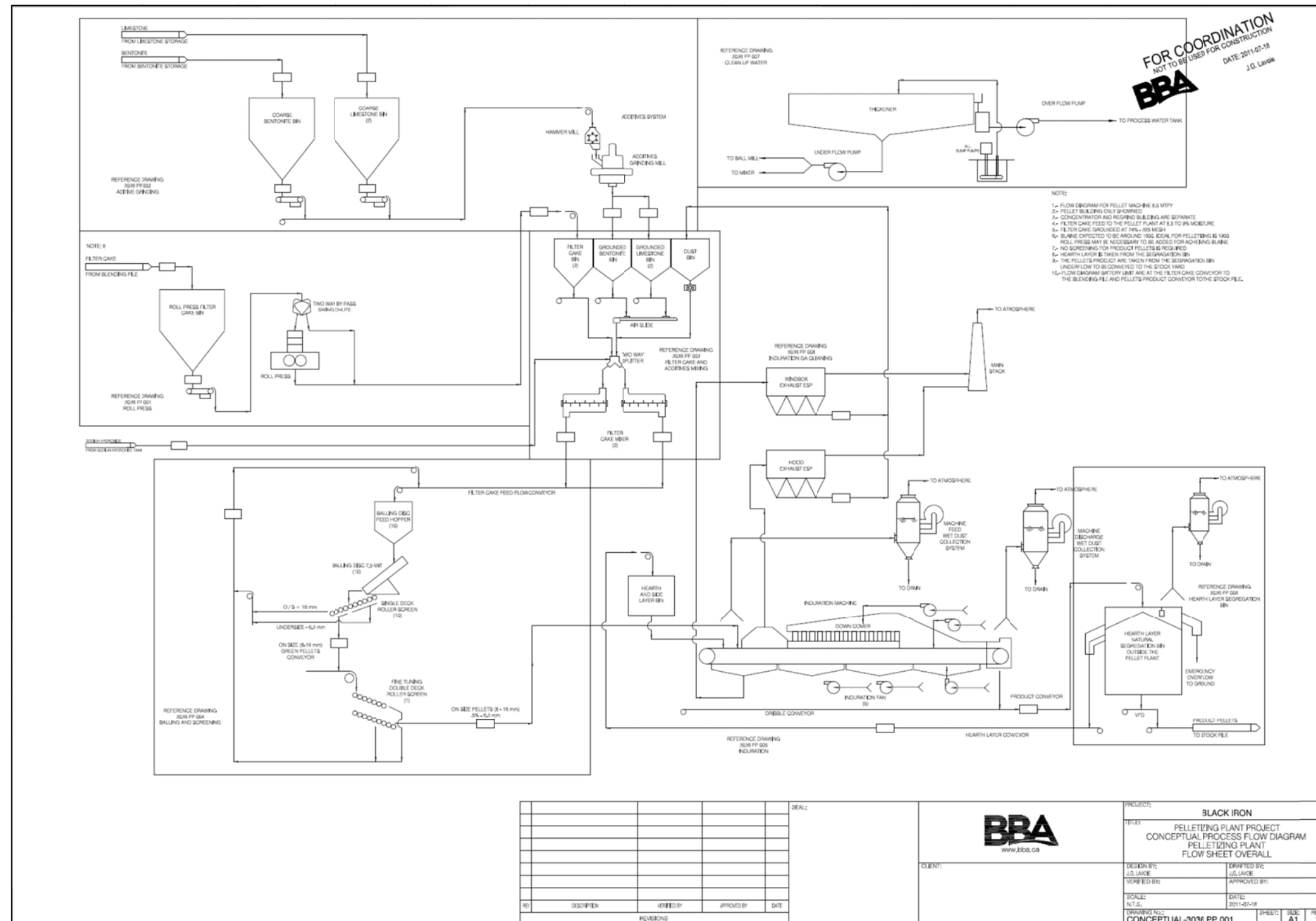


Figure 17.4: Overall Pelletizing Flowsheet



17.3 General Process Description and Plant Design

General process and plant design criteria for the concentrator are based on the following:

- The location of the pre-crushing building, concentrator, crushed ore stockpile, major conveyors, tailings and concentrate thickeners are shown on the site plan developed in this Study. The site plan is presented in Figure 18.1;
- Ore is passed through a single gyratory crusher and the crushed ore is stored in an outdoor, uncovered stockpile;
- From the crushed ore stockpile to the tailings and concentrate thickener, two parallel grinding and separation lines are treating the same throughput;
- The ore is reclaimed through a tunnel equipped with two apron feeders and a pre-crusher conveyor. The tunnel feeds the crushed ore from the conveyor into an XL-1100 pre-crusher;
- Primary grinding is performed with a 10.97 m x 6.09 m SAG mill. The SAG mill is fed crushed ore from the pre-crusher from the SAG mill feed conveyor;
- Two stage screening: scalping followed by multi-slope screening is performed on the SAG mill discharge;
- The screen oversize is conveyed to an XL-1100 pebble crusher, and then combined with the fresh feed to return to the SAG mill;
- The screen undersize is pumped to a three-stage magnetic separation circuit with two regrinding stages: LIMS cobbing, ball mill regrinding, a rougher stage, Vertimill regrinding and a finisher stage. Tailings are rejected at each stage of magnetic separation;
- Concentrate from both grinding and separation lines are recombined, thickened, filtered and directed to pelletizing;



- Tailings are dewatered in a cyclone, then both grinding and separation lines are recombined, thickened and directed to the tailings disposal area;
- To account for plant utilization, supplemental factors have been incorporated into the plant design;
- BBA will use general design criteria based on those developed for BBA's reference projects;
- Major equipment sizing is to be considered preliminary and was estimated by one or more of the following methods:
 - Vendor charts using testwork data or flowsheet balances;
 - Scaling factors to adjust BBA's reference projects;
 - Handbooks, published papers and theoretical or empirical formulae.

In addition to Vendor quotes and similar projects, the capital costs for the facility were also estimated based on the plant General Arrangement (layout) drawings.

17.4 Ore Crushing, Conveying and Storage

The ore crushing, conveying and storage circuit described here for the Black Iron facility is similar to designs used in BBA's reference projects. Certain aspects have been adjusted based on experience and operations at other facilities.

Run-of-mine ore is transported to the crusher area by 290 mt trucks. An industry standard single 1524 mm x 2261 mm, 800 HP, gyratory crusher, reduces the ore to -200 mm (8") in size. Given the limited ore grindability information, it was established that the selected gyratory crusher is sufficient to deliver 3,200 t/h to the grinding circuits. This is based on BBA's reference projects with similar throughput and the ore characteristics. The 1,524 mm x 2 261 mm gyratory crusher has a maximum capacity range of 4,100 – 5,500 t/h depending on the machine settings.



The crushed ore (-200 mm) discharged from the gyratory crusher is fed by an apron feeder onto a conveyor. The conveyor discharges onto a transfer conveyor and transports the ore to an outside crushed ore stockpile.

17.5 Grinding and Screening

Two reclaim tunnels equipped with two apron feeders withdraw the ore from the crushed ore stockpile and feed onto a conveyor. The conveyor discharges into two separate XL-1100 cone pre-crushers. The pre-crusher reduces the ore (to -60 mm) and discharges it onto a conveyor in order to transport the ore to the 10.97 m x 6.09 m SAG mill.

The ground ore from each SAG mill line is distributed to two scalping screens. The undersize is collected in a pump box equipped with two pumps (one operating and the other on standby). The slurry is pumped and distributed to three multi-slope screens. The oversize of the scalping and multi-slope screens is collected on a conveyor and fed to a XL-1100 pebble crusher. The pebble crushers and pre-crushers are contained in the same building. The crushed ore discharges onto the SAG mill conveyor alongside the fresh feed and is returned to the SAG mill for further grinding. The undersize of the multi-slope screen is collected in a launder which empties into a pump box and is pumped to the magnetic separation circuit.

17.5.1 Primary Grinding Mill Sizing

Grindability testwork from SGS presented in Section 13, in addition to information from similar projects, was used to size the SAG mill. Initially, the SAG mill specific energy was assumed to be 8.5 kWh/t for iron ore. This assumption was based on similar BBA's experience on other projects and was used to obtain an estimate of the maximum throughput possible. The largest SAG mill commonly used in the industry was selected (10.97 m x 6.09 m). Given that the mill draws a combined 10,000 HP from two motors, it was calculated based on grinding energy that a maximum of 1,600 t/h could pass through. It was established that two grinding lines totalling 3,200 t/h would be required to obtain the specified design criteria.



Once SGS grindability testwork was received, parameters from the drop-weight test were inputted into the simulation software: JKSimMet. The software confirmed the initial calculation that two SAG mills were capable of reducing 3,200 t/h of ore and calculated the SAG specific energy to be 7.5 kWh/t. JKSimMet showed that given those parameters and a SAG mill top size of 54 mm, the smallest grind obtainable is 963 μ m. It was also established that to maintain 3,200 t/h of throughput with a recycle tonnage below the mandatory 35 weight percent, a pre-crusher and pebble crusher were required for each grinding line.

Table 17.2 indicates the power requirements for the mill for each Operating Work Index and for nominal and design production tonnages.

Table 17.2: SAG Mill Power Requirements

Operating Work Index	Mill Energy at the Pinion	
	Production Tonnage	
	2880 t/h	3200 t/h
7.50 kWh/t	21600 kW	24000 kW
8.50 kWh/t	24480 kW	27200 kW

The two 10.97 m x 6.09 m SAG mills selected are capable of delivering 27,200 kW of combined power for the hardest ore at the design tonnage.

17.6 Magnetic Separation and Regrind Circuit

Two parallel magnetic circuits comprised of three separation stages and two regrinding stages receive the ground ore from each respective grinding line. In each line, the slurry is distributed to six cobbing low-intensity-magnetic-separators (LIMS). The concentrate is collected in a launder, fed to a pump box and pumped with two single-stage pumps (one working and the other on standby) to a closed ball mill and cyclone regrind circuit. Testwork presented in Section 13 requires the concentrate to be ground fine in order to obtain adequate magnetic separation. A single ball mill per line (7.92 m x 12.34 m) was selected to grind the desired tonnage from 963 μ m to 74 μ m. The cyclone overflow is pumped and distributed to six rougher LIMS. The concentrate is collected in a launder and distributed to three Vertimills to further reduce the ore



from 74 μm to 24 μm . The Vertimill discharge is then pumped to six triple drum finishers. The concentrate is collected in a launder and both lines are then pumped to the concentrate thickener and combined.

The LIMS magnetic separators (1200 mm x 3000 mm) were selected based on typical industrial use and the required quantity was calculated based on Vendor data.

17.6.1 Regrind Mill Sizing

Based on the Bond Ball Mill Work indices, it was estimated that two 7.92 m x 12.34 m ball mills (one per line) would be required to grind the ore from 963 μm to 74 μm .

For adequate separation, an additional three ball mills are required to grind down to 24 μm . Given that Vertimills are about 30% more energy efficient and are more compact than ball mills, six Vertimills (three mills per grinding line) were selected to reduce the grinding energy and floor area footprint.

17.7 Concentrate and Tailings Dewatering and Handling

Concentrate exiting from the finisher stage for both grinding lines is combined in a single high-rate concentrate thickener, 39 m in diameter. The underflow is pumped to a storage tank from where it is, then pumped and distributed to ten vertical vacuum disc filters. The filtered concentrate discharges onto the concentrate conveyor and is sent to pelletizing. Slurry from the filter is recycled to the thickener. The thickener overflow of water is recycled to the process water tank.

Tailings from the magnetic cobbing stage are combined with the tailings from the rougher and finisher stages in a pump box and pumped to a dewatering cyclone. The de-watering cyclone overflow from the magnetic finisher stage from both grinding lines discharge into a single 45 m high-rate tailings thickener. The thickener overflow is recycled to the process water tank. The



thickener underflow is combined with the magnetic finisher de-watering cyclone underflow in the tailings pump box. The combined tailings are pumped to the Tailings Pond via a single line.

The tailings and concentrate thickeners were sized based on the throughput of this Project and the settling rate from similar projects. Due to the absence of tailings and concentrate settling testwork, the size of the thickeners should be assumed preliminary in nature and further testwork and sizing is required for the Feasibility Study.

17.8 General Concentrator Plant Services

In this Study, services have not been specifically quantified, but rather estimated based on BBA's reference projects or developed mass and water balances. Capital costs have been estimated accordingly. General plant services for the concentrator and pellet plant are described below.

17.9 Compressed Air

Compressed air requirements have been assumed similar to BBA's reference projects and capital costs for the compressed air distribution network have been estimated accordingly. For the concentrator, it is assumed that two (one operating and the other on standby), compressors with a capacity of 2,000 scfm each will be required. A desiccant dryer of equivalent capacity is also assumed for supply of instrument air. An emergency compressor with a capacity of 200 scfm is also provided.

17.10 Freshwater and Process Water

It is recommended that freshwater be obtained from the Karachunovskoye water reservoir to be used for production and firefighting needs. Confirmation in being able to tie into this reservoir from the local authorities is required. The basic consumers of process water are the processing and pelletizing plants.



The water from the Karachunovskoye water reservoir (located 7-8 km from the proposed concentrator) will be delivered by two staged pumping stations to the water preparation plant and then to two (2) ponds measuring 75x75x7(h) with a useful capacity of 7000 m³ each, located in the plant site area. The water will then be pumped from these reservoirs by the water station pumps and delivered to the consumers. The water pipe from the water supply source to the water supply site is to be single-lined.

Potable water is obtained from the pre-existing 200 mm pipeline leading to the neighbouring YUGOK production plant. The water pipe from the water supply source (existing water pipe) to the water supply site is to be single-lined. The water passes through the pipelines to four tanks with a capacity of 50 m³ each, placed on the water supply site. The tanks will provide backup for adjustment, firefighting and emergency purposes (10 h). The water is pumped from the tanks and delivered to the consumers.

According to the reference iron ore mine YUGOK, operating roughly 300 m east of the Shymanivske pit, potable water is mainly used for the needs of administration and auxiliary buildings equipped with showers, a canteen and laundry services. As for the main production buildings, the potable water is used for the safety eye-wash stations, washrooms and showers.

A preliminary water balance is presented in Figure 17.3. Plant process water requirements have been estimated and are in line with similar operations and BBA's reference projects.

17.11 Fire Protection

The reservoirs maintain emergency water reserves for ten hours of firefighting and contingencies. The capacity of the reservoirs accounts for evaporation and seepage losses.

The ponds will be a combination of excavation and embankments (dam) up to 3 m in height. The bottom of the ponds will be covered with an impervious liner to prevent seepage losses. The impervious liner will be a 1 mm thick geomembrane contained within two layers of geotextile and overlain with a layer of crushed rock.



17.12 Process Design Criteria

Table 17.3 presents the general process design criteria for the concentrator. This information is used to develop preliminary sizing of equipment and the major process equipment list.



Table 17.3: Concentrator Process Design Criteria

PROCESS DESIGN CRITERIA			
SHYMANIVSKE IRON ORE PROJECT PRELIMINARY ECONOMIC ASSESSMENT			
Source Data References			
A	Testwork		
B	Assumed - Based on Experience		
C	Vendor-Supplied Information		
D	Calculated		
E	Process Requirement, Project Internal Design		
F	Mine Plan		
G	BBA Reference Projects		
H	Plant Layout		
I	Estimated Calculation by Engineering Simulations		
Parameter	Value	Units	Source
PLANT DESIGN BASIS			
Plant Operating Days Per Week	7	days	E
Plant Operating Hour Per Day	24	hours	E
Total Concentrate Production (dry)	7.3	Mtpy	E
Ore Crushed (dry)	24.7	Mtpy	D
Ore Moisture Content	1	%	B
Concentrate Grade	67	%	E
Iron Recovery	62.6	%Fe	D
Concentrate Weight Recovery	29.6	%	A
Plant Utilization	90	%	B
Iron in Ore	31.7	%Fe	F
Hematite in Ore (including non-recoverable iron)	4.1	%Fe ₂ O ₃	F
Magnetite in Ore	25.4	%Fe ₃ O ₄	F
PELLETIZING PLANT			
Induration Technology	Straight Grate	-	G
Annual Production of Pellets	7.6	Mt/y	G
Grate Active Area	744	m ²	G
Schedule Maintenance	30	Days	G
Operating Days Per Year	335	Days	G
Operating Time Per Day	24	Hours	G
Hourly Design Production Capacity	985	Tonnes	G
Operation Mode	Continuous	-	G
Product			G
Type of Pellet	Acid Pellet	-	G
Iron Grade	65.0	% Fe	G



17.13 Pellet Plant

An option being considered in this Study is the production of acid pellets from the concentrate. An alternative to the pellet plant would be to sell the concentrate without further processing. In Section 22, both scenarios are considered and analyzed financially for the optimal financial gain.

The pellet plant is designed to produce 7.6 M t/y of dry pellets from 7.3 M t/y of dry concentrate. The increase in weight of approximately 3.4% is mainly a result of the magnetite oxidizing to hematite in the blast furnace plus addition of bentonite.

17.13.1 Additives Grinding

The coarse bentonite and limestone additives are received from the coarse additives storage area and delivered to the additive building dump hopper and then conveyed to the day bin in the additives grinding building. The additives are withdrawn by a weigh feeder and fed to a hammer mill located before the vertical roller mill to break larger lumps (if required).

The vertical roller mill drive shall be a variable speed type and shall be provided with a hot gas generator to achieve drying during the grinding operation.

Material which has passed between the mill roll is lifted in a stream of air. A dynamic adjustable separator within the mill returns coarse particles directly to the mill. Fine particles are lifted out of the mill in the gas stream and are collected by a cyclone and a bag filter and then discharged through rotary valves into an aerated storage silo. Part of the clean air is returned to the mill.

The bentonite, nominally 80% -74 μm (200 mesh) will be pneumatically transported to the day bins in the mixer area of the pellet plant.



17.13.2 Filter Cake Reception

The concentrate filter cake will be received directly from the blending stockpile by a reclaim conveyor and will be transported to the pellet plant mixer area. The unmixed material will be fed to the mass flow filter cake day bin by a conveyor, located above the day bin (or fed by “plough” if more than one bin). The filter cake bin has a residence time of 12 hours.

A pressurized dust bin shall also be located in the plant mixers area. The dust collected from the dry de-dusting devices (ESP) of the pelletizing machine will be stored in the day bin to be eventually mixed proportionally with the filter cake in the mixers.

17.13.3 Mixing

The bentonite and limestone will be fed to the mixers feed chute by an enclosed screw feeder. The dust collected from the induration machine dedusting equipment can also be mixed with the filter cake in the mixers if this procedure is chosen by the Supplier.

The filtered material will be withdrawn from the mass flow filter cake day bin by weigh belt feeder and discharged onto a conveyor belt to feed the two mixers. The filter cake can be fed to the two mixers simultaneously or individually by means of a swing chute or another suitable device offered by the Supplier. The filter cake and binder shall be intensively mixed in the horizontal drum mixer in order to obtain a good homogenous mix of the balling material. One mixer shall be able to sustain the production of the second unit for a short time in case of breakdown or scheduled maintenance.

Provision will be made to add slurry water from the thickener to the mixer, depending on the moisture content of the filter cake and the allowable water addition for balling. Provision will also be made for the addition of sodium hydroxide to the mixers, as needed.



The mixed material will be transported by a series of belt conveyors to the balling area. Rejected green balls from the green ball screening system and balling disc reversible discharge conveyors will be added to the mixed material downstream of the mixers.

17.13.4 **Balling**

The balling area of the pellet plant will be of a conventional design with balling discs as described below.

A horizontal conveyor equipped with automated liftable V-shape ploughs will distribute the mixed material and green ball returns into the balling disc bins. The horizontal ploughs conveyor will be extended over the last balling bin and will discharge the dribbles onto a conveyor and finally to the recycling system. The mixed material will be continuously withdrawn from each balling disc bin by a variable frequency drive weight conveyor belt and fed to the balling disc.

The Supplier will determine the number of balling units required to sustain the planned indurated pellet production.

Each disc will be powered by a suitable size variable speed electric drive. The disc pan and edge scrapers will be made and fixed according to the latest and most successful designs.

The disc inclination will be between 45° and 49°. The disc rotational speed shall be adjustable from a local panel near the balling disc for quick action from the operator.

The planned number of balling discs will be capable of supplying full tonnage of green balls to the induration machine, for the periods when one (1) disc is taken off-line for periodical maintenance.

Each disc will discharge the green pellets onto an individual reversible collecting belt in order to deliver them to the main collecting conveyor. The reversible belt will discharge any sub-par product to the recycle conveyor belt located under the disc floor.



The main green pellets collecting belt will discharge onto a shuttle belt that runs on rail across the wide belt that feeds the double-deck roller screen.

The function of the double-deck roller screen is to effectively remove the oversized pellets generated by the balling disc with the top deck, and, secondly to remove the broken and -6.3 mm pellets with the lower deck from the machine feed. Green pellet fines and oversize will be returned together with the balling disc reversible rejects product conveyor to the mixed material stream on the way between the mixers and the balling feed bins.

Typically, the total rejects from balling and the double-deck roller screen are of the order of 20-25%. However, to avoid conveyor overload in case of bad mixing and balling conditions and, to allow continued operation during process disturbances, the belts in the balling area and from the mixers discharge station shall be sized to accommodate 40% recycle on a continuous basis.

17.13.5 Green Pellet Screening

The mixed size green pellets are discharged from the wide belt conveyor onto a double-deck roller screen. The purpose of the double-deck roller screen is to effectively remove the oversize, undersize, and broken pellets from before feeding the travelling grate.

The double-deck roller screen will be sized and designed as per the latest and most successful design.

The double-deck roller screen fines and oversized green pellets collecting conveyor will be designed in such a manner as to keep the amount of dribbles falling onto the travelling grate at a minimum.

17.13.6 Induration

The travelling grate is the preferred means of process for the induration of pellets for this proposal.



The green pellets will be hardened on a four meter wide Straight Grate induration machine. Provisionally, the machine will have (but not limited to) an active area of 744 m², corresponding to a grate factor of 28 t/m²/day.

Green pellets will be dried in two stages: updraft followed by downdraft drying gas flow. The dried pellets will be preheated to a progressively higher temperature. The pellets will then be fired at approximately 1270°C. A short section designated as after firing allows the heat front to completely penetrate to the bottom of the pellet bed.

Cooling is accomplished in two stages: by an updraft passage of ambient air supplied and by a cooling air fan. The cooled pellets shall leave the induration machine at 100°C or less.

Five adequately sized process fans will provide the gas flow throughout the induration machine.

The grate will be provided with a refractory lined hood above the machine and wind boxes below the machine. The hood will have water cooled sides and transverse lintels. Internal dividing walls will separate zones in the hood, while moveable shell-shaped dead plates will separate zones in the wind boxes. Two false wind boxes at the feed end of the machine will be connected to the exhaust gas to provide clean and cool conditions at the feed end of the machine.

The bed height of the machine is envisaged to be 80 mm hearth layer plus a green ball layer of 428 mm, giving a total bed height of 508 mm. The travelling grate speed shall be controlled automatically by a series of ultrasonic probes at the feed end that will continuously measure the height and evenness of the bed to ensure a good air flow.

A system shall be provided for the rapid change-out of damaged pallet cars. The pallet cars change-out system will be located at the upper section of the machine drive end.

A pallet rapper (grate bar cleaner) of an effective proven design will be provided and conveniently positioned for easy maintenance.



17.13.7 **Hearth Layer**

A hearth layer is used to protect the grate bars and the side walls of the pallet car from excess heat that will otherwise accelerate damage. Only the larger sized fired pellets are used as a hearth layer.

The hearth layer system will be designed as per the latest and more successful design. Either one of two known systems can be proposed at this time:

1. One system consists of the newly introduced pellets natural segregation bin. Larger pellets will segregate to the side of the bin to be allowed to overflow into a side chute to return to the hearth layer bin via the conveyor system in the pellet plant. As there are no moving parts, noise and dust, emissions are reduced to a minimum.
2. The second acceptable option is the screening of the pellets in a separate screening building before their return to the pellet plant as hearth layer.

17.13.8 **Machine Dribble**

Spillage from the machine drive wheel will be diverted directly to the dribble conveyor by a special design of the wheel deflectors. Spillage from the wind boxes will be directed to the dribble conveyor by means of double dump valves. The dribble conveyor will discharge onto the fired pellets conveyor

17.13.9 **Clean Up Water**

A suitable thickener for the use of the pellet plant clean up system will be provided.



17.13.10 Gas and Dust Cleaning

A gas cleaning and dust removal system will be provided. The process gas system will be with electrostatic precipitation (ESP). Dust removal at the machine feed and discharge point and at the hearth layer shall be with a wet process.

17.13.11 Machine Discharge Conveyor

Fired pellets from the induration machine are discharged onto a conveyor designed to transport the pellets to a stockpile located outside of the pellet plant. The head of the fired pellets conveyor will be sufficiently elevated to allow storage for 60,000 tonnes of pellets.



18. PROJECT INFRASTRUCTURE

This section describes the major infrastructure required to support the Project, both at the Shymanivske site as well as off site and at the port facility.

18.1 General Shymanivske Site Plot Plan

The general Shymanivske site preliminary plot plan is presented in Figure 18.1. The following approach was taken to develop the site plan:

- As a first step, a review of the Property was done by BBA in collaboration with the WGM exploration team, domestic and international consulting firms. The known and potential mineralization areas on the Property were identified, and as a rule, site infrastructure was kept outside of the boundaries of the mineralization zones;
- The selection of the ore-dressing and processing plant site is governed by the location of the Shymanivske deposit and Property. ArcelorMittal's railway tracks act as a Property constraint to the north. The Property is constrained by YUGOK's waste dumps to the east and by ArcelorMittal Kryviy Rih's Stepnoy waste dumps to the southwest. Agricultural lands line the west Property border and land owned by the Ministry of Defence constrains the north-west side of the Property;
- Using the geological block model for the Shymanivske deposit, the preliminary pit design was created based on an optimized pit shell with no surface expansion limits as outlined on the site plan;
- It is assumed that the iron ore pellet feed material or pellets will be transported by train from the Kryviy Rih area Moiseevka rail station to the TIS-Ruda Chernomorskya Station located at Port Yuzhny on the Black Sea. The Shymanivske rail station, rail spur and access railway, situated to the northeast of the Property, can be connected by the Prydneprovsk rail line to the mainline railway owned by "OAO Ukrzaliznitsa";



- The second rail line adjacent to the Property's west boundary is privately owned by "OAO ArcelorMittal" and cannot be used by the Project. The ArcelorMittal rail cannot be relocated and any crossings or underpasses of the existing rail line will have to be coordinated with ArcelorMittal;
- The overburden dump, tailings storage facility (TSF) and tailings management facilities are located on the western side of the plant site and situated as close to the processing plant as possible to minimize pumping distances for the tailings and return water lines. In addition, the location was chosen to minimize any environmental impacts and to provide the most favourable conditions for construction. The waste dump footprints will be verified and confirmed in the FS;
- The concentrator and pellet plant laydown area and Shymanivske rail station are tentatively located along the west side of the existing Prydneprovsk railway; anticipated geotechnical data will confirm the official location. The primary crusher is located west of the overburden and waste dump;
- Ore is transported from the gyratory crusher to the crushed ore stockpile along the crushed ore conveyor. Parallel pre-crusher feed conveyors transport the crushed ore from the crushed ore stockpile to the pebble crusher building. Parallel SAG mill feed conveyors transport the crushed ore from the pre-crusher to the SAG mill located in the concentrator building. Parallel pebble crusher feed recycle conveyors return over-sized SAG discharge material to the pebble crusher building for further crushing;
- Two underpasses will be constructed to allow the mine equipment and conveyors to pass under the ArcelorMittal and Prydneprovsk railways;
- For this Study, it is assumed that road access to the plant site will be by an existing roadway adequate to handle normal traffic to the plant. An additional 5.1 km must be added to the main access road which will be used to transport people, various goods and materials;
- The 154 kV power line runs parallel to the existing ArcelorMittal private railway, between the waste dump and the pit. To protect the 154 kV power line from flying debris during blasting



operations, the power line will be relocated away from the pit and will follow the Property border north of the waste dump instead;

- Power for the Black Iron Project will be drawn from two existing substations owned by the Power Utility, and delivered to the Project site through two new 330 kV transmission power lines. The Gornaya substation is located 30 km east and Qvarzit substation is located 60 km northwest of the Project site. For the purpose of the Study, it is assumed that the Gornaya substation has sufficient spare capacity to deliver the required power to the Project. It is also assumed that there is a double bus arrangement at 330 kV with sufficient physical space to install two outdoor breakers (one for each bus) to feed the new 30 km power line going to the Black Iron site.

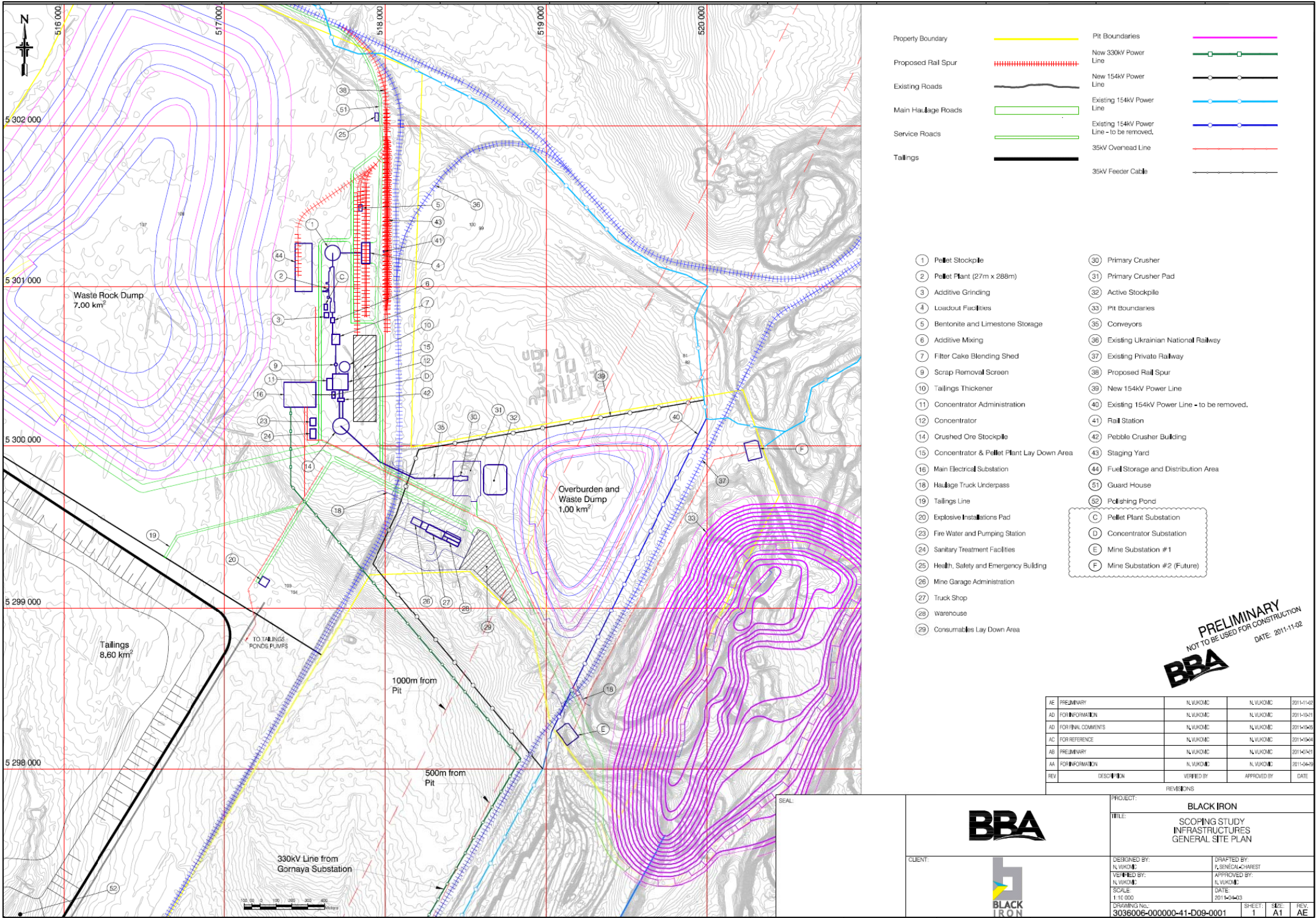
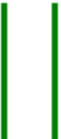


Figure 18.1: Preliminary Plot Plan

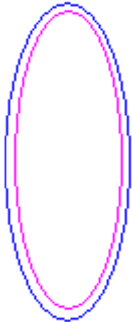
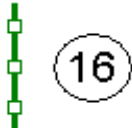
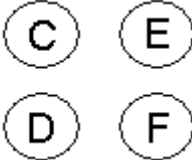
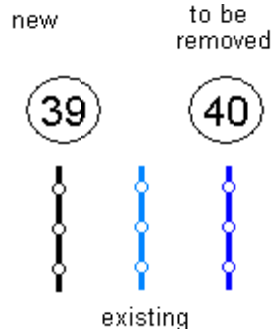


Table 18.1 provides a descriptive legend to the general site plan presented in Figure 18.1.

Table 18.1: Preliminary Plot Plan Legend

Item	Reference	Description and Design Basis
Property Boundary		The project land requirements are outlined on the site plan by the yellow line.
Existing Railways	  	- There are two existing railway crossings on the property. - The first is the Ukrainian National Railway. - The second is a private railway owned by ArcelorMittal.
Proposed Rail Spur and Rail Station		The proposed rail spur is directly attached to the Ukrainian National Railway.
Main Haulage Roads		- The main haul road will be used to transport ore and waste from the pit to the crusher, waste and overburden dumps. - The length of the road is estimated at 4.6 km with a road width of 40 m.
Service Roads		- The service roads will separate the main haulage fleet from the other fleets. - They will be parallel to the main haul road, have a width of 8 m.
Tailings and Polishing Pond	 	- The tailings will be located to the south-west of the Property. - Free water from the tailings impoundment will be discharged to the polishing pond, along with water drained from the open pit. - The volume of the polishing pond will be 8M m³.



Item	Reference	Description and Design Basis
Waste Rock and Overburden Dumps		- There are two areas defined as waste rock and overburden dumps. - The first one is located in the north-west corner of the Property and the footprint is estimated at 7 km². - The second one is located west of the private railway with an estimated footprint of 1 km².
Main Electrical Substation		The 330 kV power line with length of 30 km will be connected to Gornaya substation at the south side of the Property.
Secondary Electrical Substations		Four secondary substations will be necessary: two for the mine, one for the pellet plant and one for the concentrator.
154 kV Power lines		- A section of the 154 kV power line will have to be relocated following the north property line, south along the Ukrainian National Railway and turning south-east until it merges with the existing power line. - The newly built portion of the 154 kV power line will have a length of 4.2 km.
Pellet Stockpile		The pellet stockpile is located west of the Ukrainian National Railway.
Pellet Plant		The pellet plant is located along the Ukrainian National Railway. The concentrate regrind area and the pellet plant



Item	Reference	Description and Design Basis
	2	are assumed to be completely independent of the base case concentrator facility. Final pellets are directed to the load-out silo for loading into the railcars. An emergency stockpile is provided. No screening of the pellets ahead of loading into railcars is provided.
Pellet Plant Facilities	3 5 6 7 9	Pellet plant facilities include: - Additives Grinding Building - Additives Mixing Building - Filter Cake Blending Shed - Scrap Removal Screen Building - All these facilities are aligned in a south-west direction between the concentrator and the pellet plant except for the bentonite and limestone facilities located near the rail spur.
Loadout Facilities	4	- Pellets will be conveyed from the pellet plant to a load-out silo.
Tailings Thickener	10	- The 45 m diameter tailings thickener is located north of the concentrator.
Concentrator Administration	11	- The concentrator administration area includes the boiler and compressor room, the mill lab and dry room.
Fuel Storage and Distribution Area	44	- The diesel tank farm is located north of the main haul road and west of the pellet stockpile. Different types of diesel fuel will be used for the mine trucks and boilers. - Two series of tanks will be provided, one for the mine trucks (capacity of 2 000 000 L) and one for the boilers/generators (capacity of 400 000 L).



Item	Reference	Description and Design Basis
Primary Crusher	30 31	- The primary crusher building will be located west of the smaller waste dump. - To crush 24.7 M t/y at ROM, one gyratory crusher will be installed.
Concentrator and Pellet Plant Lay Down Area	15	- The lay down area will be located along the Ukrainian National Railway.
Pre-Crushers and Pebble Crushers	42	- The two pre-crushers and the two pebble crushers are housed in the same building. - It is located directly north of the crushed ore stockpile.
Conveyors	35	- The main conveyors will transport the crushed ore and the mill feed. - The crushed ore conveyor will be located along the main haul road under passing the Ukrainian National rail linking the crusher to the stockpile. - The mill feed conveyor will be located west of the Ukrainian National Railway. This conveyor will link the stockpile to the pre-crusher and pebble crusher.
Haulage Truck Underpass	18 	- Two haulage truck underpasses will be constructed to allow haulage trucks and crushed material to be transported to the crusher and waste dumps.
Fire Water and Pumping Station	23	- The fire water and pumping station are in the same building and are located along the Ukrainian National Railway, north of the main haulage road.
Sanitary Treatment Facilities, Health, safety and emergency building	24 25	- The sanitary treatment facility is located south of the fire water and pumping station. It will be a sprung structure. - The estimated health, safety and emergency building will accommodate two fire trucks, one ambulance, a nurse's office, and first-aid.



Item	Reference	Description and Design Basis
Truck Shop	27	- The truck shop building is located south of the main haulage road and east of the Ukrainian National Railway.
Mine Garage Administration	26	- The mine garage administration offices are part of the truck shop building and are situated in the west part of the building. - The mine garage administration building is located south of the main haulage road and east of the Ukrainian National Railway.
Warehouse	28	- The warehouse is also part of the truck shop building and is situated in the east side of the building.
Consumables Lay Down Area	29	- The consumables lay down area is located south of the main haulage roads and east of the truck shop.
Active Stockpile	32	- The active stockpile is located between the north property line and the main haulage road east of the crusher building.
Pit Boundaries		Pit boundary lines are based on the mine design.

The major building structures will be made of steel with pre-painted steel cladding. Concrete foundations will consist of spread footings; however, a more detailed geotechnical survey will determine if piling will be required. Secondary buildings will be of pre-engineered or prefabricated type when applicable. Temporary buildings and warehousing will be of “sprung structure” type.

Slurry and process water pipelines will generally run above ground although some pipework may be buried.



The design provides for domestic sewage treatment. A sewage treatment unit will be located near the concentrator and a separate one will be located near the mine garage.

Security fencing will be provided but requirements will be established during the next study phase.

Electricity

Site-wide electrical power requirements were estimated using a mix of equipment sizing and historical information from BBA's reference projects. The required power for crushing and grinding were estimated based on available ore grindability data. Power requirements for pumping, conveying, and other process equipment were estimated based on flow rates developed in the mass and water balance as well as from BBA's reference projects database. Power requirements for the mine and for infrastructure and service buildings were also estimated from BBA's database. Table 18.2 compiles the site-wide estimated power requirements and annual electrical consumption for the various sectors of the facility. As can be seen, the projected annual electrical consumption is in the order of 1020 GWh and the power demand is estimated at 140 MW. These results have been used in the Operating Cost Estimate and to develop the electrical Single Line Diagram.

Black Iron Inc.

NI 43-101 Technical Report – PEA of the Shymanivske Iron Ore Project



		PROJECT: BLACK IRON PROJECT NUMBER: 3036006 LOAD LIST NUMBER: 3036006-000000-47-ELI-0012 REV.: AA - PRELIMINARY DATE: 2011-10-05					PREPARED BY: Sylvain Bélec VERIFIED BY: Patrick Lemée APPROVED BY: Maurice Brisson			
DESCRIPTION	DATA SOURCE	CONNECTED LOAD	RUNNING LOAD	RUNNING POWER (1)	AVERAGE EFFICIENCY FACTOR (2)	LOAD FACTOR (3)	DIVERSITY FACTOR (4)	POWER DEMAND (5) = (1)/(2)*(3)*(4)	ANNUAL LOAD FACTOR (6)	ESTIMATED ANNUAL ENERGY CONSUMPTION (7) = (5)*(6)*365*24/1000
		(HP)	(HP)	(MW)				(MW)		(GWh)
CRUSHING	MECHANICAL LIST	2840	2765	2.0627	0.92	0.85	0.85	1.6199	0.9	12.77
PRE-CRUSHING, STOCKPILING AND CONVEYING	MECHANICAL LIST	6005	5735	4.2783	0.92	0.85	0.85	3.3599	0.9	26.49
GRINDING AND SCREENING	MECHANICAL LIST	6246	4646	3.4659	0.92	0.85	0.85	2.7219	0.9	21.46
GRINDING (SAG MILL)	MECHANICAL LIST	40000	40000	29.8400	0.95	0.85	1	26.6989	0.9	210.49
GRINDING (BALL MILL)	MECHANICAL LIST	44000	44000	32.8240	0.95	0.85	1	29.3688	0.9	231.54
MAGNETIC SEPARATION AND REGRINDING	MECHANICAL LIST	8322	4322	3.2242	0.92	0.85	0.85	2.5321	0.9	19.96
MAGNETIC SEPARATION CIRCUIT - VERTIMILL (x8)	MECHANICAL LIST	24000	24000	17.9040	0.92	0.85	1	16.5417	0.9	130.42
CONCENTRATE THICKENING AND HANDLING	MECHANICAL LIST	6007	5977	4.4588	0.92	0.85	0.85	3.5016	0.9	27.61
PROCESS WATER TANK AND MECHANICAL ROOM	MECHANICAL LIST	2020	1410	1.0519	0.92	0.85	0.85	0.8261	0.9	6.51
TAILINGS DE-WATERING AND THICKENING	MECHANICAL LIST	1442	522	0.3894	0.92	0.85	0.85	0.3058	0.9	2.41
PELLET PLANT	HISTORICAL							25.6000	0.9	201.83
MINE PIT	HISTORICAL			12.0000	0.92	0.85	0.85	9.4239	0.9	74.30
MINE GARAGE	HISTORICAL			2.5000	0.90	1.00	0.6	1.6667	0.9	13.14
ALLOWANCE FOR HVAC	HISTORICAL	2000	2000	1.4920	0.90	1.00	0.6	0.9947	0.9	7.84
EXPLOSIVE PLANT	HISTORICAL			2.5000	0.92	0.85	0.85	1.9633	0.9	15.48
NETWORK LOSS (2%)	HISTORICAL							2.5425	0.9	20.05
TOTAL		142882	135377	117.9912		POWER DEMAND SUBTOTAL		129.6678		1022.30
						TOLERANCE (±10%)		12.9668		0.00
								142.63		1022.30

Table 18.2: Black Iron Power Load Calculation



The Black Iron Project has a total electrical load estimated at 140 MW (165MVA). It will draw its power from two existing 330 kV substations owned by the Power Utility: the Gornaya substation located 30 km east of the Project site and the Qvarzit substation, located 60 km north-west of the Project site. This power will be delivered to the Project site through two new 330 kV transmission lines, one from each substation, with the second line being a redundancy backup. However, the present Study includes only the feed from the Gornaya substation. The second power line will be built at a later date only if required to improve power supply reliability.

Once the second power line from Qvarzit is built, the reliability of the power source will be such that emergency generators are not deemed necessary at the Black Iron site. However, for the time during which the site will be powered from only one source, it is recommended to have some power generating units at strategic locations.

At the Project site, the transmission lines will terminate into a 330 kV gas insulated switchgear housed within a building. The GIS building/switchgear will include the following:

- 330 kV, double bus GIS switchgear with a bus tie;
- Two incoming bays for terminating both power lines;
- Three feeder bays for the three planned step-down transformers;
- All 330 kV protection equipment (relays, batteries & chargers, etc.);
- Terminations of the incoming and feeder bays will be of the outdoor wall-mounted bushing type.

Downstream from the GIS building, the voltage will be stepped down to 35 kV through three transformers. Each transformer will be connected to its GIS feeder bay through an overhead cable bus. The transformers have been sized at 75/100/125 MVA and offer an N-1 redundancy. Figure 18.2 and Figure 18.3 show the conceptual layout of the main substation and elevation view of a transformer feeder at 330 kV (not to scale).

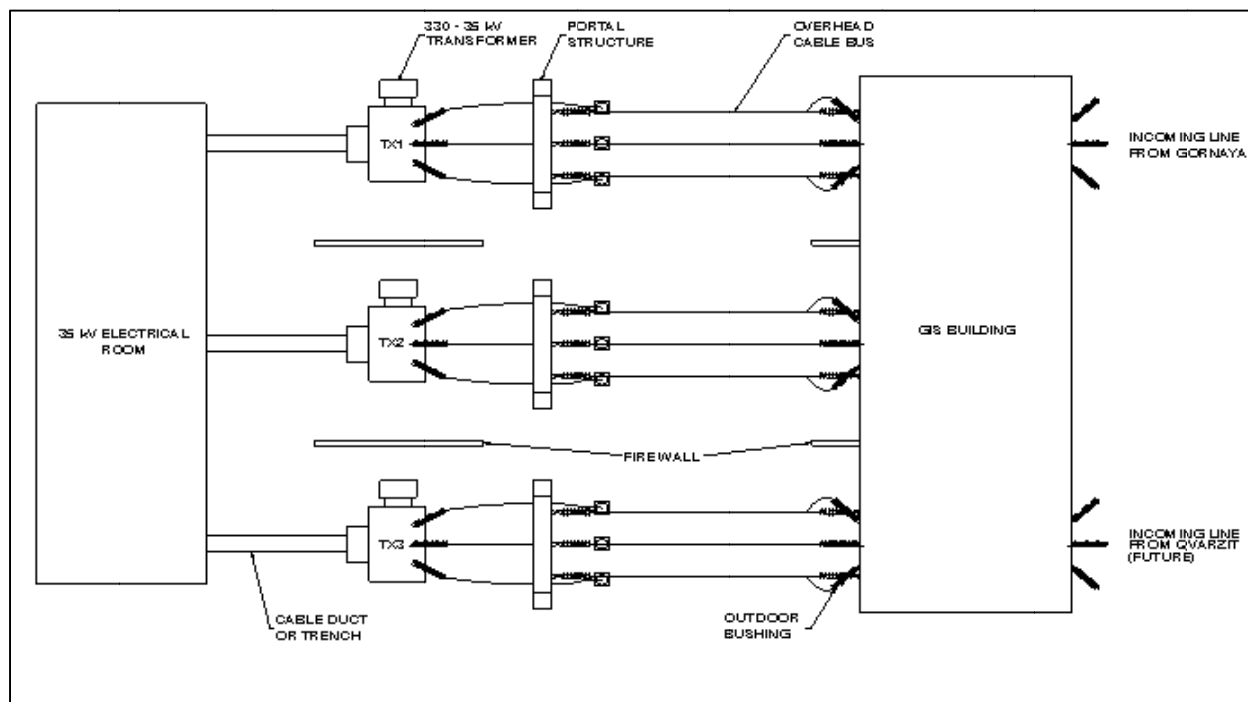


Figure 18.2: Layout of Plant's Main Substation

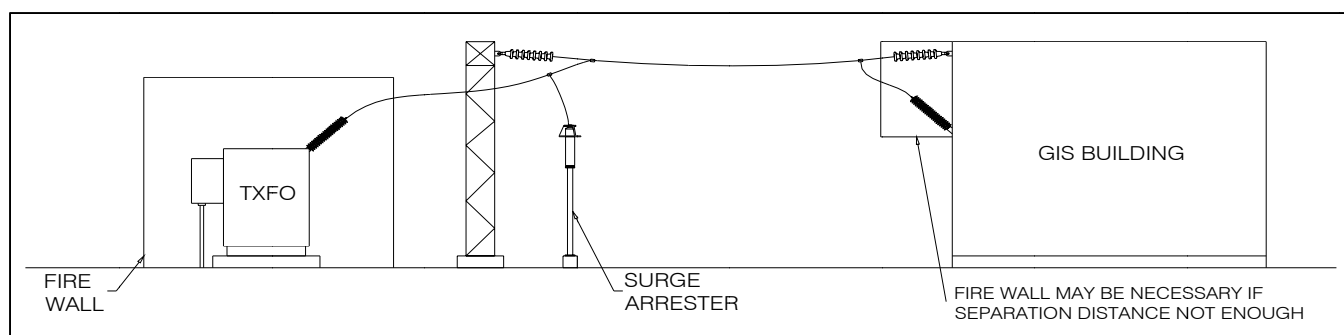


Figure 18.3: Elevation of a 330 kV Transformer Feeder

There are four 35 kV switchgears connected to the secondary side of the transformers. The load is distributed among the four switchgears such that each transformer is similarly loaded in normal operation. In the event that a transformer is stopped, simple switching will allow the affected loads to be fed from the two remaining operating transformers. The 35 kV switchgear will be installed within a prefabricated building also housing all auxiliary equipment (protection panels, batteries & charger, etc.)



The GIS building along with the three main transformers and the electrical housing for the 35 kV switchgear, form the plant's main electrical substation. It is shown as number 16 on the site plan in Figure 18.1 and is located near the concentrator, which is the biggest power user. The main 35 kV switchgear will feed the different parts of the Project through the following feeders:

- One overhead power line to the Tailings pump house;
- Two overhead power lines, one to each of the two mine substations. These two lines also feed the mine garage and the crusher areas along the way;
- Two overhead power lines (N-1 redundancy) to the pellet plant to feed a local substation;
- Seven insulated cable feeders to the concentrator plant;
 - Four to feed the two SAG and two ball mills;
 - Three to feed local transformers stepping down to 6.6 kV in an N-1 arrangement.

At the mine site, a grounding grid is installed for the protection of all mining personnel and equipment. Also, two mine substations are planned, each including a 7.5 MVA transformer to generate 6.6 kV. However, the present Study includes only one such substation. The second one is to be built when required by mining operations.

18.2 Railway Transportation Options Study

An international consulting company was retained by Black Iron Inc. to undertake the rail transportation component of this Study.

Black Iron's Project will require the movement of 7.3 Mtpy of iron ore concentrate or 7.6 Mtpy of pellets from the Kryviy Rih area Moiseevka rail station to the Black Sea Port TIS-Ruda Chernomorskaya, by the transportation mode shown in Figure 18.4.

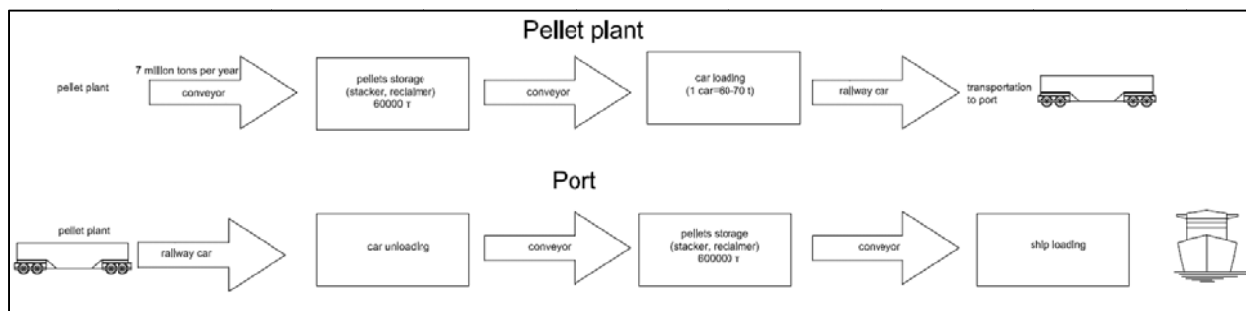


Figure 18.4: General View of Transportation Mode

For transportation of Black Iron’s final product by rail to Port Yuzhny, three routes were reviewed. As product is transported from the Shymanivske Project to the TIS-Ruda port in train sets, no extra reassembling or car sorting is required in options #1 and #3. Hence, two of the three options were more cost effective (options #1 and #3), as shown in Figure 18.5 and Figure 18.6, respectively.

Option #1 provides the shortest transportation route for the final product. The distance from the Moiseevka railway station to Chernomorskaya railway station is about 391 km, with an additional 29 km to the port unloading station. Option #3 has a total route length of 452 km and dispatches the train set through the Nikolaev region. A more detailed study on the cargo traffic capacity of the Nikolaev railway is required to determine the viability of option #3.

The final selection of the railway route will be made upon receiving a permit (Technical Conditions) issued by Ukrzaliznitsa (i.e. Government railway management). The route will be specified based on the current capacity of the main railway; however, Black Iron is in favour of Option #1 due to the shorter transportation route.



Figure 18.5: Railway Route Option #1

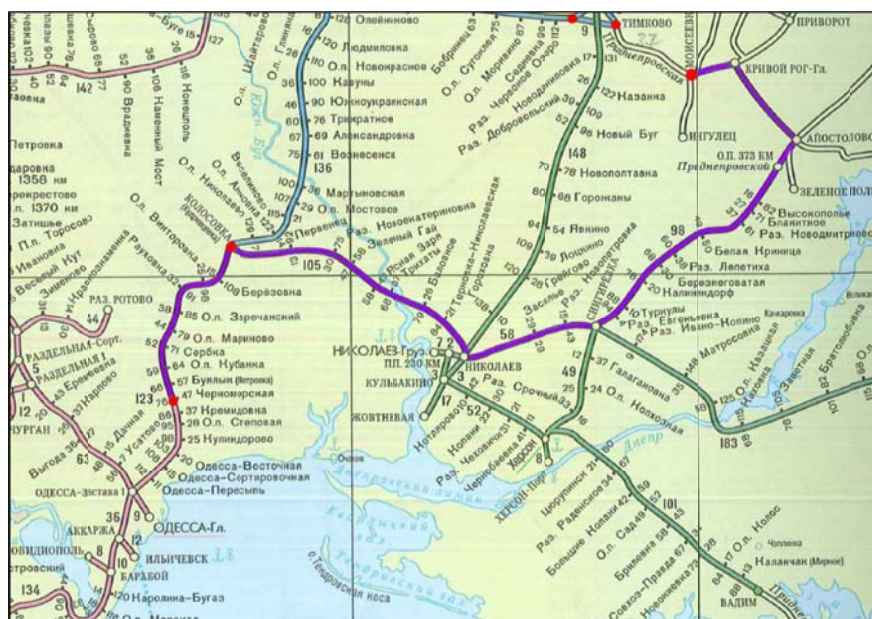


Figure 18.6: Railway Route Option #3



It is assumed that the iron ore pellet feed material or pellets will be transported by train from the Kryviy Rih area Moiseevka rail station to the TIS-Ruda Chernomorskaya Station located at Port Yuzhny on the Black Sea. Railcars will be loaded at the mine site and after acceptance operations are completed at the Moiseevka Station, they will then be sent to the Chernomorskaya Railway Station and finally sent to the Port of Yuzhny (Khimicheskaya Station). New railway infrastructure will need to be constructed by Black Iron to connect the mine to the Moiseevka Station (referred to as the Mine Spur).

It is assumed that the product will be suitable for shipment in the standard 13.9 meter open gondola cars typically used in Ukraine iron ore rail service. Each train will consist of 55 gondola cars in accordance with standard Ukrzaliznitsa train size. The car fleet will be equipped to accommodate rotary dumping to unload the cars at the Khimicheskaya Station. In a 27 hour cycle, the rail operation will require seven train sets of 55 cars, with no extra reassembling or sorting of the cars required. Each car will be capable of handling 69 metric tonnes of product. A 55-car train will therefore move 3,795 metric tonnes of product and the requirement to move roughly eight million tonnes of product annually can be completed with 2,108 trainloads.

The Mine Spur will consist of an industrial railway station with three receiving and departing tracks, with usable length of 1,050 m each, two sorting tracks of a shorter length and two draw-out tracks with usable length of 400 m shown in Figure 18.7. The average time allocated for loading each car is 58 seconds.

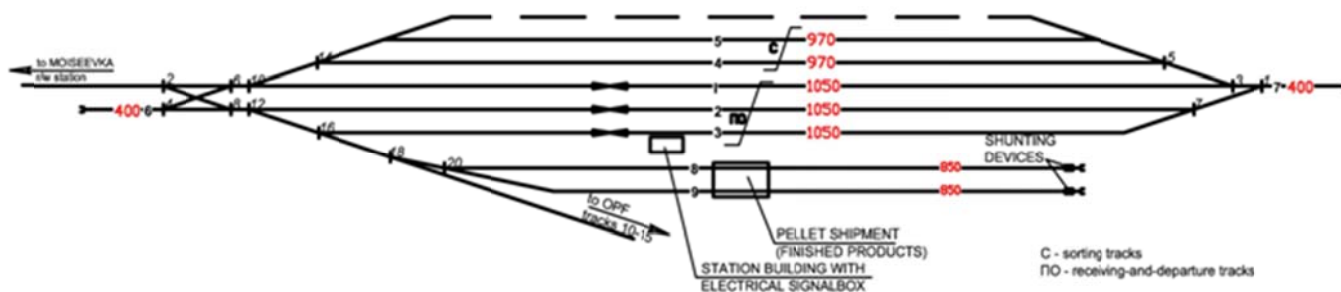


Figure 18.7: Shymanivske Railway Station



The Shymanivske rail station, rail spur and access railway, situated to the northeast of the Property, will be connected to the main railway line owned by “OAO Ukrzaliznitsa” via the Prydneprovsk rail line. To obtain a permit to build and operate the Mine Spur, it will be necessary to provide the local authorities with a detailed design of the railway, its operation plan, and proof of insurance. In order to get approval, access and connection permits between Federal Railways “Ukrzaliznitsa” and the Moiseevka Station, it is crucial to start developing the permitting documentation early. An experienced railway company will need to be selected to construct and operate the Mine Spur. The railway connection is shown in Figure 18.8.

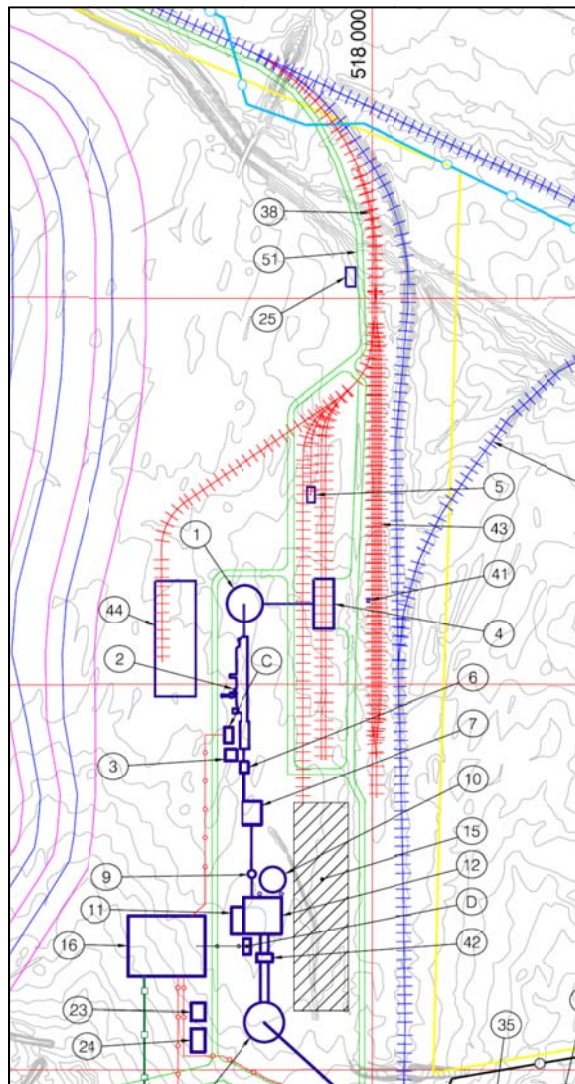


Figure 18.8: Railway Connection to Moiseevka Station



Black Iron's product is shipped by rail to the Port of Yuzhny – a TIS-Ruda terminal receiving station at Railway Yard B, located 0.5 km east of the existing Khimicheskaya Station. The new Railway Yard B interchange will consist of three receiving and departing tracks, two sorting tracks, and one unloading track as shown in Figure 18.9. The new Yard B interchange is needed since the existing facility at Khimicheskaya station cannot be expanded due to lack of space. The estimated time of unloading the whole trainload with a car dumper is 2.75 hours (as per the similar operations at existing facilities). The total estimated time for processing one train at the TIS-Ruda terminal is 3.75 hours. To account for a potential irregular arrival of loaded trains from Shimanivske (6 trains per day instead of the assumed 7 trains), installation of the second car dumper (tippler) may be required.

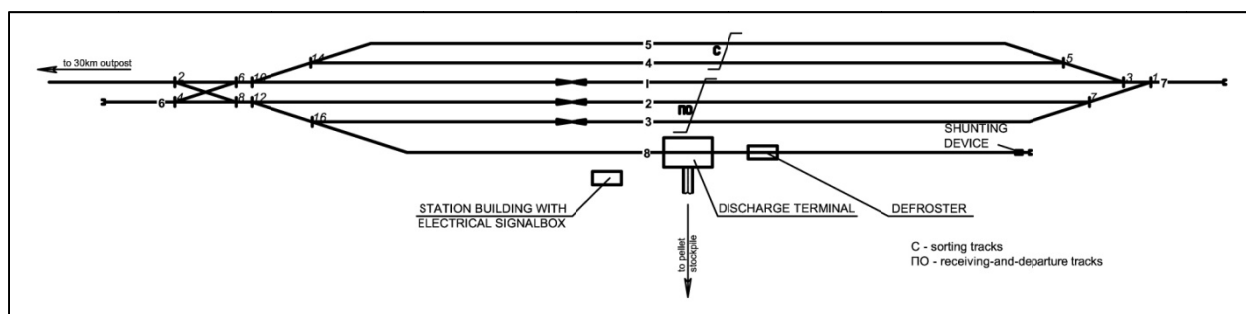


Figure 18.9: New Railway Yard B at Khimicheskaya

Black Iron initiated formal dialogue with the “Ukrzaliznitsa” regional authorities in Dnepropetrovsk in September 2011. This process is ongoing and appropriate Technical Conditions from “Ukrzaliznitsa” are expected at the end of 2012.

A cost comparison study for purchased versus leased railcars was performed. As there is a shortage of rolling stock required for car part manufacturing, it is recommended to use purchased cars as to eliminate dependence on availability of cars to be leased. In addition, it is recommended to arrange a lease-to-buy deal with a local transportation company.

In the existing cash flow analysis, the railcars are leased and included in the operating costs. Sustaining capital requirements for years of operation one to twenty were estimated to be in the order of US\$689.3 million including gradual purchase of the leased rolling stock.

18.3 Port Facility

An international consulting company was retained by Black Iron to undertake a Preliminary Economic Assessment of the Iron Ore Concentrate Storage and Reclaim Facility requirements and select a port facility for the Project.

Based on the results of the sea transportation market analysis, three main port options with the required capacities for iron ore pellets or pellet feed concentrate handling and dispatching were considered for the Black Iron Project. Upon reviewing the three available options, the privately owned TIS-Ruda terminal was selected, based on capacity and depth, as the most optimal and cost effective option. The TIS-Ruda terminal at the Port of Yuzhny has a processing capacity of 250 cars/day and the largest transfer/warehouse capacity of 270,000 t. Figure 18.10 presents a site plan of the proposed facilities.

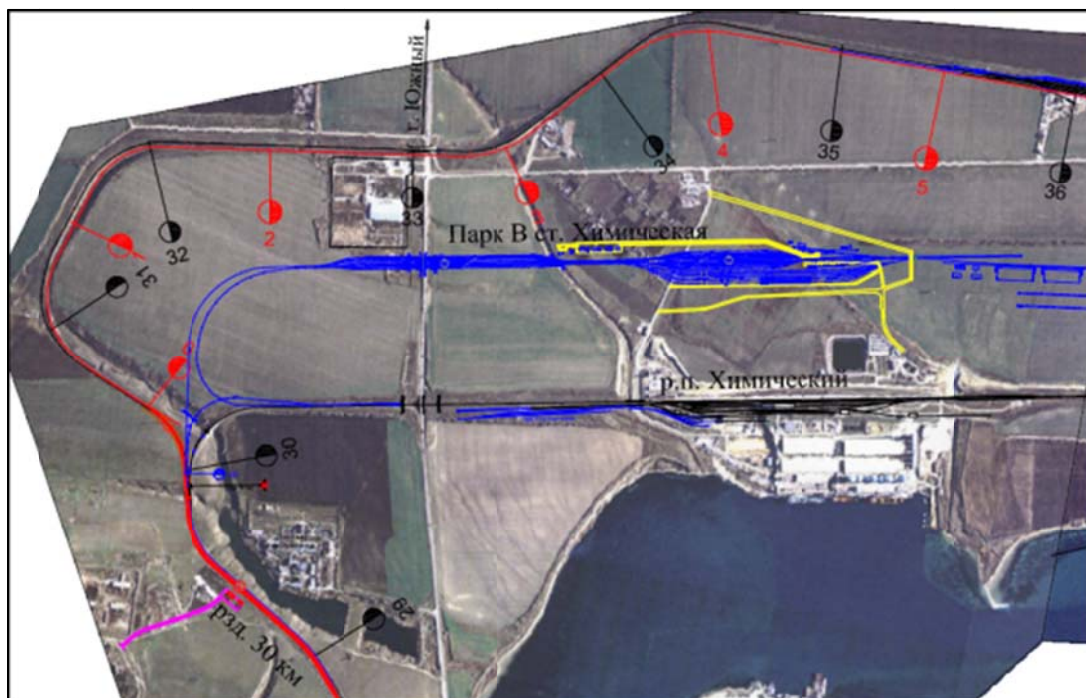


Figure 18.10: Proposed General Arrangement of Facilities

**Table 18.3: Existing Port Capacities Available for Black Iron**

Berth #	18
Berth Length, m	250
Water depth at berth, m	14
Current ship loading rate, t/day	up to 70,000
Existing Shiploaders	2x1000t/h
Existing stockyards	2x140,000t
Rail cars unloading station	250 cars/day
Portal cranes, up to 20t	1
Max deadweight of ships	Up to 140,000t

Cape size vessels transporting iron ore are currently loaded at this facility for shipment to Asian customers. At the berth, 165,000 tonnes of iron ore are loaded onto the vessel and then it is topped off in deeper waters by floating barge cranes owned by TIS-Ruda.

Black Iron will negotiate an operator's agreement with TIS-Ruda covering all port activities, including what is needed from the Port Authorities (Port of Yuzhny). Based on the existing preliminary agreements and the forecasted capital expenditure required, the fee per tonne to be charged to Black Iron is expected to be around 5.2 US\$/t of final product. All negotiations between Black Iron and TIS-Ruda and the negotiations between TIS-Ruda and the Port of Yuzhny (covering topping-off, ship guidance and general port services) will be based on an "open book" basis with full transparency.

The initial assessment of the preferred port facility suggests that sufficient capacity currently exists for the planned initial production. As a result, no additional capital is anticipated for port facilities.



19. MARKET STUDIES AND CONTRACTS

BBA understands that Black Iron is actively promoting the Project and has engaged in discussions with several potential Clients interested in pellet feed (PF) or pellets which will be produced at the Shymanivske facility. Black Iron has also been in discussions with Service Suppliers for rail transportation and a preferred port facility for loading product into ships. As of the effective date of this Report, Black Iron has not entered into any material commercial agreements with any potential Client or Service Supplier.

Black Iron mandated CRU Strategies, a division of CRU International Limited of the United Kingdom, to perform a market study. The objective of the study was to provide a view of developments in steel and iron ore markets that would affect the prospects of Black Iron's proposed Shymanivske iron ore Project and product offering. It is highly likely that all production from Black Iron's Project would be sold to export markets. Black Iron identified the following countries and regions as its main targets:

- European Union;
- Turkey;
- China;
- India;
- Japan;
- Korea (South);
- Taiwan;
- Southeast Asia.

The Study provided ten years of historical data and market forecasts to 2036 for three main areas of interest, which include:

- Crude steel and hot metal production;
- Blast furnace capacity;
- Demand for iron ore.



CRU also provided Black Iron with benchmark prices for pellet feed and pellets, and refined these specific to Black Iron's products, FOB Yuzhny, Ukraine. These forecasts, along with other information were used to develop the PF and pellet prices used in the economic analysis for this Project. The assumptions used for PF and pellet prices are covered in greater detail in Section 22 of this Report.

19.1 Crude Steel and Hot Metal Production

China is by far the largest of the target markets. According to world crude steel production statistics, China produced 627 million tonnes in 2010 and is expected to produce 700 million tonnes in 2011. This represents an average growth rate of 16.6% per year since 2001. No other country or region in the target markets comes close to this performance. Growth rates in the target markets have varied, but in all cases, they lagged that of China. For example, in Turkey and India, the growth rates between 2001 and 2011 were about 8%, whereas in the European Union there has been almost no growth.

The most important future trend is the maturation of the Chinese market. Production should peak in 2031 at about 1.34 billion tonnes, after which production should fall in absolute terms to 1.23 billion tonnes in 2036. Although India and Southeast Asia should show faster growth than China, it will remain more important in terms of production volume.

The mix of BOF and EAF steelmaking technology varies widely in the target markets. In China, about 90% of steel production is by the BOF route. Japan also depends heavily on the BOF route. In contrast, the steel production in Southeast Asia by the BOF route is less than 3%. In the European Union, South Korea, and Taiwan steel production by the BOF route is in the 50-60% range. China's high proportion of BOF steel production reinforces its dominance as a consumer of primary raw materials.

Trends in blast furnace hot metal production should largely mirror that of BOF steelmaking. China will remain the dominant producer of hot metal but the strongest growth will be in India and Southeast Asia.



19.2 Blast Furnace Capacity

According to the CRU Study, it is difficult to identify specific expansions in China, even though there must be many in the pipeline, given the seemingly unending increases in hot metal production. In India, the problem with identifying expansions is the reverse. Approximately 30 million tonnes per year of capacity expansions are committed to come into production between 2012 and 2014 and there is a long list of probable and possible projects. Some known multi-million tonne projects are not even on the list of possible projects because of uncertainties over where and when they will be built, and what sort of equipment may be required.

New blast furnaces are almost certain in Southeast Asia, especially in Indonesia. It is also probable that new capacity will be built in the medium term in Malaysia and Vietnam.

CRU expects only marginal increases in capacity in the short term in Japan. All of the capacity increase will come from incremental expansions at existing works.

19.3 Demand for iron Ore

The share of pellets in feed mix of the target markets is expected to increase from 18% in 2011 to 21% over the period of 2016 through 2026. The pellet share will ultimately increase to 26% by 2036.

The share of sinter feed is expected to decrease from 68% to 62% over the forecast period and the share of lump feed is expected to decrease from 14% to 12%. The decline in average lump rates is masked by the rapid forecast increase in Indian steel production. The total volume of lump feed in India is expected to rise.



19.4 Conclusions

Based on a preliminary assessment of the end markets available to Black Iron, it can be concluded that the most appropriate marketing strategy for the Company is to actively explore and pursue commercial opportunities across a wide array of geographies including China, East Asia, Turkey and Europe.



20. ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

This section of the Report presents the work completed on the environmental and social review for this Study. The fundamental objectives of the Preliminary Economic Assessment, as they relate to the environment and social elements are:

- Present Ukrainian and International Environmental Design Criteria to be considered during the development of the Feasibility Study for the Project;
- Identify where measures may be required to mitigate and monitor those impacts in order to meet standards of good international practice for environmental and social management; and;
- Develop an action plan for completing a full international ESIA to support applications for international finance for the Project.

The Black Iron Project is subject to the requirements for the Environmental Impact Assessment (EIA) under both Ukrainian regulations and the requirements of international investors. Ukrainian law requires the completion of an EIA (or OVOS, Ukrainian equivalent) procedure associated with the Declaration of Intent and Justification of Site Selection.

International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD) and Equator Bank policies/standards also require project proponents to undertake a comprehensive assessment of the environmental and social impacts during planning and to design and manage projects to meet stringent environmental and social standards. The results will be carefully scrutinized by lenders as part of the “due diligence” process, before being approved for lending. Conditions are usually applied to loan agreements requiring implementation of environmental and social management measures identified through the assessment. During planning, the proponent must also engage actively with external stakeholders so that their views and concerns can be taken into account in project design, and must plan for continuing constructive engagement during construction and operation of the Project.



20.1 Characteristics of the Area

Kryviy Rih is a large industrial city located in the KrivBass iron ore basin, which represents a major raw material base for Ukrainian metallurgy.

Kryviy Rih's industrial region plays a key role in Ukraine's economy and is the main raw material base for development of the steel industry in the country.

The KrivBass iron ore basin has seven out of eleven Ukrainian companies engaged in mining and processing of iron ore raw materials, as well as the companies servicing the main production facilities. The main employer is the iron ore steel industry which, as a result, defines the city profile in the territorial distribution of labor force.

Kryviy Rih accommodates one of the world's largest iron and steel works – ArcelorMittal Kryviy Rih, five ore-dressing and processing plants (GOKs) – Severny GOK (SevGOK), Yuzhny GOK (YuGOK), Tsentralny GOK (TsGOK), Novo-Kryviy Rih GOK (NGOK), Ingulets GOK (InGOK) and three mining equipment repair plants. The mining and metallurgical complexes make up 86% of the entire industrial production in the city.

According to UNO experts, Mariupol and Kryviy Rih have the most polluted air in Ukraine. Ecologists attribute this to large industrial plants which have not been upgraded for more than 20 years.

The steel plants in Ukraine currently operate using old USSR technologies. Most of the plants underwent refurbishing in the second half of the 1980's. According environmental assessments in 2010, the plants of Kryviy Rih emitted 590 kg of harmful substances per resident into the atmosphere. This resulted in an increase in oncology related diseases, a low immune system in children and a sharp rise in cardiovascular and allergy related diseases. The situation could be somewhat improved by planting trees and shrubs to create a barrier between the steel plants and residential areas. Unfortunately, at present, there is very little plant life.



However, there is a Program dedicated to “Solving Ecological Problems in the Kryvyi Rih Region and Improvement of the Environment through Reduction of Environmental Pollution” for the period of 2011 — 2022. This document has been adopted by the session of the Dnepropetrovsk Region Council. It is estimated that the amount of financing required under this program will be over 10 billion UAH (by the enterprises’ own means and 828 million UAH coming from the budget. This would reduce the amount of accumulated harmful waste 35% (139.1 thousand tonnes per year).

20.2 Legislative Base for Environmental Protection

The Shymanivske deposit shall be developed in accordance with all current regulations and within the framework of guidelines and standards of the state-of-the-art industrial practice.

Statutory requirements and standards included the following:

- The Ukrainian laws and norms;
- International environmental agreements and conventions, of which the Ukraine is a part;
- International agreements; and
- Standards of industrial association (i.e. state-of-the-art industrial practice).

20.2.1 General Ukrainian Environmental Regulatory and Legal Requirements

The general system of measures aimed at environmental protection in Ukraine is established by the Ukrainian law on Environment Protection (1991) and by the Ministry of Environmental Protection of Ukraine, which is the state body responsible for environmental protection.

All newly developed projects, which are likely to have negative impacts on the environment, shall be reviewed and must be approved by the State Environmental Experts Board. A chapter describing the full-scale assessment of the Projects’ environmental impact is included when the EIA is submitted. The EIA shall be reviewed by the State Investment Expertise (Derzhinvestexperitiza), and its reliability is checked prior to submission to the State Environment Experts Board.



The permits of the environmental bodies may be applied for, Once the Project is approved by the State Environmental Experts Board, then applications for permits of the environmental bodies can be made. The permits of the environmental bodies regulate the following activities for the Project, which may influence environmental conditions:

- Water discharge and intake;
- Air emissions;
- Waste generation, collection, handling and recovery.

Table 20.1 outlines all environmental permits required by the Black Iron Project and Ukrainian environmental bodies responsible for approvals.



Table 20.1: Required Permits from Environmental Authorities

Permitting Documents Developed by Black Iron	Environmental Authorities Issuing Approvals & Permits
Project Development Phase: Site Selection Process	
Initial review of the site selection report by environmental agencies and related state authorities. Outcome on approval of the site selection. Publication in the local and regional newspapers.	1. City of Kryviy Rih Sanitary-Epidemical Department 2. Federal office of Environmental and Natural Resources (Kryviy Rih City Council) 3. Territorial Regulatory Body on Forestry (Kryviy Rih/ Shyroke City Council)
Project Development Phase: Land Allotment Process	
Development of Environmental Sections (OVOS) as a part of the Land Allotment documentation	Local State Authorities (Shyroke and Kryviy Rih RajDerzhAdministraciya) – Department of Sanitary Protection and Environmental Department
Preliminary environmental baseline studies and environmental justification of the planned activities (iron ore open pit mining; pellet feed concentrate production and tailings management)	Local State Authorities (Shyroke and Kryviy Rih RajDerzhAdministraciya) – Department of Sanitary & Epidemiological Protection and Environmental Department
Project Development Phase: Town Planning Verification	
Town Planning Verification Report	Dnipropetrovsk City Administration – Environmental Department and Department of Sanitary & Epidemiological Protection
Project Development Phase: Ukrainian Feasibility Study (Proekt)	
OVOS (Environmental Impact Study) terms of reference	Dnipropetrovsk City Administration – Environmental Department
Development of Environmental Sections within the scope of Ukrainian Feasibility Study (Proekt): ▪ OVOS (Environmental Impact Study) including environmental baseline studies; ▪ Declaration of environmental impact from the Black Iron Project activities; ▪ Identification of environmental hazards; ▪ Sanitary Protective Zones design development; ▪ Failure analysis and environmental assessment of tailings management facilities.	Federal Environmental Organization appointed by the Ministry of Environment of Ukraine
Preparation and execution of public hearings of the OVOS Report, including: ▪ Publication in local mass media of the Project related information; ▪ Collection, analysis and assessment of received claims, proposals from interested parties and communities; ▪ Preparation of a publically accepted risk mitigation strategy.	Facilitator - Local State Authorities (Shyroke and Kryviy Rih RajDerzhAdministraciya) - Department of Sanitary & Epidemiological Protection and Environmental Department
Final version of OVOS Report and related documents	Federal Environmental Organization appointed by the Ministry of Environment of Ukraine; Sanitary-Hygienic Expertise by Ministry of Health Protection of Ukraine and Marzev Institute (Kiev)



Following the approval of the EIA by the State Environmental Expert Board and the subsequent attainment of permits, emission/discharge limits stated in the permits shall be recognized as being valid by the program for monitoring, evaluation and accounting. Once the permit expires, the operating entity shall reapply for permit issuance. The permit shall contain any revised figures and emission/discharge amounts, as established through monitoring and evaluation.

20.2.2 Normative legal acts of Ukraine

Resolutions of the Government of the Ukraine:

- National Action Plan “On the Environmental Protection of Ukraine for the period of 2011-2015” (dated 25.05.2011)
- The Concept of National Ecological Policy of Ukraine for the period up to 2020” (dated 17.10.2007 No. 880-p)
- Decree by the Council of Ministers of the Ukraine “On the List of the Types of Activities and Facilities of High Environmental Danger” (dated 27.07.95. No. 554)
- Decree by the Council of Ministers of the Ukraine “On the Procedure for Approving Investment Programs and Construction Projects and of Integrated State Expertise of the same” (dated 11.04.02. No. 483)
- Decree by the Council of Ministers of the Ukraine “On Approval of the Procedure for Holding of Public Hearings regarding the Issues of Use of Nuclear Energy and Radiation Safety” (dated 18.07.98. No. 1122)

Statutory Documents

- State Construction Norms of the Ukraine - DBN A.2.2-1-95. “Composition and Content of the Materials of Environmental Impact Assessment Study (EIA) at Design and Construction of Enterprises, Buildings and Constructions. Basic Design Provisions” (dated 01.07.95.)



- State Construction Norms of the Ukraine - DBN A.2.2-3-97. “Engineering. Composition, Procedure of Development, Review and Approval of the Engineering Documentation for Construction” (dated 01.01.98.)

Regulatory Documents:

- Instruction to Conduct a Project’s Experts Review by the State Environmental Expert Board (registered by the Ministry of Justice of Ukraine on 12.07.95. No. 214/750).

Recommendation Documents:

- “Recommendations for Organization and Performance of State Environmental Expert Board by the Bodies of the Ministry of Environment and Natural Resources of the Ukraine” (approved by the Ministry of Environment and Natural Resources of the Ukraine on 30.05.2000).
- “Recommendations for Registration of the Potential External Impact of the Proposed Business Activity” (approved by the Ministry of Environment and Natural Resources of the Ukraine on 10.08.2001.)

20.2.3 International Conventions

With regard to potential amendments and improvements of the legislation, Ukraine’s Ministry of Environmental Protection has recently drafted a law on the national environmental policy. This draft establishes the schedule of legislation monitoring in accordance with European statutory documents related to environmental protection in place of current Ukrainian legislation (typically old Soviet Environmental Legislation).

- 2008 - 2012: Development of a reliable national policy in the sphere of environmental protection;
- 2012 - 2017: Transition to European environmental standards;
- 2017 - 2020: Introduction of European standards.



Based on the open domain information, potential changes to the Ukrainian Environmental Legislation are being discussed. It has become apparent that, in case of new legal acts of the national environmental policy approval, more stringent emission/discharge limits will be adopted. The EIA process will also be revisited. It would be reasonable for Black Iron to undertake proactive steps to mitigate the risk of such change in Ukrainian legislation and follow more rigid International Environmental acts.

Shown below is a list of international conventions on environmental protection, to which Ukraine is a party. They may be applicable to the Shymanivske Project:

- The Ramsar Convention on Wetlands;
- Convention on the Conservation of Migratory Species;
- Bern Convention on the Conservation of European Wildlife and Natural Habitats;
- Espoo Convention: Convention on Environmental Impact Assessment in a Transboundary Context;
- United Nations Organization: Framework Convention on Climate Change and Kyoto Protocol;
- Convention on Biological Diversity;
- Aarhus Convention: Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters; and
- Water Convention: Convention on the Protection and Use of Transboundary Watercourses and International Lakes.



20.2.4 Guidelines on the Best Available Techniques and International Practices

It is proposed that large-scale development projects shall comply with the established international standards for social and environmental conditions. For the time being, there is no requirement set as to the Project conformity to the advanced industrial practice. In accordance with the principles of good-faith business activity, it is important to be aware of the risks associated, for example, with potential toughening of state laws/standards and consequences of international agreements, to which the Ukraine is a party. Operation in accordance with the international practice in the sphere of environmental protection will offer advantages to the owner/manager with regard to monitoring changes which may result from improvement of the Ukrainian environmental policy, increased integration with European standards and advanced international practice.

It is recommended to bring the Black Iron Project in conformity with certain International/European standards, as well as with the advanced production practice. This is also recommended in view of the probable future adoption of more stringent legislation.

The subchapters below contain only brief information on the international standards, which may apply to the development of the Shymanivske deposit.

20.2.5 World Bank Operational Manual

The World Bank Operational Manual (World Bank, 2005) describes the principles of activity of the World Bank, banking transactions, recommended norms, operational instructions and commentary corresponding to the standards of activity of the ICF.

The Operational Manual consists of two volumes. The first volume contains key targets of the bank development and tools required. The second volume contains requirements applicable to credit operations financed by the bank.



The following principles and advanced practice may be of interest for the Shymanivske Project.

- Principle 4.01 Environmental Assessment;
- Principle 4.04 Natural Habitat;
- Principle 7.50 Projects in International Waterways;
- Principle 4.12 Involuntary Resettlement;
- Principle 4.11 Natural Resources;
- Engaging Non-Governmental Organizations in Bank-Supported Activities GP 14.70;
- Principle 4.20 Gender Policy and Development.

20.2.6 Equator Principles

The Equator Principles (July 2006) are reference standards used by leading international banks and investors for control of the social and environmental aspects related to financing of projects under development. The banks will use such principles on an international scale, with respect to project financing in all industry sectors, including the mining industry.

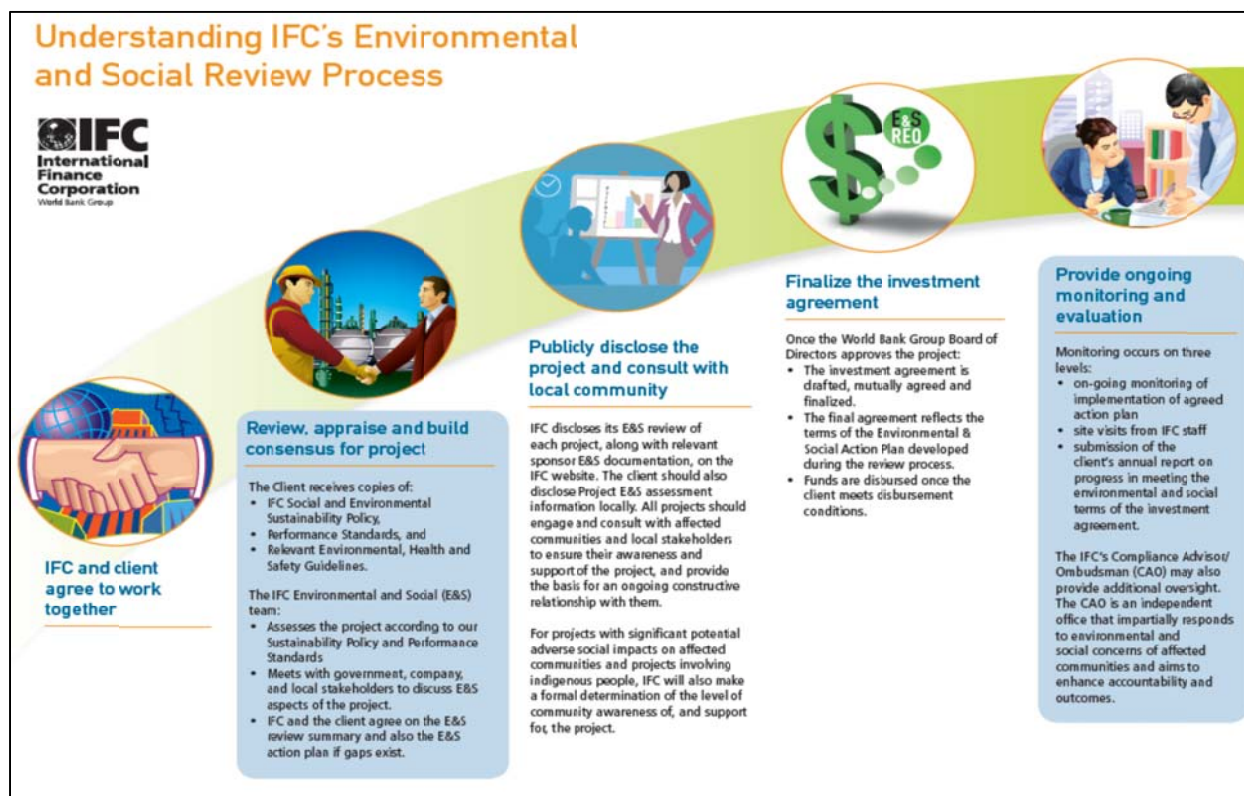
The Equator Principles correspond to the policy and guideline principles of the World Bank and of the IFC. It is mandatory to observe the Equator Principles for the IFC Clients, as well as for many other financial institutions. For the subjects, which are not dependent on financing by the institutions - followers of the Equator Principles, voluntary observance of such principles may be treated as positive business practice, which ensures conformity to the advanced standards of environmental management, planning and risk management.

20.2.7 Performance Standards of the International Finance Corporation

Equator Principles pertaining to social and environmental sustainability have been developed according to the Performance Standards of the IFC. Performance standards of the IFC determine the Clients role and responsibility in regards to the management of their projects and in regards to the requirements, observance of which is required for obtaining and retaining the IFC's support.

The IFC Performance Standards are listed below and explained in Figure 20.1:

- Performance Standard 1: Social and environmental assessment and management system;
- Performance Standard 2: Labor and working conditions;
- Performance Standard 3: Environmental pollution prevention and abatement;
- Performance Standard 4: Community health, safety and security;
- Performance Standard 5: Land acquisition and involuntary resettlement;
- Performance Standard 6: Biodiversity conservation and sustainable natural resource management;
- Performance Standard 7: Indigenous peoples;
- Performance Standard 8: Cultural heritage.



IFC PERFORMANCE STANDARDS ON SOCIAL AND ENVIRONMENTAL SUSTAINABILITY	
Performance Standard 1: SOCIAL AND ENVIRONMENTAL ASSESSMENT AND MANAGEMENT SYSTEM Underscores the importance of managing social and environmental performance throughout the life of a project.	Performance Standard 5: LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT Applies to physical or economic displacement resulting from land transactions such as expropriation or negotiated settlements
Performance Standard 2: LABOR AND WORKING CONDITIONS Recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection of basic rights for workers.	Performance Standard 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE NATURAL RESOURCE MANAGEMENT Promotes the protection of biodiversity and the sustainable management and use of natural resources
Performance Standard 3: POLLUTION PREVENTION AND ABATEMENT Recognizes that increased industrial activity and urbanization often generate higher levels of air, water and land pollution	Performance Standard 7: INDIGENOUS PEOPLES Aims to ensure that the development process fosters full respect for indigenous peoples
Performance Standard 4: COMMUNITY HEALTH, SAFETY AND SECURITY Recognizes that projects can bring benefits to communities, but can also increase potential exposure to risks and impacts from accidents, structural failures, and hazardous materials	Performance Standard 8: CULTURAL HERITAGE Aims to protect cultural heritage from adverse impacts of project activities and support its preservation
WHAT ARE THE BENEFITS OF THE PERFORMANCE STANDARDS	
GUARD AGAINST UNFORESEEN RISK Implementing the Performance Standards helps companies identify and guard against interruptions in project execution. Some potential disruptions include: • Strikes or protests • Costly environmental clean-ups • Loss of investor confidence due to unfavorable media attention	In addition, the standards help clients find ways to maximize local development benefits and encourage the practice of good corporate citizenship. This often results in greater acceptance of the project by local communities and governments, allowing companies to acquire social license to operate. Enhanced brand value and reputation may also be attractive to new investors. GAIN AN INTERNATIONAL STAMP OF APPROVAL The "Equator Principles" that have been adopted by more than 60 of the world's leading investment banks in developed and developing countries are based on IFC's Performance Standards. These principles are estimated to cover nearly 90% of project financing worldwide. Companies applying the Performance Standards meet or exceed these global benchmarks.
IMPROVE FINANCIAL AND OPERATIONAL PERFORMANCE IFC believes that meeting the Performance Standards helps clients improve their bottom line. Most directly, implementation of the standards can help optimize the management of inputs such as water and energy, leading to a more efficient and cost-effective operation and supply chain.	

Figure 20.1: Understanding IFC's Environmental and Social Review Process

20.2.8 Environmental, Health and Safety Guidelines for an Individual Sector of Industry

The World Bank task team published new versions of the Environmental, Health, and Safety Guidelines, which became effective on April 30, 2007. There are various sectoral guidelines, including those reserved for the mining industry. These guidelines may be used to formulate the tasks and targets related to various aspects of risk management and of the activities in the environmental, health and safety sphere.

20.2.9 Current International Initiatives

There are a number of existing international initiatives for the Mining Association, which shall be treated as positive practice in the production organization. It is quite likely that some of these initiatives may be beneficial for Black Iron Inc. and the development of the Shymanivske deposit. Such initiatives include the following:



- International Council for the Mining Industry and Metallurgy;
- Initiative of transparency in the mining industry.

20.3 Ukrainian Environmental Design Criteria

20.3.1 EIA Study

20.3.1.1 General Provision

Implementation of the EIA (or OVOS, Ukrainian equivalent) is mandatory in the projects which involve activities defined by the Laws of Ukraine "On Environmental Protection" (Article 51) and "On Ecological Expertise" (Articles 15, 36). Requirements for the composition and content of the EIA are defined by Ukrainian state building codes: DBN A.2.2-1-2003 and DBN A.2.2-3-2004.

The main objectives of the EIA are to identify the extent and impact intensity of the foreseen activities on the environment and the rationale for measures to limit or prevent the effects of the planned facilities on the environment.

20.3.1.2 Structure and Scope of EIA

The EIA should contain the following subsections:

- Basis of EIA;
- Physical and geographic peculiarities of the area and the area (track) construction of the facility design;
- General characteristics of the design object;
- Impact assessment of the proposed activity on the environment;
- Impact assessment of planned activities on the social environment;
- Impact assessment of the proposed activities on the surrounding anthropogenic environment;
- Comprehensive measures to ensure the environmental state prescribed by regulations, and its safety;



- Assessment of environmental impacts during construction;
- Statement of environmental impact.

20.3.1.3 Requirements for the EIA within the Scheme of Construction Investment Process

The bulk of the EIA work is usually carried out under the Feasibility Study and conceptual design phases and is to be adjusted in case of changes in the adopted solutions for the detailed design, in particular, in the event of changes in the process or changes of the capacity of the facility, and in case of an emergence of new startup complexes, etc. Zero changes in the Project's detailed design, upon comparing with the Feasibility Study or conceptual design shall be certified by the signatures of the Customer and the chief engineer of the Project.

At the detailed design phase, preparation of EIA materials in their entirety shall be performed only in cases where such materials have not been prepared at earlier stages.

20.3.1.4 Mine Closure Planning

In most jurisdictions, including Ukraine, the issuance of permits is conditional upon the submittal of a closure plan that conceptually describes how site facilities, including industrial sites, open pits, tailings storage facilities, and bulk material dumps will be decommissioned. The development of a closure plan early in the design process is useful in optimizing the life-cycle costs associated with these facilities. Specifically, such a plan facilitates the integration of closure methods into operational processes and can lead to a large portion of closure costs being amortized over the duration of mining operations as operating costs. Alternatively, and depending on the nature of operations, closure costs can be deferred to the final years of the mine life.

In the case of the Black Iron Project, the most efficient integration of closure concepts and ultimately of their costs, will be determined as the global project design progresses. However, other than the stockpiling of materials that may be useful for closure (topsoil, overburden, inert rock, etc.), no up-front capital costs directly attributable to closure are expected to be defrayed, as these costs should normally be incurred either as operation costs or as lump-sum expenditures at the end of the mine life (based on the recent projects in Ukraine, the lump-sum



cost associated with the mine closure is in the vicinity of 10% of the value of funds at the moment of the closure).

20.4 Black Iron's Environmental Management and Monitoring Program

Black Iron's Sustainable Development policy sets out the company's commitments and vision to develop mines which are in harmony with the local communities and environment, and which contribute to sustainable socio-economic development in the south-eastern region of Ukraine.

Black Iron is developing a sustainable plan which describes its intention to have an appropriate and relevant Safety, Health, Environment and Community (SHEC) system in place at each lifecycle of operations, from exploration and planning to development and ultimately, closure. Currently, the company is in the process of developing Safety, Occupational Health, Environment and Community management procedures to expand and put into practice the principles in its policy. Figure 20.2 illustrates the general structure of the SHEC system.

The purpose of a management system is to raise awareness of safety and environmental issues at all levels of the organization and to seek ways to continuously improve the management practices carried out to control, avoid, minimize and mitigate impacts of a project. Without such a system in place, there is a risk during project implementation, that basic safety and environmental practices may not be a priority and that issues may have to be handled retrospectively rather than in a more constructive (and generally cost-effective) proactive manner. An effective system also ensures that permit conditions, legislative requirements and company standards are complied with throughout the construction, operational and closure phases of the mine.

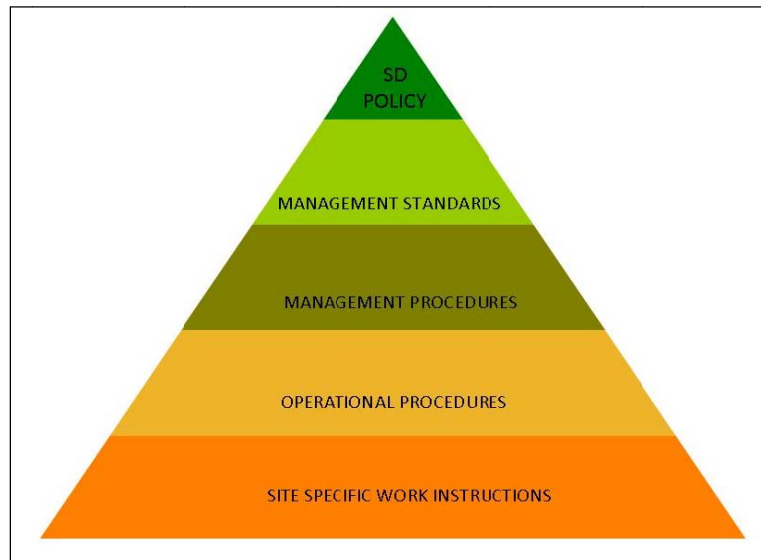


Figure 20.2: Black Iron's SHEC Systems Structure

Black Iron Inc. will have a set of corporate SHEC procedures, which set out the company's practices at a general level. A set of key SHEC performance indicators will be selected. A comprehensive monitoring and auditing plan will be implemented to follow and check changes in these indicators, to provide early warnings of deterioration, or to demonstrate compliance and/or improvement.

20.5 Black Iron's Mine Permit Process

In Ukraine, the Environmental Impact Assessment (or "OVOS" in local terms) involves:

- Baseline surveys;
- Impact assessment;
- Mitigation measures;
- Monitoring and control procedures;
- Public consultation.

Land use and ownership are covered in detail under the mining permit application process.



The EIA processes for power lines, public railways and public roads are the responsibility of the competent authorities or relevant companies.

20.6 Baseline Studies

The EIA require extensive baseline studies. This enables the impacts and effects of the Black Iron Project activities on the physical, natural and social environments to be assessed. In September 2011, Black Iron Inc., through their subsidiary in Ukraine, Shymanivske Steel Ltd, began the EIA process by engaging specialized companies in biophysical and socio-economic baseline surveys.

The baseline categories are based on the legal requirements guiding Environmental Impact Assessments in Ukraine and the European Union. An additional level of requirement is derived from what possible project financing organizations may require.

The objectives of the baseline studies are to ensure:

- That the environmental permitting works comply with relevant legislation;
- That sufficient data, prior to intervention, is available to enable all significant social, environmental and economic impacts of the proposed project to be defined and assessed;
- To identify key indicators specific to Kryviy Rih's social, environmental and economic context, for the proposed project to act as a basis for monitoring and control programs during the life of the project;
- The baseline studies must enable;
- All possible impacts of the proposed mine activities and supporting infrastructure to be determined;
- Appropriate negative impact mitigation strategies to be developed;



- Appropriate positive impact enhancement strategies to be developed.

20.6.1.1 Legislative Requirements for Baseline Studies

Table 20.2 lists the baseline category investigated by Black Iron and compares them with relevant EU and Ukrainian legislative requirements.

Table 20.2: Legal Baseline Requirements

EU EIA	Ukrainian EIA Law	Black Iron EIA Baseline Categories
Population	Community structure, housing, human health and safety, living conditions & amenity, industrial and commercial activity	Human beings
Flora and fauna	Vegetation and habitats. Organisms and biological diversity	Biodiversity
Water	Water; surface water, groundwater	Surface water Groundwater
Soil	Soil and bedrock	Soil Geology
Air Climate	Air and climate	Air and climate
Material assets and the cultural heritage	Community structure, townscape and land use planning, buildings, cultural heritage and archaeological heritage, usage of natural resources	Cultural heritage
The inter-relationship between the above factors	Interaction between the [above] factors	Captured during impact assessments

Additionally, the EIA has been designed to follow the World Bank Group's IFC Equator Principles.



Geographically, the area to be considered at a minimum covers Black Iron's Shymanivske Property, including:

- •Shymanivske mine site;
- •Processing plant with supporting infrastructure areas;
- •Stepnoye and Chervona Polyana area for tailings;
- •Transport routes connecting the mine site to Ukrainian Federal Railway "Ukrzaliznytsya";
- •Zeleny Hay and the area west of waste dumps;
- •The reclaimed waste dumps north of Shymanivske;
- •The reclaimed waste dumps south-east of Shymanivske Property;
- •Surrounding villages of Rakhmanovka and Rudnichnoye.

Table 20.3 lists the baseline categories included in Black Iron's plan for baseline assessment, the specific topics per category and a short description of the topics, together with the service providers who will be carrying out the works.



Table 20.3: Baseline Study Categories

Service Provider	Category	Specific Research Topic and Description
South-Eastern Scientific Centre of Academy of Science of Ukraine (Kharkov)	Human beings: socio-economic; households	Work environment, occupational health and safety
		Transnational history & language
		Demography, economy, education, crime
		Labour supply
		Gender
		Local trade & industry
		Infrastructure
		Governance
		Preferences in the population
		Indigenous people in the area
South-Eastern Scientific Centre of Academy of Science of Ukraine (Kharkov)	Biodiversity	Vegetation, habitats
		Fish stocks & fisheries
		Birds, owls, migratory bird species
		Vertebrates
		Invertebrates
		Surface water bodies, types, quality
OOO "Centre of Environmental Baseline Studies", Kryviy Rih ("Centr Ekologicheskikh Issledovaniy i Audita")	Surface water	Depth, types, quality, upper ground layers
	Soil	Groundwater bodies, quality
	Groundwater	Landscapes, landforms, remote sensing
Regional Meteorological Station ("Aviametrologicheskaya Stanciya", Kryviy Rih)	Landscape/geography	Air quality
		Meteorological
		Noise, dust, vibration
GidroMeteo Service (Kryviy Rih)	Air and climate	Metrological
		Baseline concentrations of pollutants covering nine ingredients applicable to the Black Iron Project
Municipal Department Heritage Protection (Kryviy Rih)	Cultural heritage	Archaeological sites, cultural heritage



20.6.1.2 Environmental Baseline Condition

The Project area is primarily an urbanized industrial area and includes farmlands. In the recent past, mining activities occurred at Kryviy Rih, resulting in these areas being significantly influenced by these activities. Examples of existing structures include open pits, waste rock heaps, tailings area, underground mining area and a railroad line.

The Black Iron Project site and all infrastructures in Ukraine are located in the water catchment area of the Ingulets River. Consequently, Black Iron's activities are not permitted to cause a reduction in the overall quality of water in the Ingulets River catchment area. There are strategies available which mitigate the risks related to water quality on Black Iron's Project area.

20.6.2 Impact Evaluation and Mitigation Measures

There are three principal impact receptors:

- The physical environment (water, landscape);
- People, via employment;
- People, via the local community.

20.6.2.1 Environment

The operations will lead to significant changes to the existing landscape. Pit lakes and new topographic highs from the waste rock and tailings storage facilities will remain once operations cease. These changes would not leave negative impacts, especially as the risk of oil and acid rock drainage and leachates of other materials will be mitigated through design of the facilities, and with appropriate closure methods.



20.6.2.2 Employment

Employment created by the Project will be full time, year round, and overall, highly skilled and technical. This will utilize and develop a pool of mining expertise in the region, which can benefit the mining sector in eastern and southern Ukraine.

The growth in employment will lead to an escalation in tax and municipal revenue, as well as increased demand of recreational, commercial and residential private sector services.

20.6.2.3 Local Community

Impacts on the local community begin during construction, when site preparation takes place and infrastructure, roads and transport corridors are built.

During operations, sustained activities such as heavy vehicle transport, blasting, excavation, transport and crushing of ore, deposition of waste rock and tailings leads to a consistent level of impact, including noise, dust, vibration and blast waves. These levels need to comply with Ukrainian guide values, environmental norms and standards. Impacts are based on intensity, frequency, duration and consequence of the activity. The possible impacts of the mining activities will be studied in detail during the EIA process. For Black Iron, such impacts can be mitigated or reduced to acceptable levels.

Following cessation of mining activities, most impacts cease and conditions will gradually return to the prior project circumstances. However, there will be residual impact in the form of a pit lake and topographic highs formed by the waste rock storage facility and tailings storage facility, and any transport infrastructure which may remain.

In summary, the benefits from the planned mining operations have been assessed as outweighing potential negative consequences on the health of people and on the environment. The change to the current topographic character of the landscape will be the most significant permanent impact of the operation.



20.6.2.4 The Area Surrounding the Project Site

The total area which the planned facilities will occupy will need to be determined in the next phase of the Project. The mining operations have a planned duration of 28 years, with closure taking about six months. It is estimated that the construction phase will last approximately two years. Table 20.4 summarizes the approximate land take and work phase duration of the key project infrastructure.

Table 20.4: Approximate Land Take and Work Phase Duration

	Black Iron Process Plant	Black Iron Open-Pit Mine	Waste Rock Dump	Black Iron Overburden and Waste Dump	Tailings Management Facility
Land Take (ha)	186	152	700	100	860
Construction (yrs)	2	1.5	To be determined	To be determined	n/a
Operation (yrs)	28	28	28	To be determined	28
Closure (months)	To be determined	To be determined	To be determined	To be determined	To be determined

An investigation was carried out by BBA and Yuzhgiproruda (Kharkov) to determine the best location from an environmental, social and economic point of view, for key infrastructure such as process plant, tailings, waste rock dumps, and roads, as well as administration and maintenance facilities.

Specific impacts are expected to be compensated to land owners through individual negotiation, in accordance with Ukrainian practices.

20.6.2.5 Socio-Economic Benefits

The planned operations will contribute an annual average of approximately 7.3 Mt of iron ore concentrate, contributing to satisfying society's requirements for iron and steel.



The following socio-economic benefits are expected to arise from the execution of the Project:

- New employment will be created directly at the mine (direct employment);
- New employment will be created in the local economy (indirect employment);
- Local economic activity will increase;
- Taxes and other revenue for the public sector will increase;
- Infrastructure such as roads and energy supply infrastructure will be improved;
- Municipal services such as education, health care and other public services will improve;
- The availability of goods, services and operations in the region will improve;
- Demographic and other social parameters will improve through the movement of workers and their families into the area.

The level of registered unemployment and number of candidate per job has risen significantly since 2008 and has hardly changed in the last several years. Employment created by the mine, both direct and indirect, will contribute to counteracting the overall downward trend, with full-time, well-paid, technical and highly skilled employment opportunities. Introducing best industry practices will provide a positive impact on local mining operations, as this will contribute in setting new benchmarks in health and safety operating procedures and overall efficiency.

It is expected that improved infrastructure and demand for social services will also result from the establishment of the mine, and, in turn, will lead to increased interest from regional and/or international investors. The establishment of the mine may result in an overall improvement in the population trend through employees and their families moving to the region.

20.7 Stakeholder Engagement Plan

20.7.1 Introduction

Good EIA practice requires active consultation with relevant regulatory bodies, experts, affected communities and other interested and affected parties. The aim is to inform them about the developing plans and give them an opportunity to express their views on the Project and its impacts, so that these can be taken into account in developing the Project proposals and in



assessing and mitigating impacts. Consultation is also invaluable in identifying useful information on the baseline situation and on vulnerable resources and receptors in the highly industrialized Kryviy Rih area.

During the current phase of work, consultations have been initiated with the local administration. Some external consultation has also been undertaken as part of the Ukrainian preliminary EIA/OVOS and site selection procedure in 2011.

A more detailed Stakeholder Engagement Plan (SEP) and Program of external engagement will be developed during the Feasibility Study phase for the full ESIA and Ukrainian OVOS. The SEP is a “living” document and should be updated throughout the phases of the Project, from design to construction, operations and closure. The SEP includes details on:

- Consultations with national and local government agencies with regulatory responsibilities relevant to the Black Iron Project or with responsibilities for protection of environmental and social interests (including labour) that may be affected by the Project;
- Consultations with representatives from local communities around the site, including representatives of any groups who may be particularly affected by or vulnerable to the impacts of the Project;
- Community events (e.g. meetings) in settlements near the Shymanivske site;
- Wide publicity and dissemination of information about the Project and the ESIA so that other interested parties can express an interest in being consulted and offer their views;
- Consultations with local, national and possibly international, non-governmental organisations, representing environmental and social interests that may be affected by the Project.

In accordance with international good practice, these consultations should continue throughout the ESIA studies. The aim should be to ensure that stakeholder concerns are identified and taken into account in the assessment and the development of mitigation measures.



Consultations should be undertaken in a manner that is suited to the cultural needs, amongst others, of each group and should be free and open to all.

20.7.2 Stakeholder Identification

The Black Iron Project Team has identified stakeholders who may be expected to have interests in the Project. This list should be updated and amended in the course of the Project development and implementation. Currently, the stakeholders are identified as:

- Local population;
- Federal authorities and supervisory agencies;
- Administrative authorities and supervisory agencies in the Dnepropetrovsk region;
- Authorities at Kryviy Rih city and local Shyrokye district level;
- Local, regional, national and international non-governmental organizations;
- Media and information agencies;
- Research institutions;
- Educational institutions and workforce recruiting agencies;
- Potential project investors;
- Potential customers interested in the Project's products; and
- Industrial companies, enterprises and organizations.

20.7.3 Overview of Stakeholder's Engagement Activities

20.7.3.1 Stakeholder Engagement and Consultation of Intent Stage (2007)

Public hearings on issues associated with the development of the Black Iron Shymanivske deposit are planned to be first held in the first quarter of 2012 in conformance with the Site Selection and Declaration of Intent procedures. The purpose of the hearings is to provide an opportunity for participants to become familiar with and comment on the preliminary version of the materials for the planned Environmental Impact Assessment of the planned activities.



All stakeholder feedback will be analyzed and the preliminary ESIA process and scope will be adapted to ensure that the assessment addresses all relevant concerns identified during the engagement process. Based on the feedback from similar projects, Black Iron is planning to establish an information center in January 2012 in the Town of Kryviy Rih to allow effective continuing stakeholder engagement and Project disclosure.

20.7.4 Plan for Future Stakeholder Engagement

20.7.4.1 General Recommendations

The SEP sets our recommendations for future engagement of the Black Iron Project with all its stakeholders with the following objectives:

- To establish a basis for constructive ongoing dialogue with all Project Stakeholders which will continue through Project planning and implementation;
- To ensure a regular flow of information about the Project and progress with the Pre-Feasibility, Feasibility/ESIA studies, reaches all stakeholders in a manner which is tailored to the needs of each group;
- To provide opportunities for stakeholders to give feedback to the Project regarding their views and concerns about the environmental and social impacts;
- To ensure all views are recorded in a stakeholder register and are passed to the appropriate members of the Project team for consideration, action and response, as deemed appropriate; and
- To enable the Project and potential Lenders to gauge the level of community support for the Project.



20.7.4.2 Information Disclosure

A range of different types of information should be made available during the Feasibility Study for the Project.

It is expected that during the stakeholder engagement process, Black Iron should use methods described in the Stakeholder Engagement Plan to disclose information about the Project and discuss potential risks and benefits, as well as potential mitigation measures, if necessary.

Notices about the public access to documents should be published in district media and on the Company's website. Notices should include the list of documents available for review and comments, as well as contact information of the Black Iron representatives.

20.7.4.3 Available Resources and Black Iron Organizational Structure

During the public consultations relating to the Pre-Feasibility and Feasibility Stages associated with completion of the ESIA, a team responsible for stakeholder engagement should be set up within Black Iron Inc., and together with Consultants, should keep records of comments, analyze them, monitor responses to the comments and record the replies by other divisions of the Company.

20.7.4.4 Reporting and Monitoring

All the activities conducted by the Black Iron Company as part of stakeholder engagement should be tracked by the public relations department of the Company in the "Stakeholder Engagement Register" with the relevant copies of the minutes of meetings or protocols in order to keep all the records and documentary evidence of consultations and engagement of stakeholders.

Based on the results of the engagement process and in the course of the Black Iron Project, the SEP should be amended accordingly, to address any new upcoming issues.



In order to help address stakeholder concerns and promote transparency, an independent expert organization should be involved on a regular basis in order to ensure that the consultation process is in line with the SEP and the requirements of the International Finance Corporation (IFC).

20.7.4.5 Grievance Mechanism

Notification of the public about the grievance mechanism is one of the components of the public engagement program. The grievance mechanism for the Black Iron Project should be developed early during the feasibility phase. The form proposed for recording grievances should be available in Russian and Ukrainian at Black Iron Inc. offices in Toronto, Shymanivske Steel Ltd offices in Kryviy Rih and Kiev, as well as in the administrations of the local communities (Shyrokye). A leaflet informing stakeholders as to how they can communicate Project-related issues and grievances should be developed by Black Iron. It should also set out the steps that will be taken by Black Iron to address grievances. All grievances should be recorded on the Grievance Form and be considered, appropriately addressed and responded to.



21. CAPITAL AND OPERATING COSTS

The Shymanivske Iron Ore Project scope covered in this Study is based on the construction of a greenfield facility having a nominal annual production capacity of 7.3 Mt of pellet feed (PF) concentrate on a dry basis. The Capital and Operating Cost Estimates related to the mine, concentrator and Shymanivske site infrastructure have been developed by BBA. Costs related to the railway, port facilities, environmental and Tailings Pond and site Closure Plan have been developed by another Black Iron Consultant. BBA consolidated the cost information received from all sources.

BBA also considered the option of producing 7.6 Mty of pellets at the Shymanivske site. The capital and operating costs of both options are presented below.

21.1 Capital and Operating Costs – Pellet Feed Concentrate, the Financial Analysis (FA) Base Case Scenario

Table 21.1 presents a summary of the total estimated initial capital cost for the Project, producing pellet feed concentrate only.

Table 21.1: Total Estimated Initial Capital Costs – Pellet Feed Concentrate Production Only (M\$), FA Base Case Scenario

Total Estimated Initial CAPEX Costs	
Mining Capitalized Pre-Stripping Costs	73.5
Other Pre-Production Capitalized Costs	13.6
Concentrator and Site Infrastructure	419.8
Environmental and Tailings Management	80.1
Rail Transportation System	11.4
Port Facilities	Nil
Indirect Costs & Land Acquisition	166.8
Contingency	130.6
Total	895.8



The total initial capital cost, including Indirect Costs and contingency was estimated to be in the order of **\$896M**. The mining costs include pre-stripping costs, which have been calculated from operating costs and capitalized (estimated at \$73.5M). This Capital Cost Estimate is expressed in constant October 2011 Canadian Dollars, with an exchange rate at par with the US Dollar and of 7.694 to the Ukraine Hryvnia.

The leased equipment (mining and railcars), with an estimated value of \$354.3M, was excluded from the capital costs and included in the operating costs. There are no rehabilitation and closure costs that are required to be disbursed prior to production start-up.

Table 21.2 presents a summary of total estimated operating costs presented in Canadian Dollars (CAD\$) per tonne of pellet feed concentrate produced. The total average operating costs over the first 20 years of operation (i.e. basis for discounted cash flow analysis), including annual costs for leasing of equipment over the life of the leases, are estimated at \$52.40 per tonne of concentrate. The average operating costs in the initial seven year equipment lease period are estimated at \$60.17 per tonne of concentrate, while the average operating costs following the initial equipment lease period are estimated at \$48.22 per tonne of concentrate.

Table 21.2: Total Estimated Average Operating Costs (\$/t pellet feed concentrate), FA Base Case Scenario

Total Estimated Average Operating Costs			
	Average Years (0-20)	Average Years (1-7)	Average Years (8-20)
Mining	24.05	31.38	20.10
Concentrator	15.44	15.44	15.44
Site Infrastructure	0.67	0.67	0.67
Sales & General Administration	1.49	1.49	1.49
Environmental and Tailings Management	0.13	0.13	0.13
Rail Transportation	5.42	5.85	5.18
Port Facility	5.20	5.20	5.20
Total	52.40	60.17	48.22



Ukraine Government Royalty payments of \$0.40/t ore mined are not included in the Operating Cost Estimate presented, but are treated separately in the economic analysis.

21.2 Capital and Operating Costs – Pellet Production

Table 21.3 presents a summary of the total estimated initial capital cost for the Project, assuming pellets would be produced at the Shymanivske site.

Table 21.3: Total Estimated Initial Capital Costs for Pellet Production (M\$)

Total Estimated Initial CAPEX Costs	
Mining Capitalized Pre-Stripping Costs	73.5
Other Pre-Production Capitalized Costs	14.6
Concentrator and Site Infrastructure	414.2
Pellet Plant	518.7
Environmental and Tailings Management	80.1
Rail Transportation System	12.0
Port Facilities	Nil
Indirect Costs & Land Acquisition	215.2
Contingency	243.0
Total	1,571.3

Table 21.4 presents a summary of the total estimated operating costs presented in Canadian Dollars (CAD\$) per tonne of pellets produced. The total average operating costs over 20 years, including annual costs for leasing of equipment over the life of the leases, are estimated at \$64.15 per tonne of pellets. The average operating costs in the initial seven year equipment lease period are estimated at \$71.66 per tonne of pellets, while the average operating costs following the initial equipment lease period are estimated at \$60.11 per tonne of pellets.

**Table 21.4: Total Estimated Average Operating Costs (\$/t pellet)**

Total Estimated Average Operating Costs			
	Average Years (0-20)	Average Years (1-7)	Average Years (8-20)
Mining	23.26	30.35	19.44
Concentrator	14.93	14.93	14.93
Pelletizing	13.15	13.15	13.15
Site Infrastructure	0.65	0.65	0.65
Sales & General Administration	1.45	1.45	1.45
Environmental and Tailings Management	0.13	0.13	0.13
Rail Transportation	5.39	5.81	5.17
Port Facility	5.20	5.20	5.20
Total	64.15	71.66	60.11

21.3 Basis of Estimate and Assumptions

The Capital Cost Estimate pertaining to the processing areas and Shymanivske site infrastructure within the BBA scope was prepared by a professional estimator in BBA's estimation team. The Capital costs for the mine were estimated by BBA's mining group. The Capital costs for the rail, port, Tailings Pond, site rehabilitation and closure costs were developed by another Black Iron consultant.

21.3.1 Type and Class of Estimate

The present Capital Cost Estimate pertaining to this Study meets Class 4 - Initial (FEL-1) estimate type criteria, which are usually prepared to establish a preliminary Capital Cost Forecast and assess the Project's profitability potential. This will allow management or the project sponsor to obtain authorization for funds for further project definition. As such, this estimate forms the initial "Control Estimate" against which subsequent Cost Estimates developed in the next study and engineering phases will be compared and monitored. The



accuracy range for the Capital Cost Estimate and the Operating Cost Estimate developed in this Study is -20%/+30%.

21.3.2 Dates, Currency and Exchange Rates

This Cost Estimate was calculated and presented in October 2011, Canadian Dollars (CAD\$). The exchange rate was assumed at \$1 CAD = \$1 USD = 7.694 UAH.

21.3.3 Labour Rates and Labour Productivity Factors

The hourly Crew Rates used in the present estimate were developed by BBA and were based on information from the Ukraine Compensation & Benefits Survey, conducted by Ernst and Young in 2010, and from the 2011 Global Construction Cost and Reference Yearbook. Crew Rates include direct and indirect components and were developed as “all-in” rates.

The direct rates include a mix of skilled, semi-skilled and unskilled labourers for each trade, as well as the fringe benefits on top of gross wages. The direct supervision by the Foremen and Surveyors is built in the Direct Costs. The Indirect Cost components consist of allowances for small tools, consumables, supervision by the General Foremen, Management Team, Contractors on site, temporary construction facilities, mobilisation / demobilisation, Contractor's overhead and profit.

The Construction Equipment rates were developed by BBA for each discipline, by speciality.

The Labour productivity factors have been developed for each discipline and applied as a productivity loss factor to the base man-hours developed for each discipline.

21.3.4 General Direct Capital Costs

This Capital Cost Estimate is based on the construction of a greenfield facility having a capacity to produce 7.3 Mt/y of pellet feed concentrate and for the pelletizing option, 7.6 Mt/y of pellets.



The design of the crusher, the crushed ore stockpile area and the concentrator has largely been based on BBA's reference projects. The general Arrangement drawings developed in this Study have been used to scale quantities estimated from factors derived from relevant BBA reference projects. The equipment costs have been estimated using recent Vendor prices for major process equipment, and labour rates have been estimated as described previously. The capital cost of the pellet plant was based on a recent Vendor budget estimate for a complete pellet plant, adjusted for Ukrainian construction labour rates. Related infrastructure has been estimated by BBA, based on the site plan developed for the Study.

BBA has developed this Capital Cost Estimate based on the following assumptions and estimation methodology:

- The mining equipment quantities and costs have been developed by BBA's mining group based on the mine plan developed in this Study. Equipment costs were estimated from BBA's recently updated database of Vendor pricing. In order to reduce initial mining equipment costs, it is assumed that Black Iron will lease to own all major equipment for the first seven years of operation.
- For this Study, it was assumed that the initial installation for servicing mining equipment will be limited to a sprung structure type building, whose cost was estimated by BBA, based on recent experience with similar installations. Sustaining capital includes the installation of an initial six-bay garage, a wash station and a tire shop.
- Pre-stripping costs incurred in the pre-production period have been capitalized. This Capital Cost Estimate is based on pre-stripping tonnage, as defined in the mine plan, and includes costs associated with the mining and hauling of overburden, waste rock and ore.
- The capital cost for the crusher and the crushed ore stockpile area was estimated based on BBA's reference projects, using estimated quantities and updated local Ukraine unit costs.
- The capital cost for the concentrator area was estimated based on BBA's reference projects, using estimated quantities for commodities (concrete, steel) and updated local Ukraine unit costs. Major process equipment was sized by BBA and budget prices were obtained from



Vendors or from the recently updated BBA database. In cases where equipment could be sourced locally in Ukraine, equipment prices were reduced by 25%.

- Other mechanical equipment, piping, electrical and automation quantities (and sizes if applicable) were taken directly from the BBA reference projects, grouped into distinct packages and factors were applied.
- The concentrate or pellet load-out silo and emergency stockpile were estimated based on BBA's reference projects.
- The Black Iron Project will draw its power from two existing 330 kV substations, owned by the Power Utility: the Gornaya substation, located 30 km east of the Project site, and the Quarzit substation, located 60 km north-west of the Project site. The power will be delivered to the Project site through two new 330 kV transmission lines, one from each substation for redundancy. However, the present Study includes only the cost for the feed from the Gornaya substation. The second power line will be built at a later date if required.
- It was assumed that the bearing capacity of the soil is in the order of 200 kPa and that no rock drilling or blasting will be required.
- It was assumed that all backfill materials will be available from local sources and suppliers.
- Unit costs for commodities such as concrete, structural steel, metal works and architectural finishes were obtained from the Client or other Black Iron Consultants.

21.3.5 Indirect Costs

Indirect Costs for areas under BBA's responsibility for Capital Cost Estimation were factored by BBA based on experience on other projects, as described below:

- Owner's costs are estimated as a percentage of total Direct Costs. For this Study, BBA used 5.5%. Owner's costs include items such as Owner's team salaries and expenses, insurance,



authorization certificates and permits, geotechnical and surveying costs, laboratory testwork, etc. Expropriation costs were estimated at \$25M.

- Engineering, Procurement and Construction Management (EPCM) services are estimated at 11.5% of Direct Costs.
- Construction, operation and maintenance were estimated at 2.25% of Direct Costs.
- Temporary construction facilities and utilities are capitalized and were estimated at 3.25% of Direct Costs.
- Cost of sub-consultants and other third parties was estimated at 0.5% of Direct Costs.
- Costs for pre-operational acceptance of mechanical equipment were estimated at 0.4% of Direct Costs.
- Costs for plant mobile equipment used during construction were estimated at 0.3% of Direct Costs.
- Costs for spare parts, freight, and Vendor's representative were estimated at 4% of Direct Costs.
- Costs for spare parts, freight and other such items were estimated at 9.25% of equipment value.

21.3.6 Contingency

Contingency provides an allowance to the Capital Cost Estimate for undeveloped details within the Scope of Work covered by the estimate. The contingency is not intended to take into account items such as labour disruptions, weather related impediments, changes in the scope of the Project from what is defined in the Study, nor does contingency take into account price escalation or currency fluctuations. A contingency of 20% of the sum of Direct and Indirect Costs has been attributed to the Capital Cost Estimate developed in this Study for areas estimated by BBA.



21.3.7 Exclusions

The following items are not included in this Capital Cost Estimate:

- Inflation and escalation, the estimate is in constant October 2011 Canadian Dollars
- Costs associated with protection against currency fluctuations
- All taxes, duties and levies
- Project financing costs



22. ECONOMIC ANALYSIS

The economic evaluation of the Shymanivske Iron Ore Project was performed using the discounted cash flow model. The Capital and Operating Cost Estimates based on the mine plan developed in this Study to produce 7.3 Mt of pellet feed (PF) concentrate annually were used as input to the model. A financial analysis was also performed for the option of producing 7.6 Mt of iron ore pellets annually assuming that a pelletizing facility is built at the mine site. The Internal Rate of Return (IRR) on total investment was calculated based on 100% equity financing. The Net Present Value (NPV), based on a discounting rate between 0% and 10% resulting from the net cash flow generated by the Project, was also calculated. The payback period is also indicated as a financial measure. A sensitivity analysis was also performed and presented. The following assumptions were made for the financial analysis:

- A construction period of two years;
- Notwithstanding that the life of the mine has been estimated to be in the order of 28 years, the financial analysis is presented for the first 20 years and includes sustaining capital disbursements for equipment that will be used beyond 20 years.
- A sales price of \$135/t of PF concentrate is used for the first two years of production and \$115/t of PF concentrate is used for production years three to 20 based on a final product grade of 67.0% Fe. This price was based on the following:
 - Long-term concentrate benchmark price of \$85/t forecasted by analysts and producers based on 62% Fe shipped from Brazil to China;
 - Iron content adjustment of \$5/t for each 1% Fe (i.e. \$25/t adjustment to account for the 67% iron product Shymanivske will produce);
 - Shipping advantage adjustment of \$5/t to account for the shorter distance between Ukraine and China vs. the benchmark Brazil to China;
 - Forecasted trends in shipping rates;



- Black Iron Market Study;
- Production startup in Q4-2015.
- A \$35/t premium for pellets above the PF concentrate price has been used;

Further key modelling assumptions include:

- All of the product is sold in the same year of production;
- No escalation or inflation factor has been taken into account (constant 2011 Dollar);
- The financial analysis is carried out on a pre-tax basis.

Table 22.1 and Table 22.2 present the undiscounted cash flow projection for the Project. BBA assumed that the initial capital cost disbursement takes place over a two year period prior to production startup. Production starts in Year 1.



Table 22.1: Project Undiscounted Cash Flow Table for PF Concentrate Sales

CASH-FLOW ANALYSIS (PELLET FEED CONCENTRATE SALES)																								
YEAR		PP-2	PP-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
REVENUE				987.7 \$	987.7 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	841.4 \$	17 120.3 \$
Total Opex Summary (M\$)				430.0 \$	438.1 \$	452.9 \$	451.4 \$	445.5 \$	432.3 \$	431.2 \$	382.5 \$	378.0 \$	364.6 \$	357.9 \$	345.9 \$	345.7 \$	345.8 \$	345.3 \$	344.6 \$	344.4 \$	344.2 \$	344.1 \$	343.4 \$	7 667.7 \$
Royalties (M\$)				9.6 \$	9.6 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.7 \$	9.7 \$	9.6 \$	9.6 \$	9.7 \$	9.6 \$	9.6 \$	9.6 \$	9.5 \$	9.7 \$	9.5 \$	191.5 \$
Mining Pre-Stripping Capex (M\$)		14.4 \$	59.2 \$																					73.5 \$
Other Pre-Production Capex (M\$)			13.6 \$																					13.6 \$
Mining Fleet Sustaining Capex				- \$	22.4 \$	0.1 \$	- \$	- \$	7.7 \$	12.4 \$	14.5 \$	48.1 \$	54.9 \$	64.7 \$	- \$	8.6 \$	6.5 \$	1.8 \$	- \$	5.9 \$	11.9 \$	70.6 \$	9.2 \$	339.3 \$
Site Facility Sustaining Capex				24.2 \$	45.9 \$	46.8 \$	28.0 \$	31.1 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	350.0 \$
Site Initial Capex Disbursement (M\$) (40/50/10)		323.5 \$	404.3 \$	80.9 \$																				808.7 \$
Working Capital				21.0 \$																				
Cashflow('000\$)		(337.8)	(477.1)	422.1	471.7	332.1	352.4	355.3	380.2	376.6	423.3	394.1	400.5	397.5	474.2	465.9	467.9	473.1	475.6	469.9	464.3	405.4	467.7	7 655.0 \$
Cumulative Cashflow('000\$)		(337.8)	(814.9)	(392.8)	78.9	411.1	763.5	1 118.8	1 499.0	1 875.7	2 299.0	2 693.1	3 093.6	3 491.2	3 965.4	4 431.3	4 899.2	5 372.2	5 847.8	6 317.7	6 781.9	7 187.3	7 655.0	

Table 22.2: Project Undiscounted Cash Flow Table for Pellet Sales

CASHFLOW ANALYSIS (PELLET SALES)																								
YEAR		PP-2	PP-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
REVENUE				1 286.1 \$	1 286.1 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	1 134.8 \$	22 997.9 \$
Total Opex Summary (M\$)				532.0 \$	540.1 \$	554.8 \$	553.4 \$	547.4 \$	534.2 \$	533.1 \$	484.4 \$	479.9 \$	466.5 \$	459.8 \$	447.8 \$	447.7 \$	447.7 \$	447.3 \$	446.6 \$	446.3 \$	446.1 \$	446.0 \$	445.3 \$	9 706.4 \$
Royalties (M\$)				9.6 \$	9.6 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.5 \$	9.7 \$	9.7 \$	9.6 \$	9.6 \$	9.7 \$	9.6 \$	9.6 \$	9.6 \$	9.5 \$	9.7 \$	9.5 \$	191.5 \$
Mining Pre-Stripping Capex (M\$)		14.4 \$	59.2 \$																					73.5 \$
Other Pre-Production Capex (M\$)			14.5 \$																					14.5 \$
Mining Fleet Sustaining Capex				- \$	22.4 \$	0.1 \$	- \$	- \$	7.7 \$	12.4 \$	14.5 \$	48.1 \$	54.9 \$	64.7 \$	- \$	8.6 \$	6.5 \$	1.8 \$	- \$	5.9 \$	11.9 \$	70.6 \$	9.2 \$	339.3 \$
Site Facility Sustaining Capex				24.2 \$	45.9 \$	46.8 \$	28.0 \$	31.1 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	11.6 \$	350.0 \$
Site Initial Capex Disbursement (M\$) (40/50/10)		593.3 \$	741.6 \$	148.3 \$																				1 483.2 \$
Working Capital				25.2 \$																				
Cashflow('000\$)		(607.7)	(815.3)	546.9	668.2	523.6	543.8	546.8	571.7	568.1	614.8	585.6	592.0	589.0	665.7	657.4	659.3	664.5	667.0	661.3	655.7	596.9	659.1	10 814.2 \$
Cumulative Cashflow('000\$)		(607.7)	(1 423.0)	(876.1)	(207.9)	315.6	859.5	1 406.3	1 978.0	2 546.0	3 160.8	3 746.4	4 338.4	4 927.3	5 593.0	6 250.4	6 909.7	7 574.2	8 241.2	8 902.6	9 558.3	10 155.1	10 814.2	



A discount rate is applied to the cash flow to arrive at a NPV and payback period. The NPV calculation was done at 0%, 5%, 8% and 10%. The Base Case NPV was assumed at a discount rate of 8%. Table 22.3 and Table 22.4 present the results of the financial analysis for the Project based on the assumptions and cash flow projections previously presented, respectively for PF concentrate sales and pellet sales.

Table 22.3: Financial Analysis Results for PF Concentrate Sales

PF Concentrate Sales		
IRR	42.1%	
	NPV	Payback
0%	\$7 655 M	1.8 yrs
5%	\$4 144 M	2 yrs
8%	\$2 966 M	2.2 yrs
10%	\$2 400 M	2.3 yrs

Table 22.4: Financial Analysis Results for Pellet Sales

Pellet Sales		
IRR	35.2%	
	NPV	Payback
0%	\$10 814 M	2.4 yrs
5%	\$5 768 M	2.7 yrs
8%	\$4 070 M	2.9 yrs
10%	\$3 253 M	3.1 yrs

As can be seen, for the PF concentrate sales scenario, the Project is forecasted to provide an IRR of 42.1% (before tax) and an NPV of \$2,966 M using an 8% discount rate. The payback period is 2.2 years after the start of production. For the pellet sales scenario, the Project is forecasted to provide an IRR of 35.2% (before tax) and the NPV is \$4,070 M using an 8% discount rate. The payback period is 2.9 years after the start of production.

Preliminary Economic Assessments are preliminary in nature and include Inferred Mineral Resources that are considered too speculative geologically to have economic considerations



applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that the Preliminary Economic Assessment will be realized.

22.1 Sensitivity Analysis

A sensitivity analysis was done on parameters that are deemed to have the biggest impact on project financial performance. The following sensitivity analysis was performed and results are presented in Table 22.5 and Figure 22.1 for the case of PF concentrate sales, and in Table 22.6 and Figure 22.2 for the case of pellet sales.

- Base Case initial CAPEX estimate +/- 30%;
- Base Case Commodity Selling Price +/- 30%;
- Base Case OPEX estimate +/- 30%.

As is indicated, the NPV at an 8% discount rate is most sensitive to commodity selling price followed by operating costs and then initial capital cost.



Table 22.5: Sensitivity Analysis Table for PF Concentrate Sales

PF Concentrate Sales			Sensitivities											
			INITIAL CAPEX				SELLING PRICE				OPEX			
			+30%		-30%		+30%		-30%		+30%		-30%	
IRR	42.1%		32.8%		58.7%		66.4%		15.4%		29.7%		53.8%	
	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback
0%	\$7 655 M	1.8 yrs	\$7 386 M	2.6 yrs	\$7 923 M	1.3 yrs	\$12 791 M	1.1 yrs	\$2 519 M	6.8 yrs	\$5 355 M	2.9 yrs	\$9 955 M	1.4 yrs
5%	\$4 144 M	2 yrs	\$3 884 M	3 yrs	\$4 404 M	1.4 yrs	\$7 217 M	1.2 yrs	\$1 070 M	8.2 yrs	\$2 739 M	3.4 yrs	\$5 549 M	1.6 yrs
8%	\$2 966 M	2.2 yrs	\$2 712 M	3.2 yrs	\$3 221 M	1.4 yrs	\$5 533 M	1.3 yrs	\$599 M	9.8 yrs	\$1 873 M	3.8 yrs	\$4 059 M	1.6 yrs
10%	\$2 400 M	2.3 yrs	\$2 149 M	3.4 yrs	\$2 652 M	1.5 yrs	\$4 423 M	1.3 yrs	\$377 M	11.2 yrs	\$1 461 M	4 yrs	\$3 340 M	1.7 yrs
Please note that this financial analysis is before tax.														

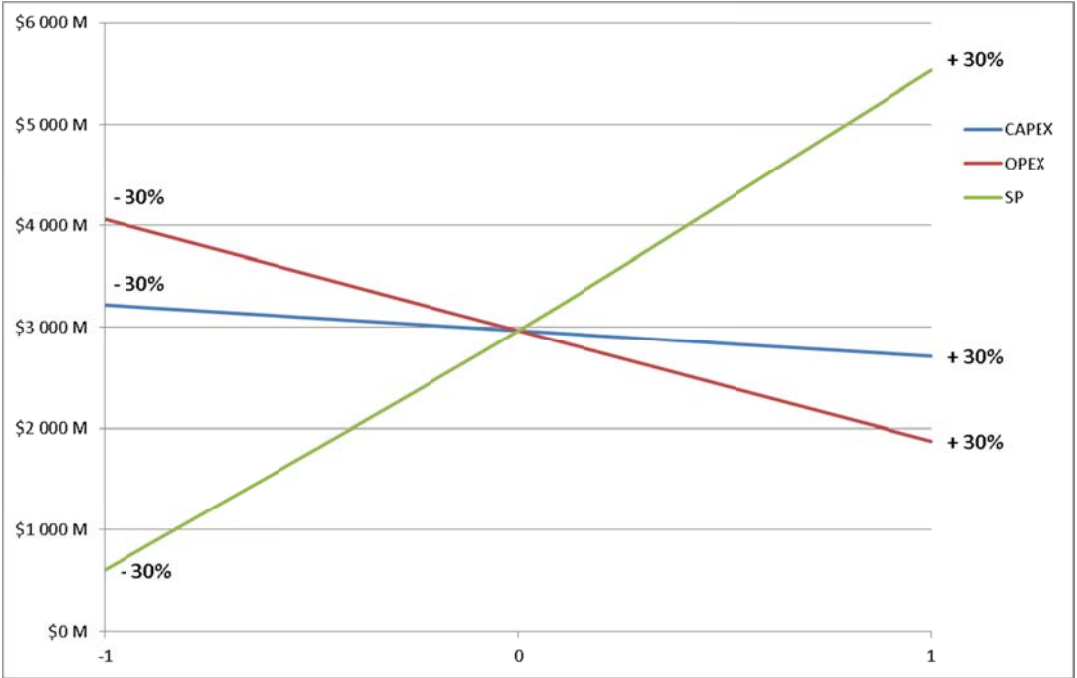


Figure 22.1: Sensitivity Analysis Graph for PF Concentrate Sales



Table 22.6: Sensitivity Analysis Table for Pellet Sales

Pellet Sales			Sensitivities											
			INITIAL CAPEX				SELLING PRICE				OPEX			
			+30%		-30%		+30%		-30%		+30%		-30%	
IRR	35.2%		27.4%		49.0%		53.8%		14.6%		26.4%		43.6%	
	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback	NPV	Payback
0%	\$10814M	2.4yrs	\$10343M	3.3yrs	\$11286M	1.6yrs	\$17714M	1.5yrs	\$3915M	6.7yrs	\$7092M	3.5yrs	\$13726M	1.9yrs
5%	\$5768M	2.7yrs	\$5312M	3.8yrs	\$6224M	1.7yrs	\$9989M	1.6yrs	\$1647M	8.2yrs	\$4000M	4yrs	\$7536M	2yrs
8%	\$4070M	2.9yrs	\$3623M	4.2yrs	\$4517M	1.8yrs	\$7240M	1.7yrs	\$901M	9.8yrs	\$2699M	4.5yrs	\$5441M	2.2yrs
10%	\$3253M	3.1yrs	\$2812M	4.5yrs	\$3695M	1.9yrs	\$5960M	1.7yrs	\$547M	11.3yrs	\$2077M	4.8yrs	\$4429M	2.3yrs
Please note that this financial analysis is before tax.														

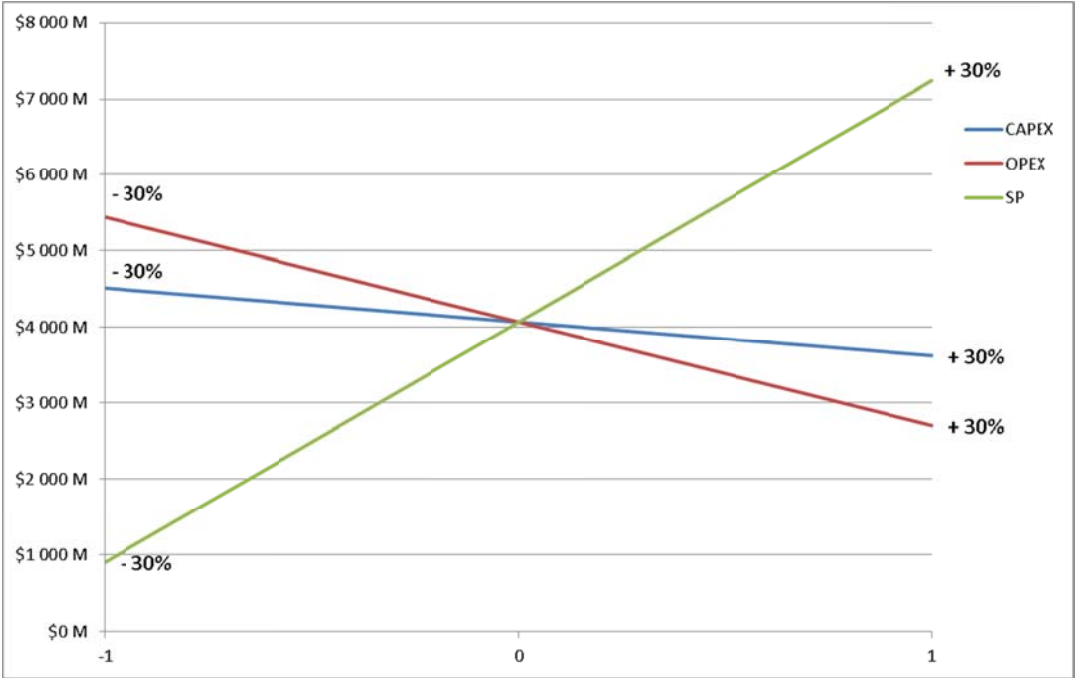


Figure 22.2: Sensitivity Analysis Graph for Pellet Sales



22.2 Risk Management

22.2.1 Scope

BBA's approach to Risk Management in the context of this Study is to identify major risks associated with this Project in terms of the following categories:

- Risk related to meeting the targeted project schedule;
- Risk affecting CAPEX;
- Risk affecting OPEX;
- Risk affecting product quality with potential repercussions on product marketability;
- Risks related to resource valuation;
- Risks related to project financing.

Risk Management is a continuous process that is performed over the full life-cycle of a project, therefore, Risk Management is only complete when the Project is complete. Consequently, the data and information presented in this Report is a snapshot of the project risk profile as understood on the effective date of this Report. It will be noted that because of the continuous nature of the Risk Management process, many open risk issues exist at this time. A review of the Risk Register will show that not all risks have been fully evaluated nor are they accompanied by well-defined mitigation plans or actions since these are to be updated regularly.

22.2.2 Risk Assessment Methodology

Risk identification is the process of examining the various project areas and each critical process in order to identify and document any associated potential risks. A preliminary Risk Register was compiled by BBA during the early phases of this Preliminary Economic Assessment. Risk review meetings were held during the course of this Study. As new risks were identified by the various parties contributing to this Study, they were submitted to BBA and added to the Risk Register.



For this Study, risk assessment was conducted on a qualitative basis. The Probability of Occurrence was assessed and qualified on three levels. The Manageability of the risk, which indicates how effectively the risk may be mitigated, was also qualified on three levels. These are indicated in Table 22.7. The consequence associated with the risk was qualified in the Risk Register but only as a description.

Table 22.7: Classification of Occurrence and Manageability

Label	Probability	Manageability
High	Likely to Occur	Direct control with a clear solution
Medium	May Occur	No control with a solution or Some control with no clear solution
Low	Unlikely to Occur	No control and no clear solution

From this table, it is understood that a risk with a High Probable Consequence and a Low Manageability should receive a high priority for mitigation activities and resources.

Table 22.8 presents a summary of the risk items identified, the risk category for each risk item and their probability of occurring. The detailed Risk Register for the Project is presented in Appendix H.

Table 22.8: Risk Register

Risk Register Black Iron Project							
N°	Risk Item	Risk Category					
		Schedule	CAPEX	OPEX	Market	Valuation	Financing
1	Environmental Permitting	Med					
2	Land Requirements	Med	Med				
3	Electric Power	Low	Med				
4	Railway Transportation	Med	Low				
5	Port Facilities	Med	Low				
6	Procurement of Long Lead Equipment	Med					
7	Construction	High					
8	Process			Med	Low		
9	Geology, Database and Assays					Med	
10	Geotechnical / Hydrogeology					Med	
11	Resource Valuation	High		High		Med	
12	Project Financing						Med
13	Government Administration	Med					
14	Competing Mines	High					
15	Expropriation	Low	Low				



The potential risks to the Project:

- Environmental Permitting and Land Requirements:
 - RISK: Delays in the process to obtain municipal and regional environmental permits;
 - MITIGATION: Black Iron should immediately begin discussions with Ukrainian authorities and start the process of obtaining environmental land acquisition permits and other local and federal authorizations and approvals.
- Land Requirements:
 - RISK: Inability to acquire additional land required for the Project;
 - MITIGATION: Continue to engage with land owners to acquire properties required using the local experienced service provider and law firm.
- Electric Power:
 - RISK: Local grid inability to support project power requirements;
 - MITIGATION: Start early negotiation with government and private Suppliers, establish grid accessibility and establish power requirements and benchmark against existing projects.
- Railway Transportation:
 - RISK: Insufficient capacity in rail network to support project requirements;
 - MITIGATION: Firm contract with Government who owns the railway to secure sufficient capacity as required for Black Iron's needs and purchase of rail cars.



- Port Facilities:
 - RISK: Insufficient capacity in existing ports to accommodate project requirements leading to delays and additional CAPEX;
 - MITIGATION: Black Iron should continue to progress discussions to seek a long-term agreement directly with the preferred port authority.
- Procurement of Long Lead Equipment:
 - RISK: Delays in delivery of long lead equipment;
 - MITIGATION: Identify long lead equipment early; further refine which equipment can be supplied locally and use letters of intent to secure manufacturing spots for critical equipment with long lead times.
- Construction:
 - RISK: Lack of local construction materials and low construction productivity;
 - MITIGATION: Employ and engage front-end execution planning using reputable and experienced Contractors for the plant construction and finalize construction strategy early in the Feasibility Study (FS).
- Process:
 - RISK: Inability to meet sellable product specification, low recovery rates, testwork producing unrepresentative data and high levels of deleterious materials in final product;
 - MITIGATION: Conduct further Davis Tube test on selected drill core intervals and consider running a pilot scale plant to develop reliable weight, iron and magnetite recovery relationships, grindability testing, variability testing, pilot scale testing for engineering design data, filtration and thickening tests, rheology tests and water treatment tests.



- Geology, Database and Assays:
 - RISK: Incorrect interpretation of mineralized domains or units, incorrect grade interpolation within defined mineralization domains and possible inaccurate past and future assays. Incorrect geological interpretation and block modelling;
 - MITIGATION: Drill additional holes to verify interpretations, reperform and validate grade interpolation techniques and conduct the second half core sampling and re-assaying program. Update existing geological block model.
- Geotechnical / Hydrogeology:
 - RISK: Poor ground conditions may impact pit size and stripping as the actual pit slope characteristics may vary;
 - MITIGATION: For rock mass definition and selection of design criteria, geotechnical and hydrogeological drilling, testing and analysis should be conducted.
- Resource Valuation
 - RISK: Higher percentage of Measured Resources; future infill drilling and metallurgical testing may not validate current 3-D model; pit size sensitivity to optimization parameters; proximity to waste piles, adjacent properties and existing infrastructure may limit pit expansion;
 - MITIGATION: Additional exploratory drilling should be conducted going forward, and wherever possible, the drillholes should pass through the entire mineralized zone. Down-dip drilling should also be kept at a minimum such that the targeted exploration program will support improved resource classification; however, resource reporting should be limited and aligned with pit design.



- Project Financing
 - RISK: Initial investment higher than expected;
 - MITIGATION: Black Iron should undertake a more detailed and focused construction market study. A local Consultant should be used to obtain local materials, labour quotes and trends for the area.
- Government Administration
 - RISK: Delays in obtaining government approvals for various permits and authorization;
 - MITIGATION: Follow legal procedure, create a dedicated government relations team to manage the process early and select a credible/reputable service provider.
- Competing Mines
 - RISK: Limited site access caused by interface with neighbours;
 - MITIGATION: Start negotiation early in the process.
- Resettlement of Communities
 - RISK: Legal issues, local politics and resistance with regards to resettlement of the communities within 2 km adjacent to the open-pit mine could result in delays and extra cost;
 - MITIGATION: Obtain an understanding of the legal process, prepare a detailed road map and create a dedicated team to address issues.



23. ADJACENT PROPERTIES

The Shymanivske, Kryviy Rih, iron ore deposit is part of the major regional iron ore formation of KrivBass, represented by linear north-south trending metamorphosed sedimentary rocks hosting siliceous banded iron formation (BIF) over a length of 300 km.

The Shymanivske deposit is located at the central part of the iron ore district, situated in a valley surrounded by operating mines. Presently, there are seven operating mines in the district including the adjacent ArcelorMittal and YUGOK iron ore operations.

The KrivBass iron ore district includes the following existing mines:

- North section: two operating mines producing 15 Mt/y of ROM;
- Central section: four operating mines producing 58 Mt/y of ROM;
- South section: one operating mine producing 15 Mt/y of ROM.

The previous information was taken from Ukrainian public statistics and was not verified by the author. Furthermore, they cannot be taken as indicative of the mineralisation on the subject property.



24. OTHER RELEVANT DATA AND INFORMATION

24.1 Project Implementation and Execution Plan

Upon completion of this Preliminary Economic Assessment, the Project will immediately proceed with the Feasibility Study (FS) phase. Black Iron is preparing a Memorandum of Understanding (MOU) between Shymanivske Steel, the military, and the local municipality, to formally commence the process of acquiring neighbouring land belonging to the Ukrainian state. Black Iron does not currently have the necessary surface rights to conduct mining activities on the Shymanivske Project; however, a mining allotment for the Shymanivske Project will be obtained post-completion of the FS, as many of the inputs required to obtain the mining permit are generated during the FS, slated to kick-off in early 2012.

The preliminary project execution schedule, developed in this Study and described herein, covers the period from the start of the FS right to the end of commissioning. The major driving key milestones in the preliminary project execution schedule are as follows:

- Receive the construction and environmental permits prior to the completion of the FS;
- Continue with land acquisition to secure land for the Project;
- Secure long term approvals with government on final product rail transport and ability to export ship;
- Continue with the in-fill and definition drilling to support the block model resource classifications and interpretations.

An analysis of the construction schedule developed for the Project, considering only the Shymanivske site construction and excluding the railway and port facility, allowed for the development of a preliminary manpower curve, for the Financial Analysis (FA) base case scenario as shown in Figure 24.1. Figure 24.2 presents the simplified project execution schedule.

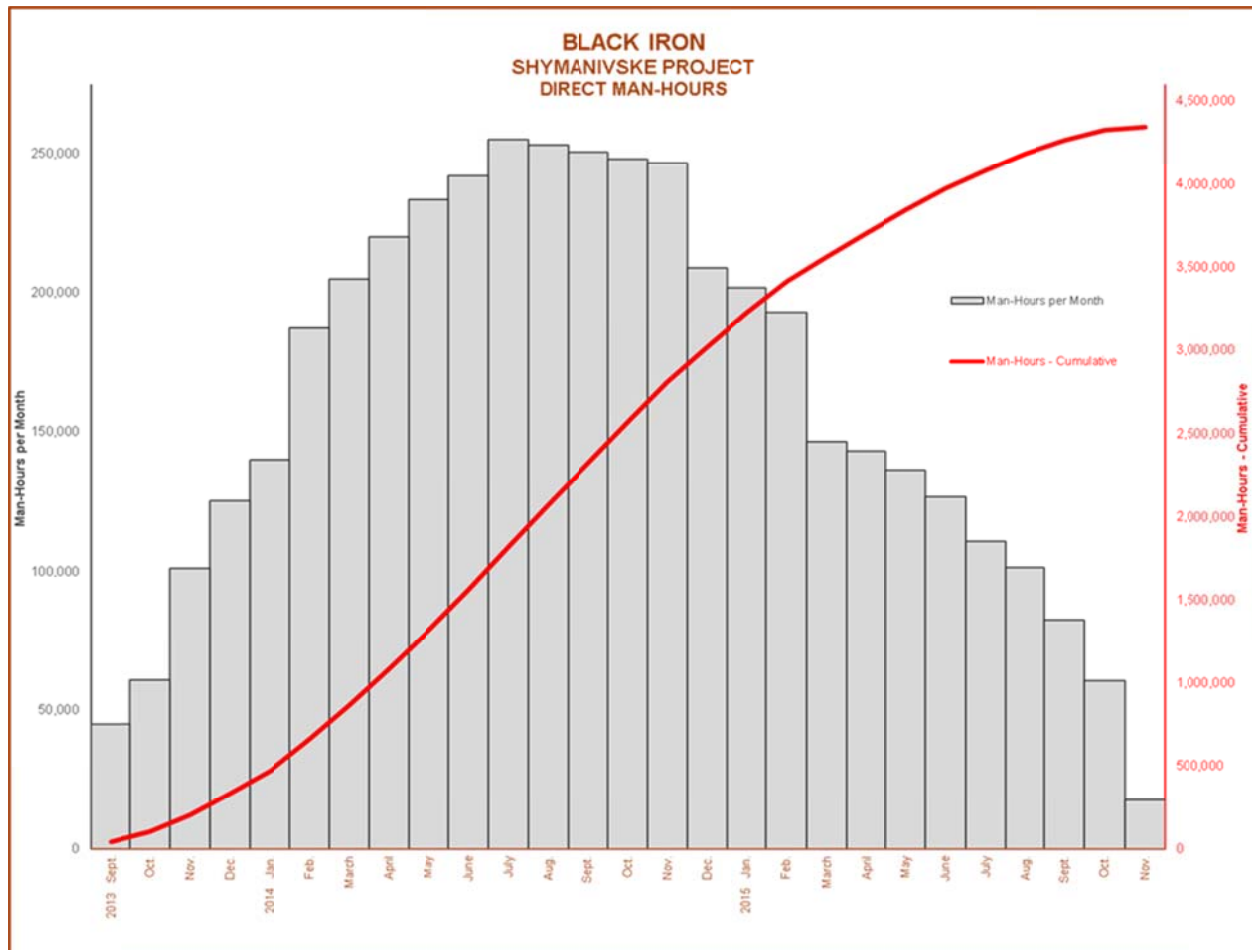


Figure 24.1: Preliminary Construction Manpower Curve for the FA Base Case Scenario

BLACK IRON - SHYMANIVSKE PROJECT - PROPOSED SCHEDULE

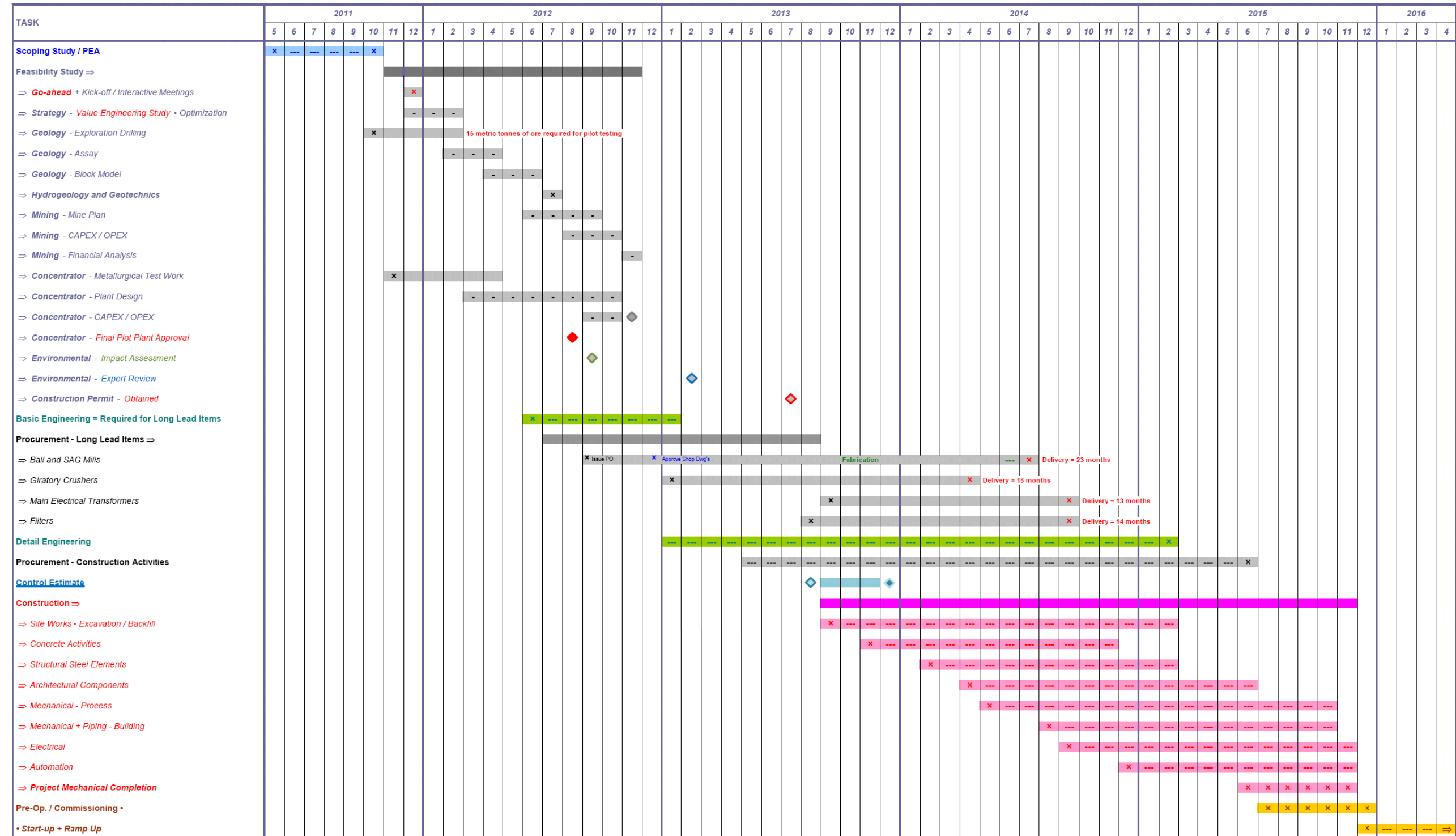


Figure 24.2: Simplified Project Execution Schedule for the FA Base Case Scenario



25. INTERPRETATION AND CONCLUSION

25.1 Mineral Resources

The most recent Resource Estimate for the Shymanivske deposit was conducted by GENIVAR and documented in an NI 43-101 Compliant Report dated January 30, 2011 that has been filed on Sedar. For the PEA Study, the resource block model for the Shymanivske deposit was updated by Farshid Ghazanfari, P.Geo., Chief Geologist of Black Iron, and reviewed and verified by Hugues de Corta, P.Geo., as an independent Qualified Person who has no relationship with Black Iron other than producing this Report. The mineral resources disclosed regarding the Shymanivske Project have been prepared using only historical technical data. The accuracy and validation of historical data was verified and is explained in detail in Section 12 of this Report by WGM. The following interpretations and conclusions were drawn by Hugues de Corta (referred to as an author) based on results reported in the aforementioned Report.

- Mineralization on the Property comprises meta-taconite, similar to deposits of the Labrador Trough in the Canadian Shield. The mineralized units are folded and faulted and dip gently to the north-east.
- The Shymanivske deposit, located in the Kryviy Rih area of Ukraine is part of an iron formation belt (KrivBass Belt) which hosts several iron ore deposits and active mining operations. It covers an area 2 km long by 1.2 km wide. It has been explored since the middle of the twentieth century by geophysical methods, drilling and metallurgical testing. It consist of four mineralized units, three of which (sx1f, sx2f and sx4f) are magnetite-quartzite and the other one (sx5f), magnetite-martite. The present Resource Estimate was done using the 2005 compiled database based on historical drilling. This database has already been used in previous estimates.
- The results for all three unoxidized horizons (sx1f, sx2f and sx4f) are listed in Table 25.1.

**Table 25.1: Mineral Resource Estimate* for Shymanivske Iron Ore Deposit (Cut-off Of 15% Fe_{tot})**

Category	Tonnes (Million)	Fe _{tot}	Fe _{mag}
Measured	306.3	31.3	18.9
Indicated	66.4	31.9	20.3
Inferred	480.3	30.2	17.4

*Tonnage and grade numbers rounded to first decimals

- A COG of 15% Fe_{tot} was determined to be appropriate at this stage of the Project and was chosen based on a preliminary review of the parameters that would likely determine the economic viability of a large open-pit operation, and compares well to similar projects and to projects that are currently at a more advanced stage of study.
- The total Inferred Resource tonnage for the oxidized horizon (sx5f) was calculated at 111.5 Mt at 33% Fe_{tot} and 4.3% Fe_{mag} in a previous estimate by author Hughes de Corta in 2011, but is not shown in the current estimate. It is possible that this material will come back into the resource categories once the metallurgical testwork is repeated, using modern techniques.
- Black Iron recently completed a Twin Drillhole Program and initiated the second phase of the 22,000 m exploration/infill drilling program on the Shymanivske Property. The density of drilling is uneven as it is more concentrated in the middle of the deposit and in the upper levels. The part of the deposit located between sections two and six (Figure 6.1) is well covered and can be allocated to Measured and Indicated Resources, while the extremities and lower levels would need more defining to be transferred from Inferred to Indicated Resources. A more defined pattern of drilling should be used going forward and wherever possible, the drillholes should be drilled to pass through the entire mineralized zone.
- The Shymanivske deposit has undergone various degrees of folding and faulting. The search ellipse sizes and orientations for the grade interpolation need to be adjusted based on new drilling and model interpretation.
- Although mineralized domain and resources stretch up to the 550 m level (about 620 m below surface), it doesn't mean that all Inferred Resources at a greater depth can be



economically extractable or can be upgraded to Mineral Reserves. Mineral Resources are not Mineral Reserves and their economic viability has not been demonstrated with certainty by this Study.

- Although the author cannot verify the quality assurance and quality control processes and methods used in compiling the historical technical data, the author believes that the historical technical data is relevant to the overall potential of the Shymanivske Project and in establishing updated Mineral Resources. Further engineering and economic studies are required to support the current conclusions.

The block model for the Shymanivske deposit, prepared under supervision of Hugues de Corta, P.Geo., as an independent Qualified Person, was used to provide the calculation of in-pit resources to BBA, as indicated in Table 25.2. The mining operations will be based on conventional open pit, drill and blast, load and haul methods.

A Preliminary Economic Assessment is preliminary in nature and includes Inferred Mineral Resources that are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that the Preliminary Economic Assessment will be realized.



Table 25.2: Black Iron In-Pit Resource Results

Black Iron – Engineered Pit Design Total Resource Estimate - (COG 15% Fe _{tot} %)				
Category	Tonnage (kt)	% Fe _{tot}	Wt.Rec%	Fe Con. (kt)
Measured	297,121	31.41	30.01	89 175
Indicated	64,788	31.92	31.66	20 515
Inferred	319,549	31.50	28.76	91 918
Total	681,458	31.30	29.58	201 608
Waste (kt)				
Rock	1,272,480			
OB	94,062			
		Total S/R		
Total Stripping	1,366, 541	2.01		

The additional challenges in limiting pit expansion are related to ground conditions, removal of the existing waste dumps, close proximity to rail and power line and presence of nearby small village.

25.2 Metallurgy and Ore Processing

The Shymanivske deposit is characterized by three distinct mineralization zones, which are relatively uniform with magnetite predominating. Based on historic data and twin hole drillings, no significant concentration of impurity elements were found. The Process Flowsheet, based on testwork results, contains crushing, grinding, screening, magnetic separation circuit and regrinding. The finishing concentrate is filtered prior to being sent to the pellet plant. The main pellet plant product will be an acid pellet at a grade of 65% Fe.

It is recommended that additional grindability testing be carried out during the Feasibility Study to better assess equipment sizing, power requirements and grinding circuit configuration. The additional tests would include (but are not limited to):



- Drop-Weight Tests (DWT) – minimum of three tests;
- SMC Tests – minimum of 12 tests;
- Bond Low Energy Impact Test for crusher sizing;
- Bond Rod Mill Grindability Tests – minimum of 12 tests;
- Bond Ball Mill Grindability Test – minimum of 12 tests;
- Abrasion Tests.

A trade-off study may also be required to evaluate the use of larger SAG mills with wrap-around motors versus smaller SAG mills with pre-crushing and pebble crushing.

25.3 Environmental Permitting and Land Acquisition

The process of environmental permitting is relatively well understood and a preliminary schedule outlining the critical steps has been developed in this Study and has been integrated into the preliminary project execution schedule. Figure 24.2 of Section 24 shows the latest project execution schedule.

Based on current information and the Ukrainian environmental regulations regarding the development of new projects; up-front costs for environmental activities were deemed unnecessary and these costs are not included in CAPEX estimates for the PEA Report.

25.4 Land Acquisition and Expropriation

The process of land acquisition and social impact of expropriation is relatively well understood and is an ongoing process. In the PEA Report, the costs of land acquisition and the resettlement of communities are included in the Owner's Indirect costs. Land acquisition is a key project milestone and no construction activities can commence until the required permits and authorizations are obtained.



25.5 Rail and Port

The initial assessment of the existing rail network and preferred port facility infrastructure suggests that sufficient capacity currently exists for the planned initial production. As a result, no additional capital is anticipated to increase the current capacity of the rail network and port facilities. In the PEA Report, cost estimates for rail cars and other equipment is considered as a lease-to-buy option. At the mine, the Owner will build a Mine Spur, railway station, and a load-out facility. These costs are included in the CAPEX estimate.

Access to the rail network capacity and access to Ukrainian bulk ports needs to be firmed up by Black Iron management. In order to get permits from the Federal Railway “Ukrzaliznyca” concerning access and connection to the Federal Railway at Moiseevka station; approval of the route, rail haulage contract, long-term agreement with port authorities and other service contracts must be in place. In terms of the Yuzhny Port, Black Iron needs to enter into a long-term contract with a private Service Provider at this facility prior to the existing capacity being secured by other potential users of this facility. The Owners of the preferred port own additional land adjacent to their existing facility suitable for port expansion in the event of the existing installed capacity is secured by an alternate Company prior to Black Iron, but this could impact the Capital Cost Estimate by as much as 55 million dollars.

25.6 Geotechnical and Hydrogeological

Based on the quality of the ground conditions, historic data and on the preliminary mine design, a robust geotechnical and hydrogeological drilling and testing program is recommended. To support the planned mining rates, multiple pit pushbacks might be required and definition of design criteria and any constraints with ground conditions is essential. The preliminary pit design is based on pit economics and design, with the only physical limits being the existing railway to the west and waste dumps to the east.



25.7 Conclusions

Based on the work accomplished and the results obtained in this PEA Study, it is of BBA's opinion that the Project is sufficiently robust to warrant proceeding with a Feasibility Study.



26. RECOMMENDATIONS

The following recommendations are made considering the results of this PEA Study and the project risks identified. The recommendations also take into consideration the degree of detail in information required at the Feasibility Study level.

26.1.1 Mineral Resources and Drilling

The mineral resources and drilling review led to the following remarks:

- A more regular pattern of drilling should be used going forward, and wherever possible, it should be a priority for the drillhole to pass through the entire mineralized zone;
- Down-dip drilling should also be kept to a minimum. A targeted exploration program will most likely increase the Mineral Resources at depth; however, an "economic lower level" or maximum depth of viable extraction should be determined in a subsequent Study;
- For definition of site ground conditions and selection of design criteria, geotechnical and hydrogeological drilling and other studies should be conducted;
- For further engineering and economic studies, the following recommendations would help improve the quality of the block model:
 - confirm and revise the existing geological interpretation and resource classification with infill and definition drilling;
 - cut-off grade should be applied to the Fe_{mag} versus Fe_{tot} values to reflect the selected magnetic separation processing scenario;
 - constrain recourse reporting and estimation by pit design/optimization and;
 - incorporate all rock units with corresponding bulk density values.



26.1.2 Data Verification

Overall, WGM believes that the historic drilling results are reasonably validated by the twin drillholes results. Recommendations include but are not limited to:

- Further independent and verification assaying to confirm Fe_{mag} results and others, to generally advance data quality;
- A detailed review and comparison between Soviet documentation and the Geo Inter Consulting database for each drillhole be undertaken and corrections made to match downhole survey azimuth to Soviet documentation;
- More validation work should be completed, including the blind resubmission of more samples to both SGS Lakefield and MCM and that Davis Tube tests also should be completed on a selection of samples to back up Fe_{mag} values determined by saturation magnetization analyzers;
- Collar locations for the historic holes be rechecked again by comparing and fitting locations on Soviet maps against field located and surveyed casings, and checking elevations against available historic data.

26.1.3 Mineral Processing and Metallurgical Testwork

Additional testwork will be required for the Feasibility Study, which includes Davis Tube testing on selected drill core intervals to develop reliable weight, iron, and magnetite recovery relationships, grindability testing, variability testing, pilot scale testing for engineering design data, filtration and thickening tests, rheology tests, and water treatment tests.

The additional grindability testing to be carried out during the Feasibility Study is to better assess equipment sizing, power requirements and grinding circuit configuration.



The additional proposed testwork would include (but is not limited to):

- Drop-Weight Tests (DWT) – minimum of three tests;
- SMC Tests – minimum of 12 tests;
- Bond Low Energy Impact Test for crusher sizing;
- Bond Rod Mill Grindability Tests – minimum of 12 tests;
- Bond Ball Mill Grindability Test – minimum of 12 tests;
- Abrasion Tests.

A trade-off study may also be required to evaluate the use of larger SAG mills with wrap-around motors versus smaller SAG mills with pre-crushing and pebble crushing.

26.1.4 Project Infrastructure

In the PEA Report, costs estimates for rail cars and other equipment is considered as a lease-to-buy option. At the mine, the Owner will build a mine spur, railway station, loadout and maintenance facility.

Black Iron should continue with discussions in seeking long-term agreements directly with port authorities (e.g.TIS) or by using one of the shipping/expedition agents working with the Ukrainian sea ports.

Competition over limited rail network capacity and access to Ukrainian bulk terminals and ports creates a challenge to the Black Iron Project. In order to get permits from the Federal Railway “Ukrzaliznyca” concerning access and connection to the Federal Railway at Moiseevka station; approval of the route, rail haulage contract, long-term agreement with port authorities and other service contracts must be in place before the production starts.

Black Iron should begin discussions with Ukrainian authorities and start the process of obtaining environmental land acquisition permits and other local and federal authorizations and approvals.



26.1.5 Environmental Studies

The benefits from the planned mining operations have been assessed as outweighing potential negative consequences on the health of people and on the environment. The change to the current topographic character of the landscape will be the most significant permanent impact of the operations.

It is expected that improved infrastructure and demand for social services will also result from the establishment of the mine, and, in turn, will lead to increased interest from regional and/or international investors or various types. The establishment of mine may result in an overall improvement in the population trend through employees and their families moving to the region.

The impact of the operations on the social economy will be assessed in the EIA and other research reports published.

26.1.6 Main Conclusion

BBA recommends that Black Iron proceed with the undertaking of a Feasibility Study. The costs for this next study phase have been estimated at \$18.8 M and are outlined in Table 26.1. As of the effective date of this Report, Black Iron has already authorized and/or initiated some of the work outlined in the recommendations made.

Table 26.1: Next Study Phase Cost Estimate

Study Phase	Cost Estimate
Exploration Drilling Program (to June 2012)	\$ 4.0 M
Feasibility Study (Shymanivske Site)	\$ 11.0 M
Metallurgical Testwork	\$ 1.0 M
Port and Rail	\$ 0.3 M
Geotech and Pit Slope	\$ 1.0 M
Other Site Studies	\$ 0.5 M
Environmental Studies	\$ 1.0 M
Total	\$ 18.8 M



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Appendix A

Shymanivske Iron Ore Variograms

SXF1 Zone

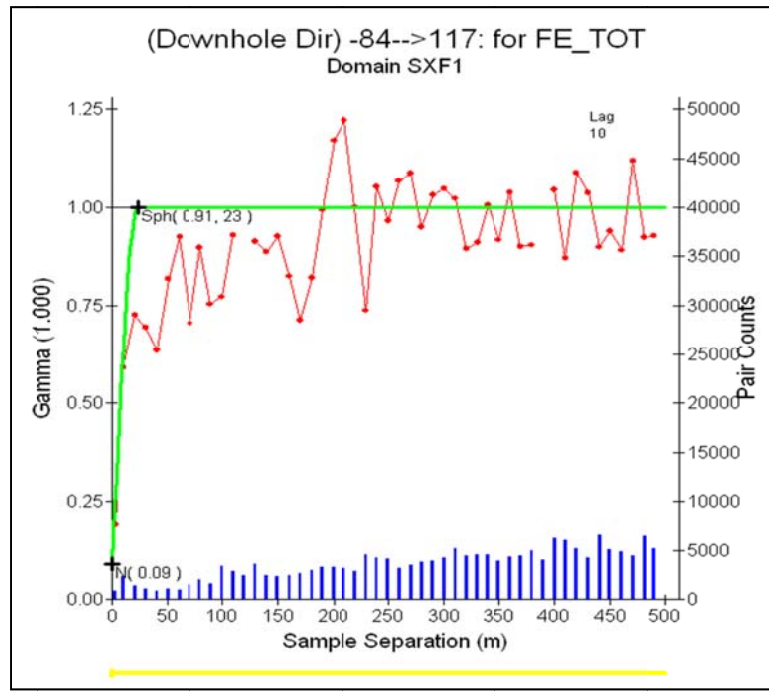


Figure 1 - (Downhole Dir) - 84 -->117: for Fe_{tot}

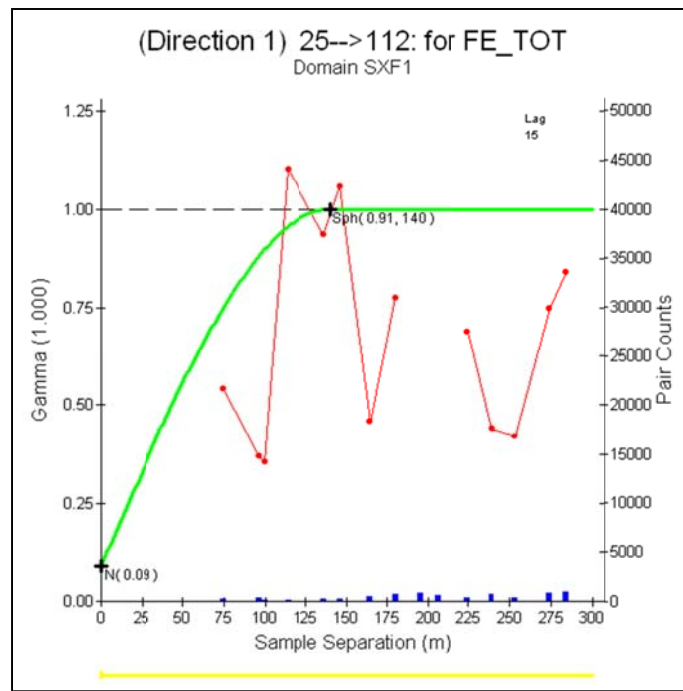


Figure 2 - (Direction 1) 25-->112: for Fe_{tot}

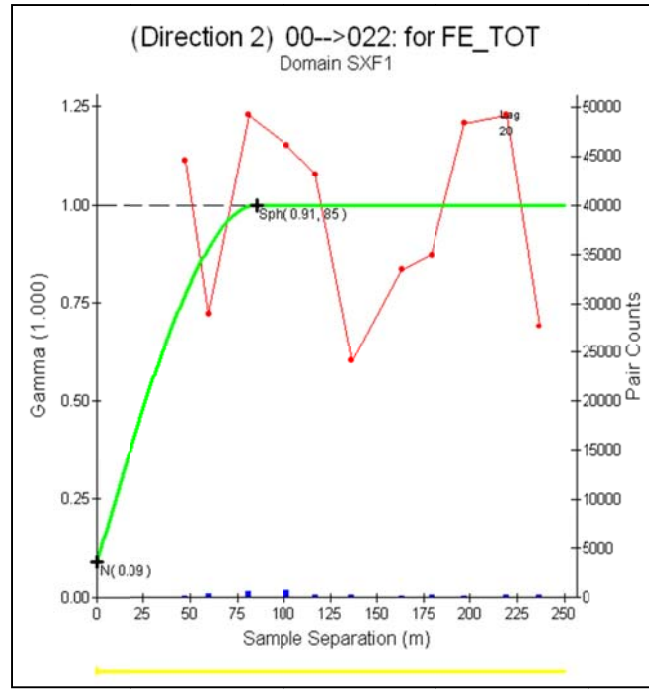


Figure 3 - (Direction 2) 00-->022: for Fe_{tot}

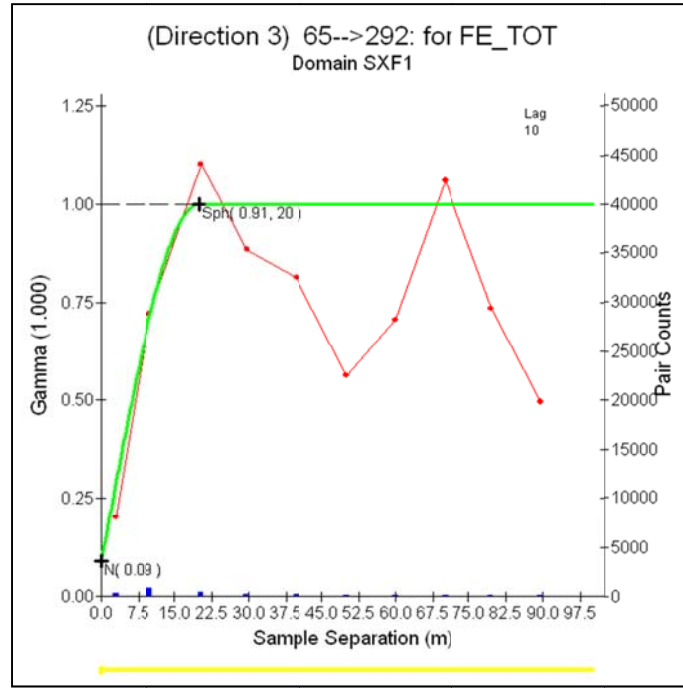


Figure 4 - (Direction 3) 65-->292: for Fe_{tot}

SXF2 Zone

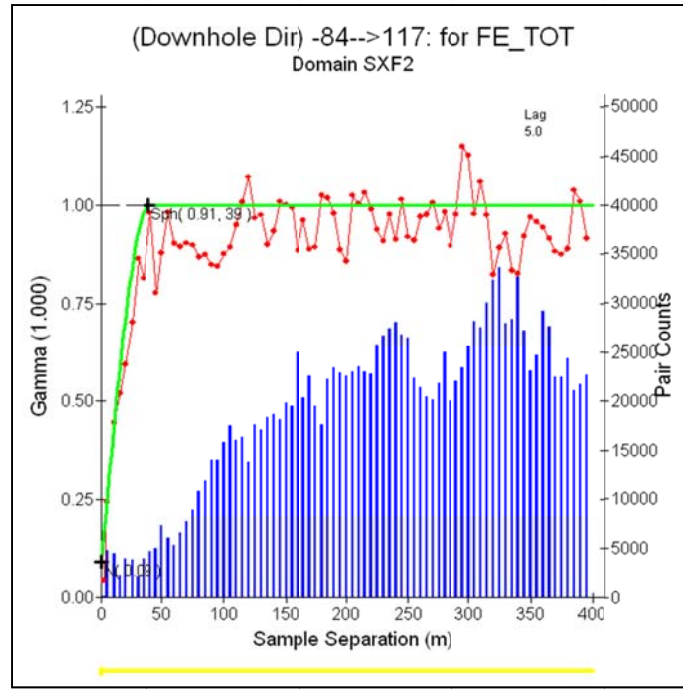


Figure 5 - (Downhole Dir) - 84-->117: for Fe_{tot}

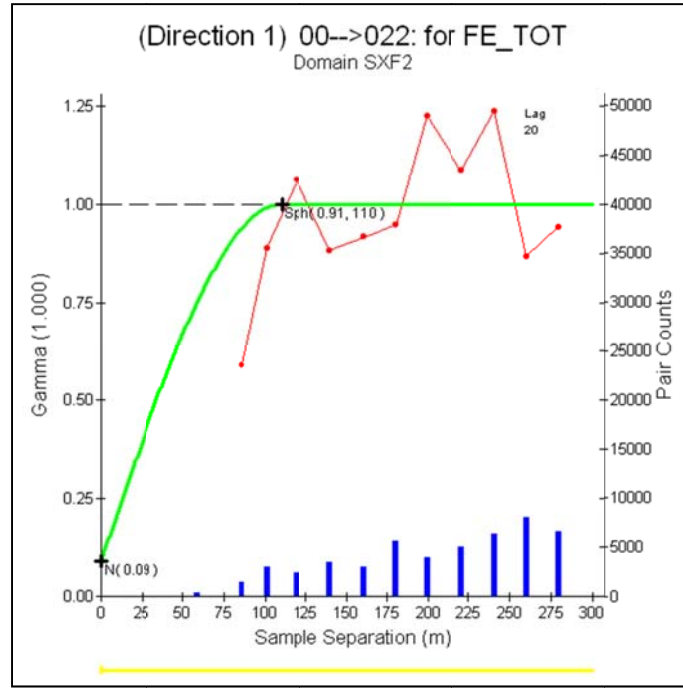


Figure 6 - (Direction 1) 00-->022: for Fe_{tot}

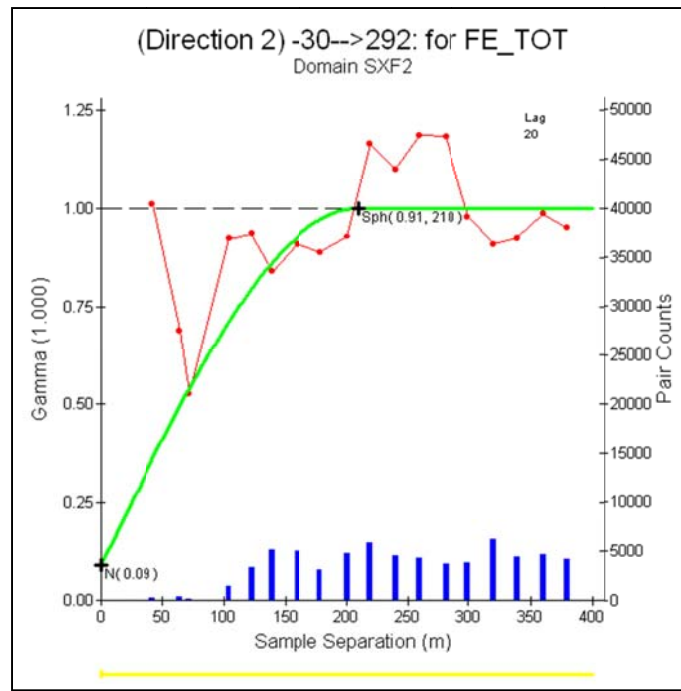


Figure 7 - (Direction 2) - 30-->292: for Fe_{tot}

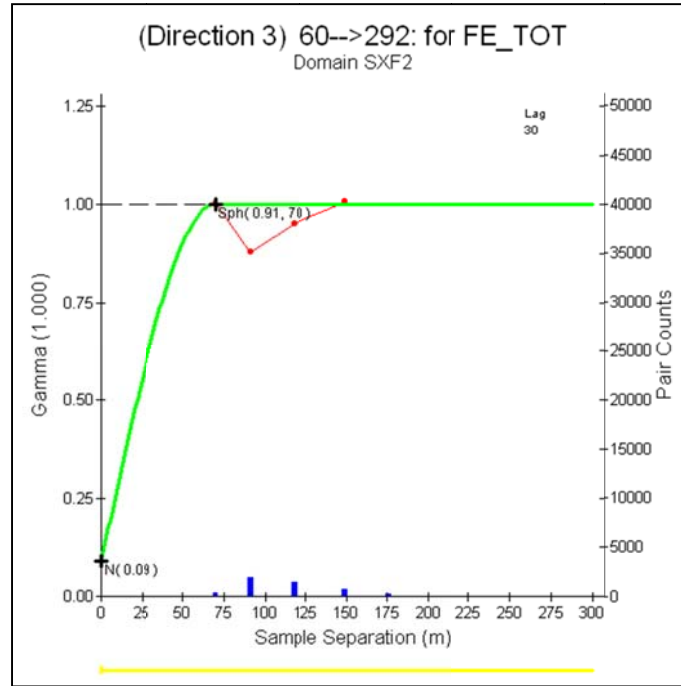


Figure 8 - (Direction 3) 60-->292: for Fe_{tot}

SXF4 Zone

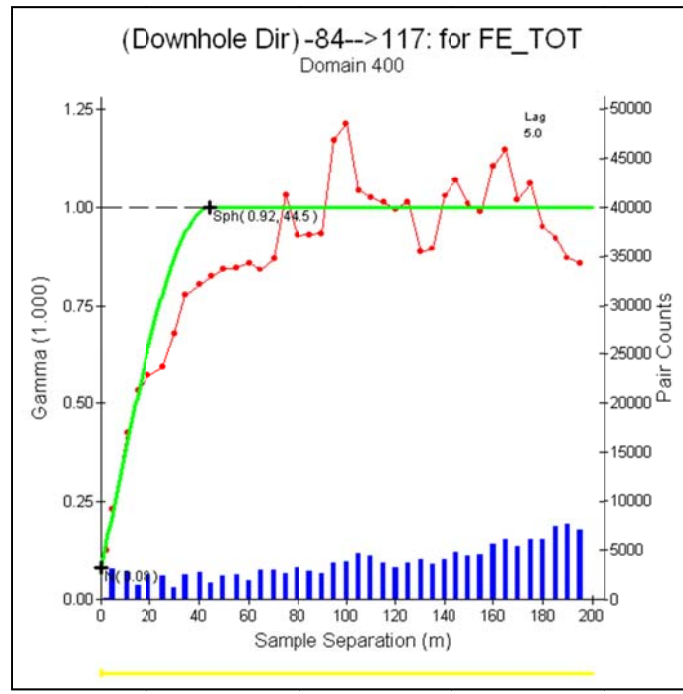


Figure 9 - (Downhole Dir) - 84-->117: for Fe_{tot}

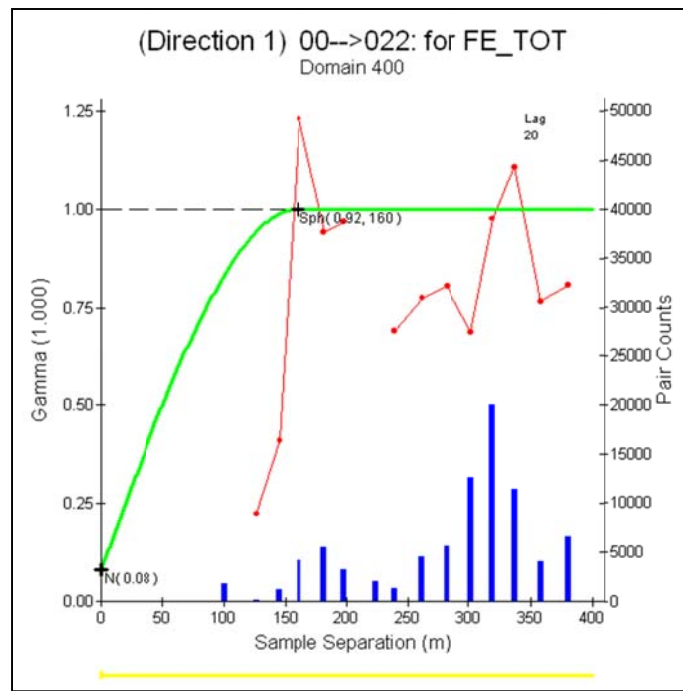


Figure 10 - (Direction 1) 00-->022: for Fe_{tot}

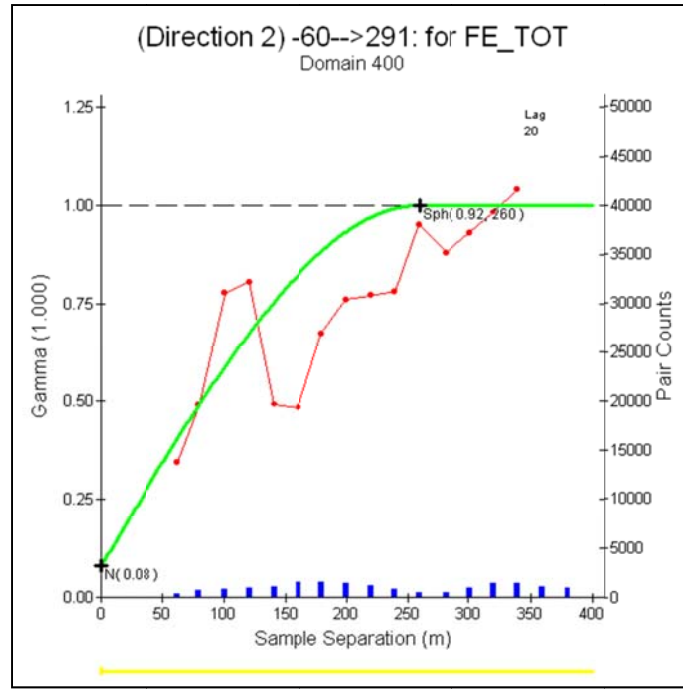


Figure 11 - (Direction 2) - 60-->291: for Fe_{tot}

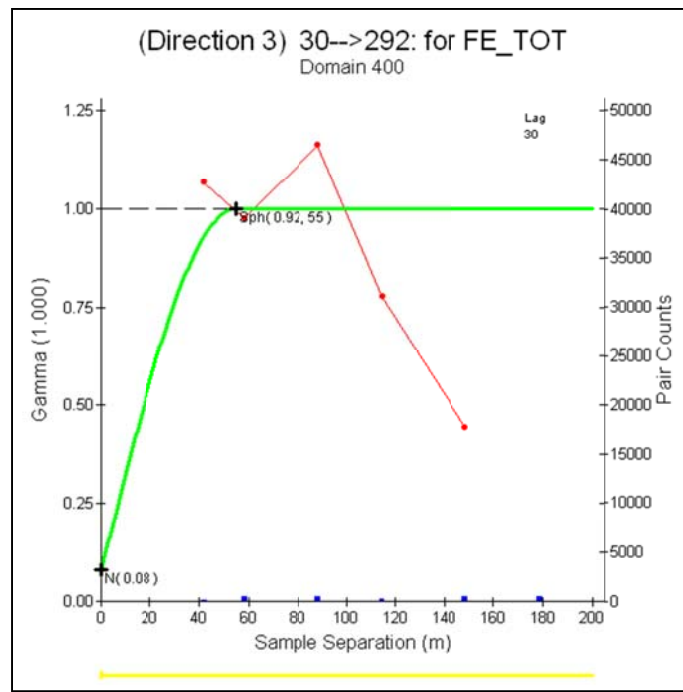


Figure 12 - (Direction 3) 30-->292: for Fe_{tot}



Appendix B

Cross Sections of the Block Model



Geology Map of Level +50 m with Drillholes and Cross Section Location

Block Model Color Legend (MagFe %)



< 10 %



10-15 %



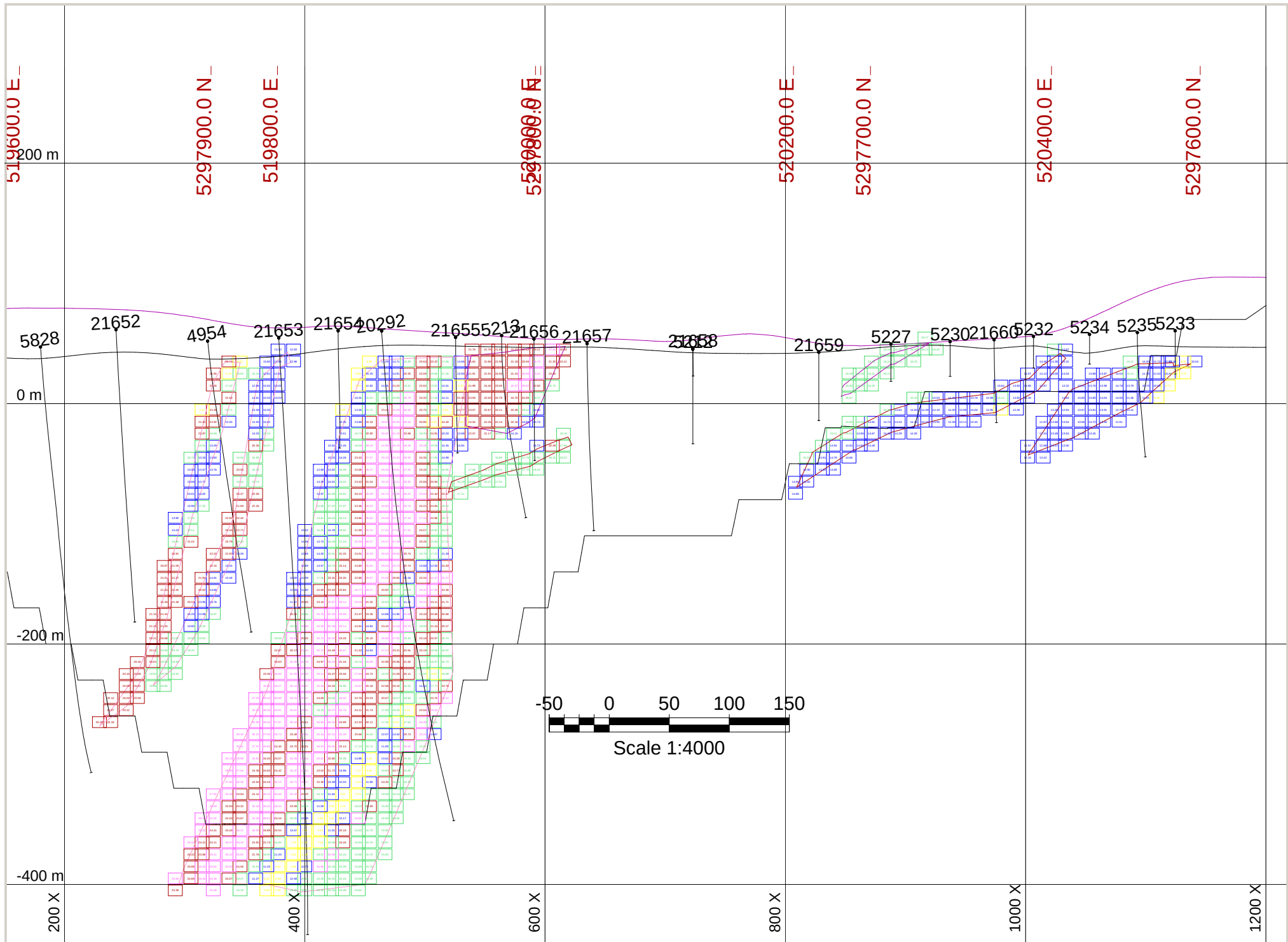
15-20 %



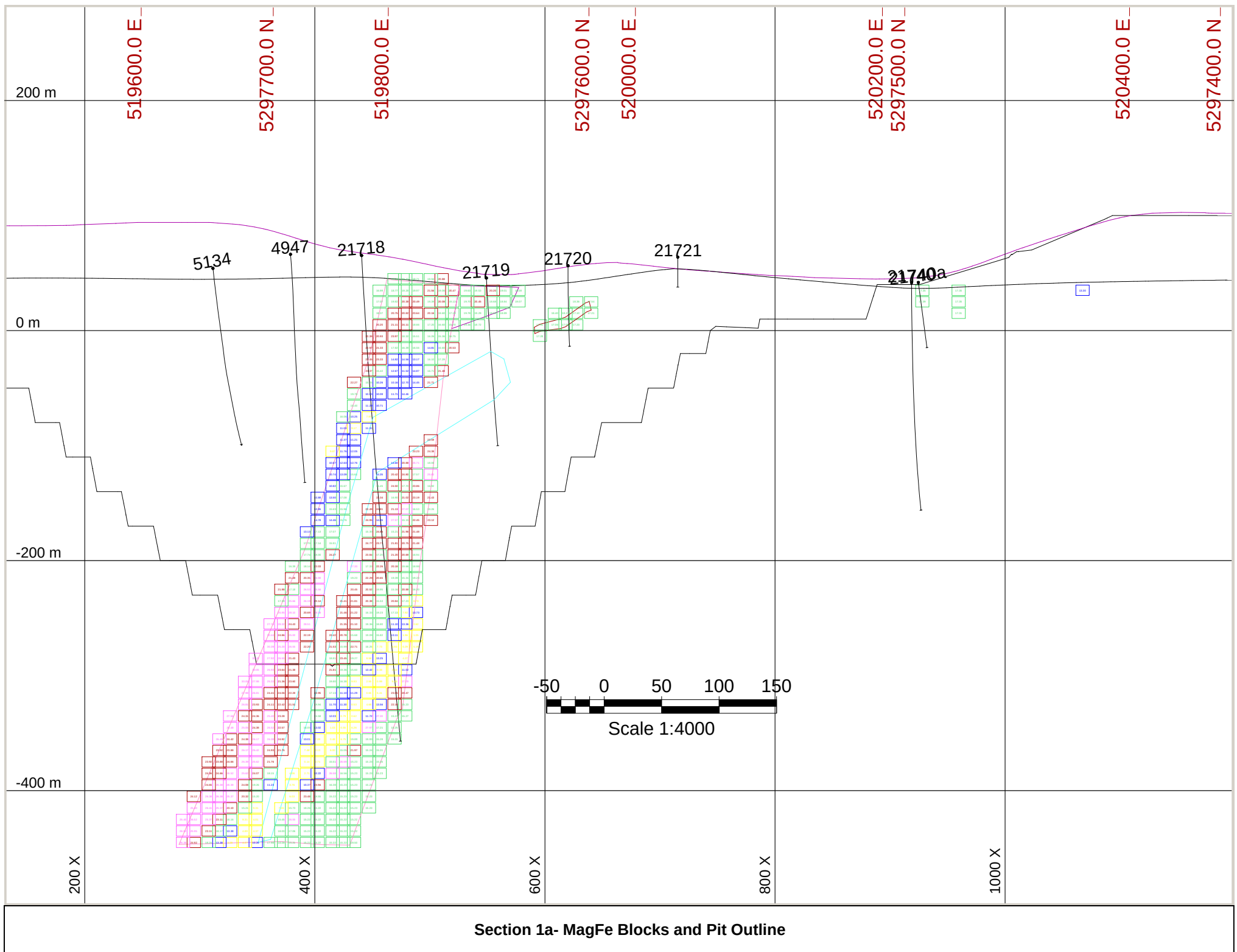
20-25 %

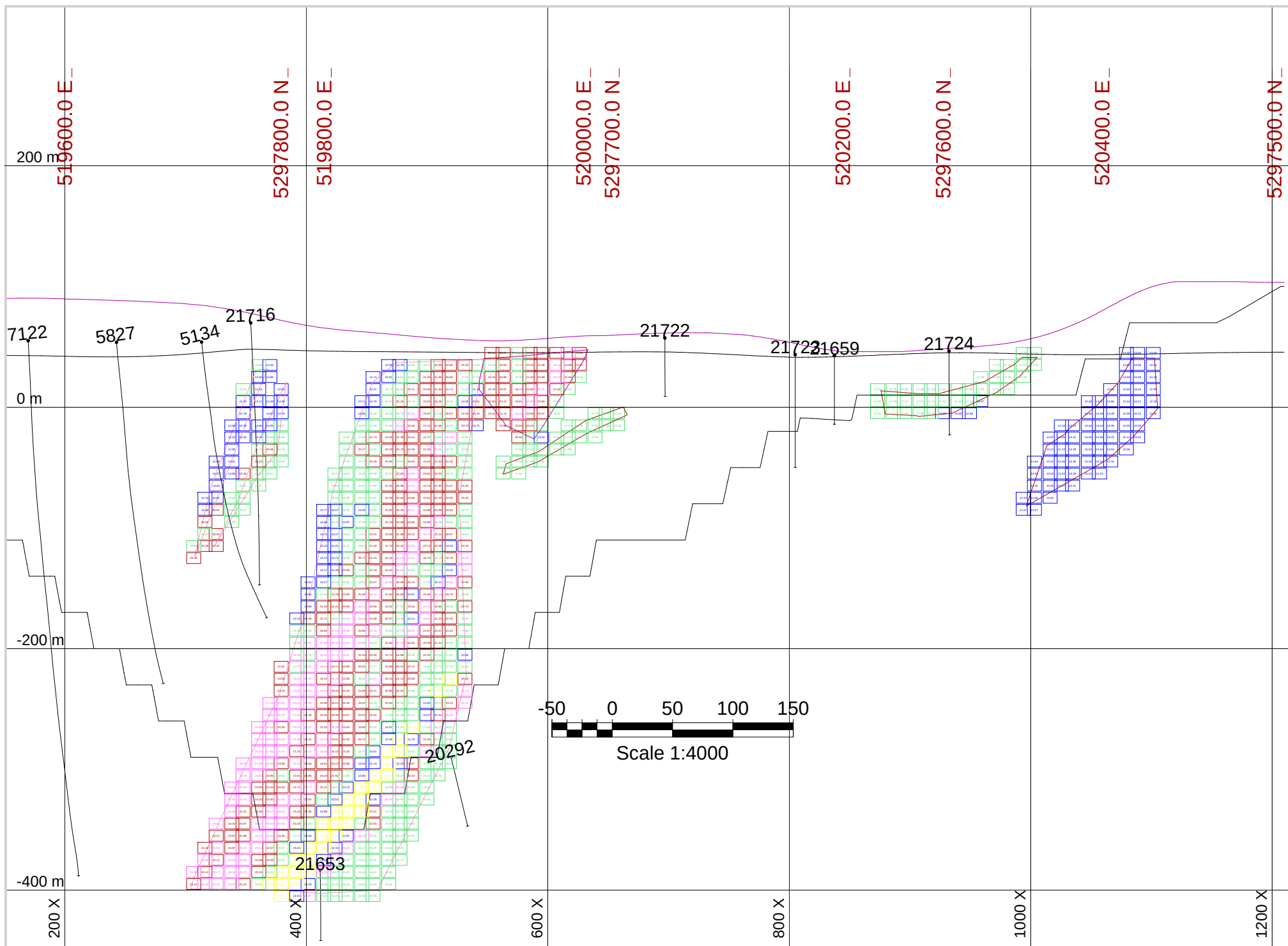


>25 %

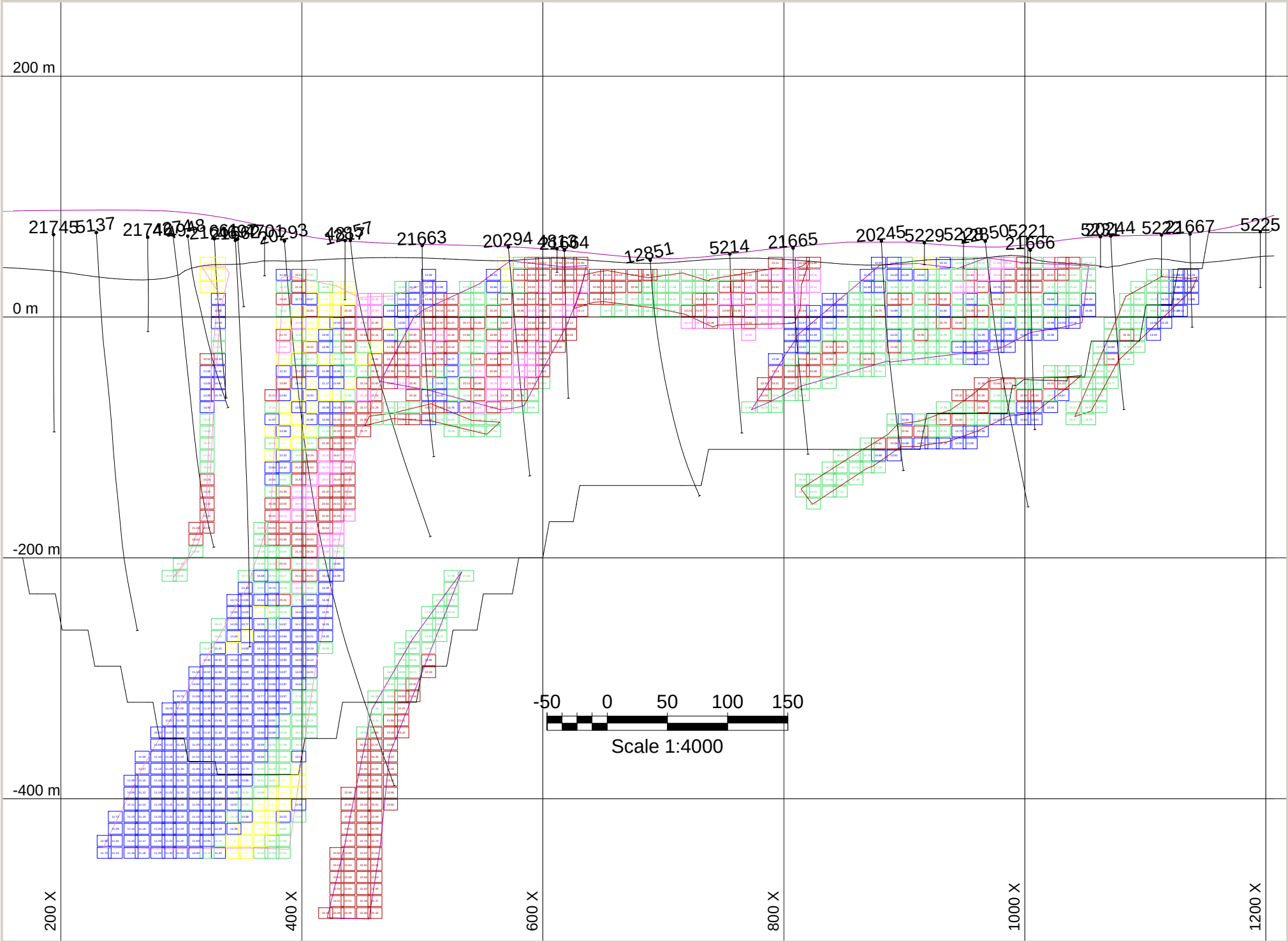


Section 1- MagFe Blocks and Pit Outline

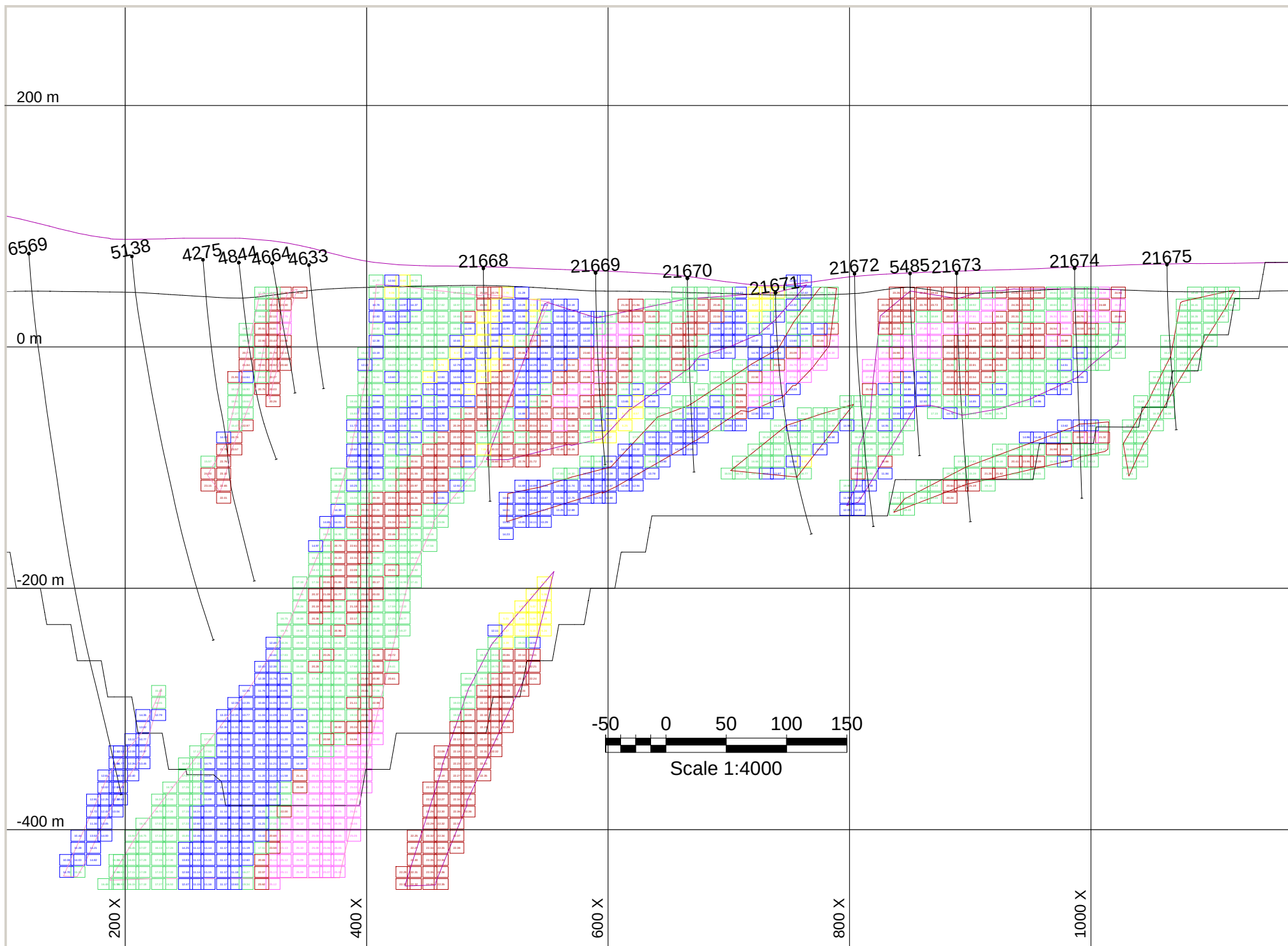




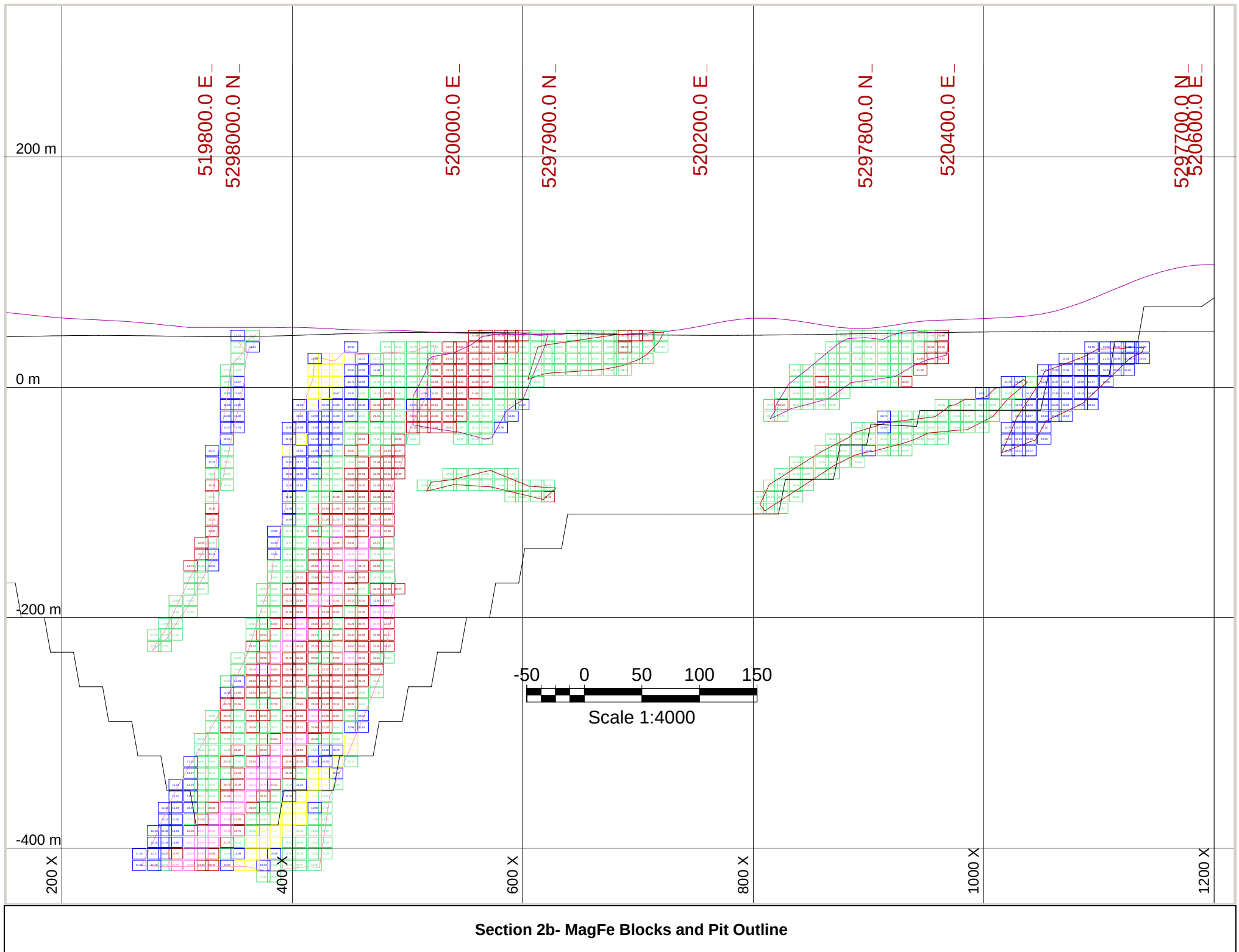
Section 1b- MagFe Blocks and Pit Outline

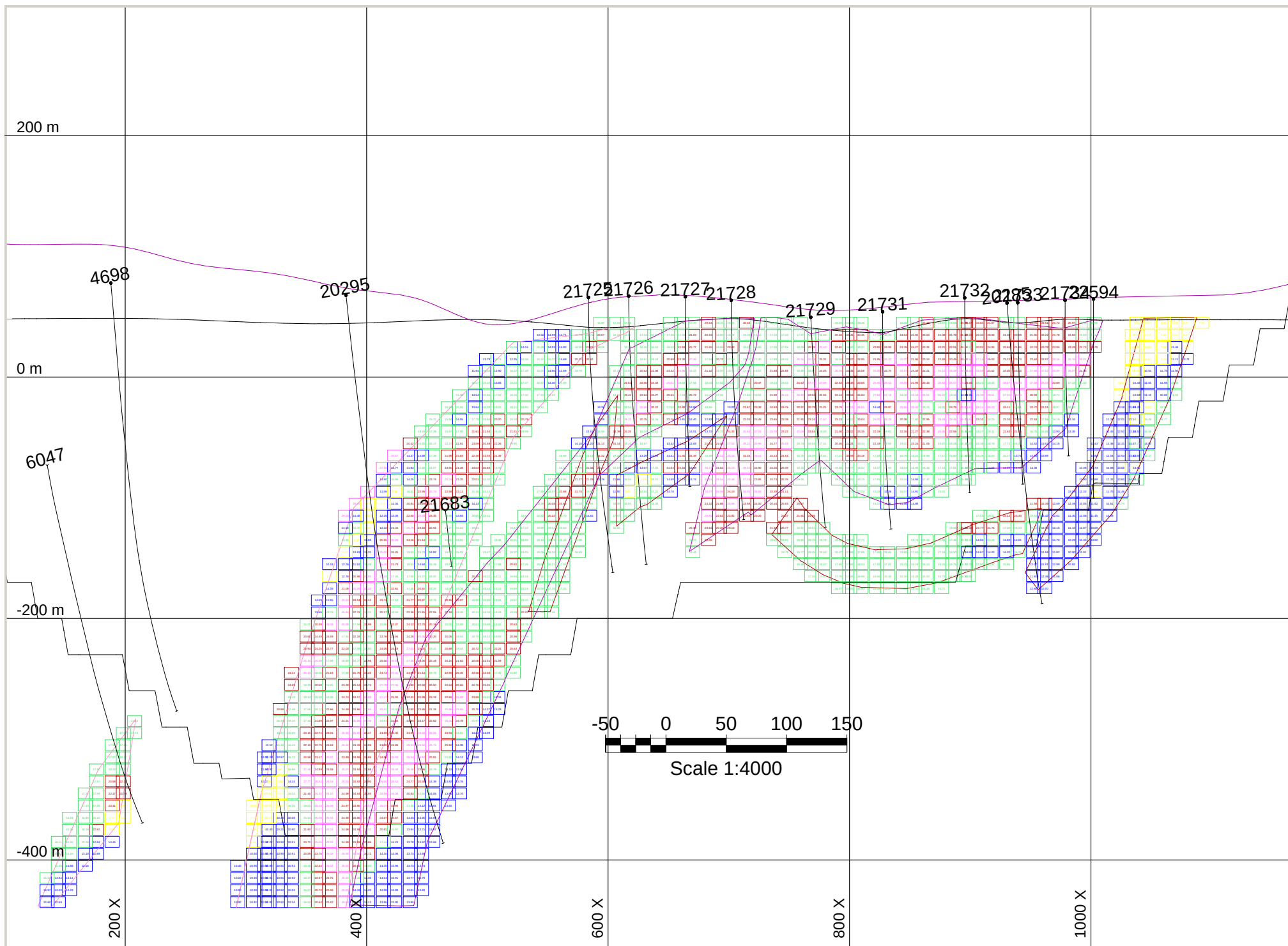


Section 2- MagFe Blocks and Pit Outline

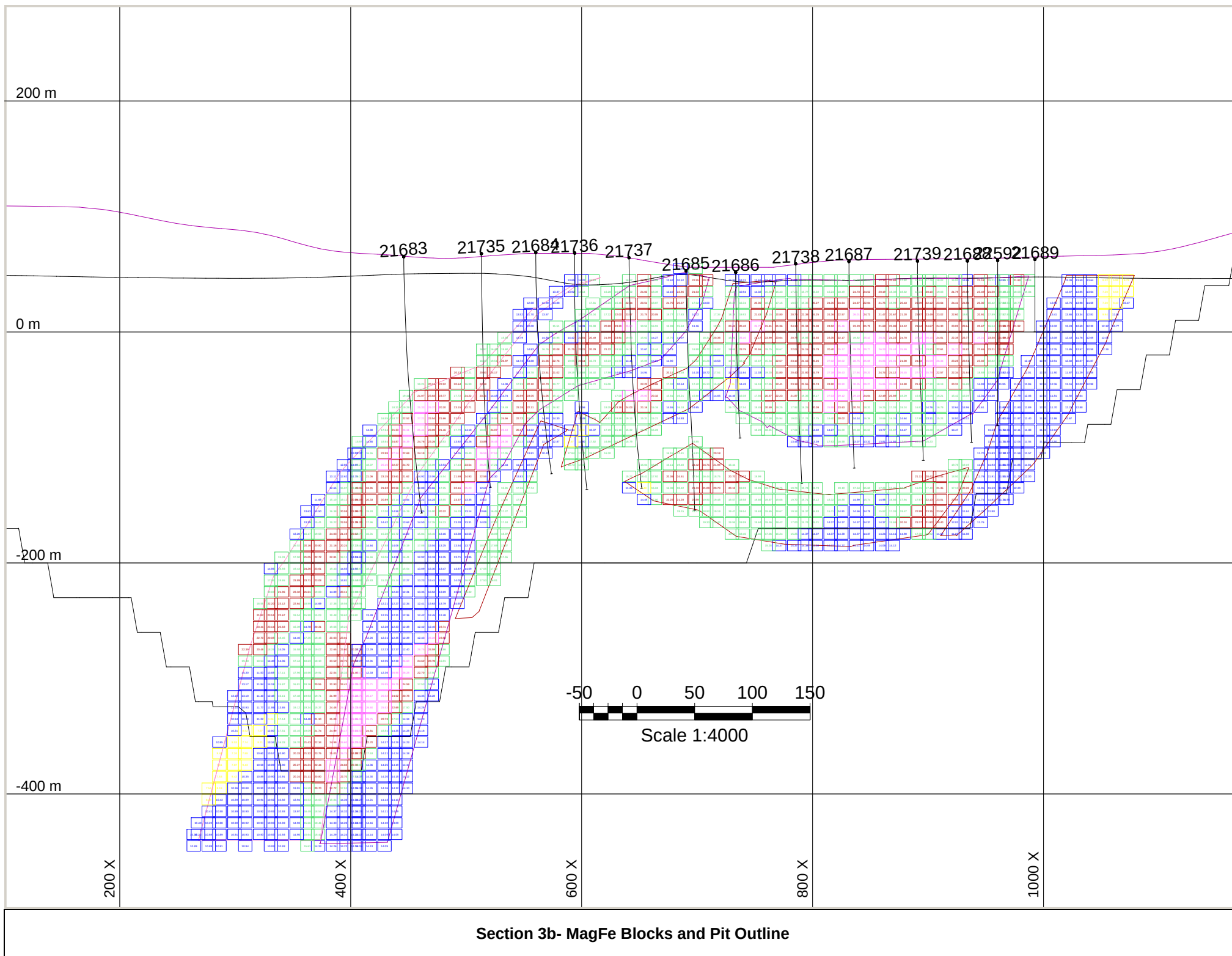


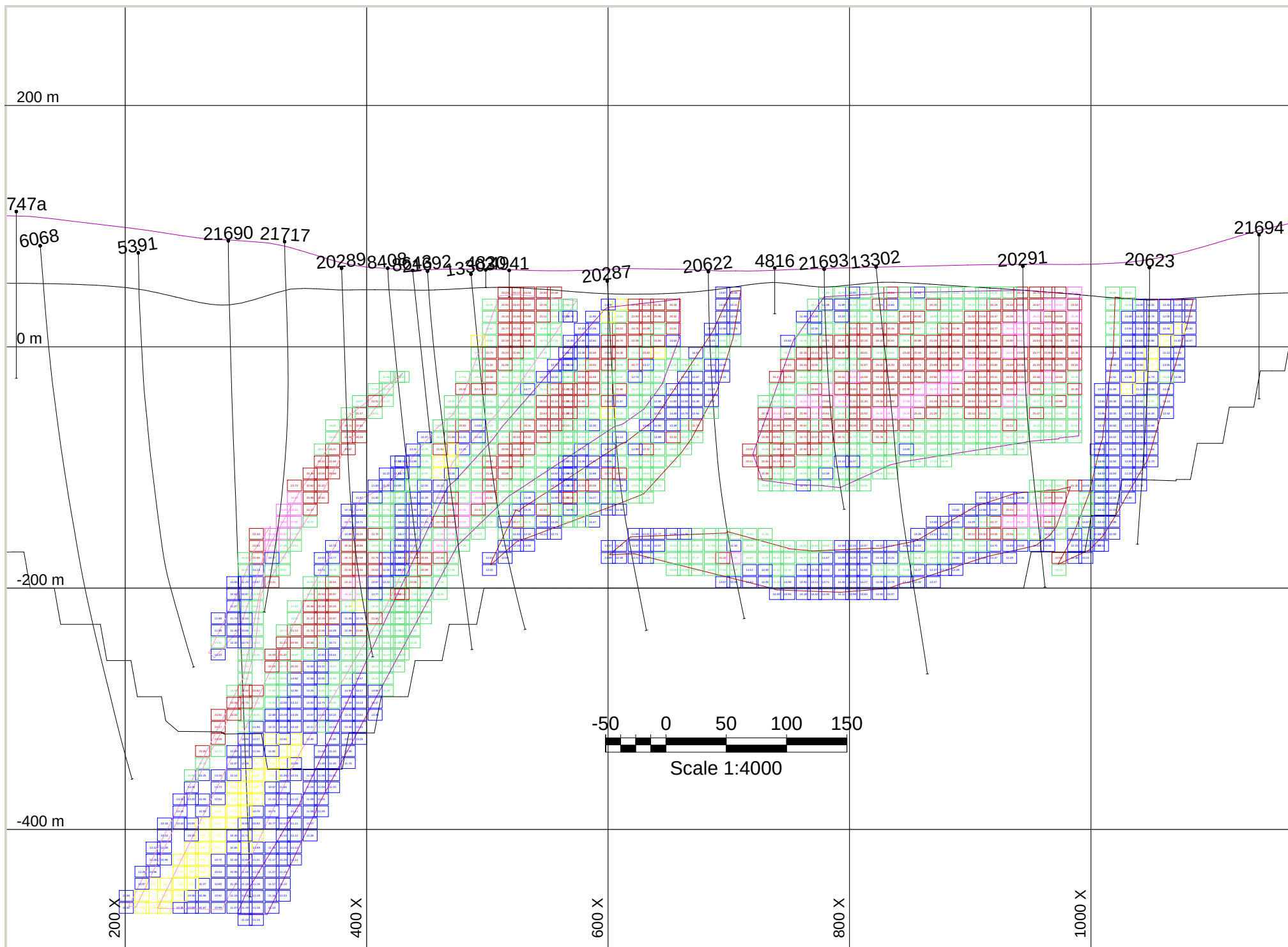
Section 2a- MagFe Blocks and Pit Outline



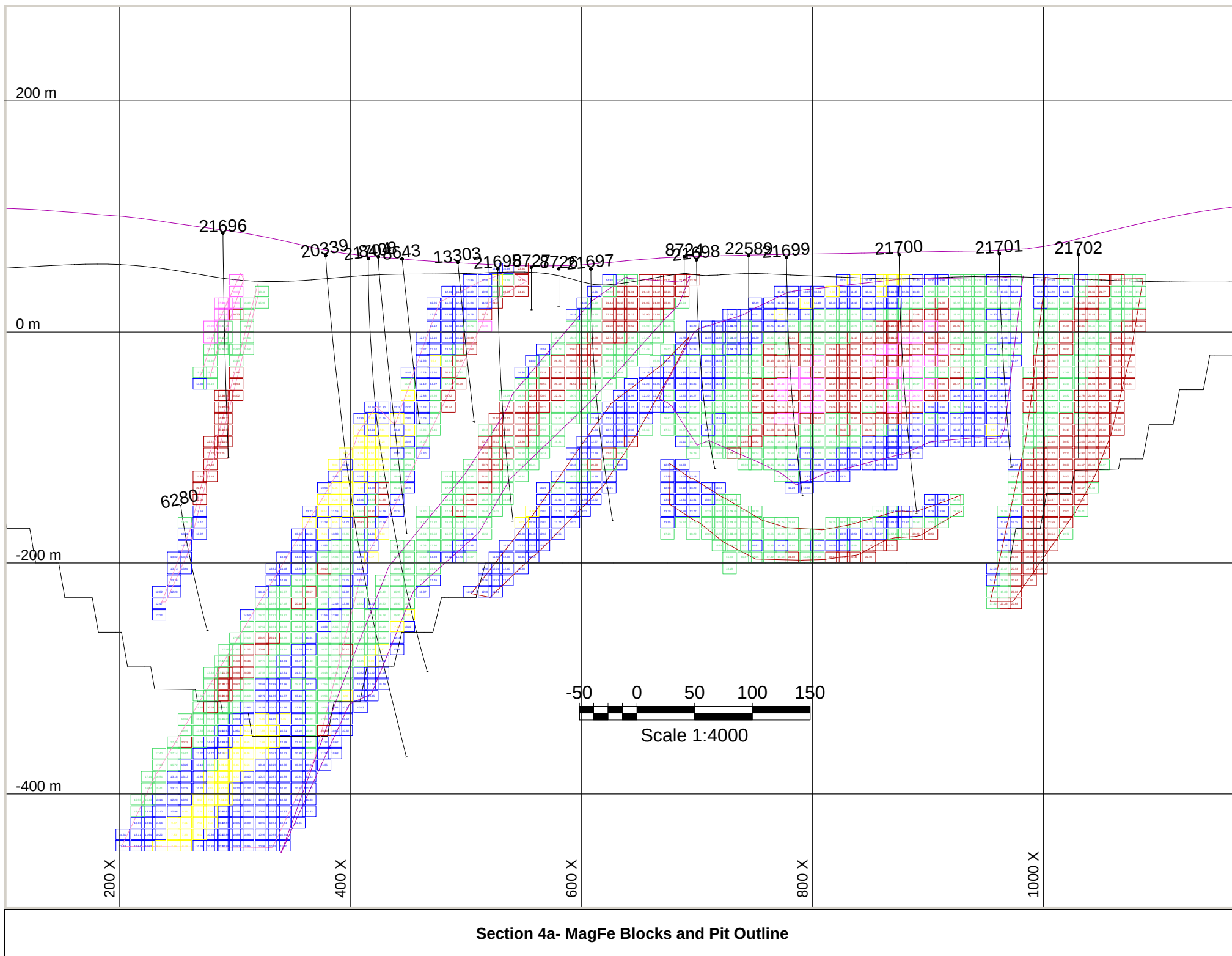


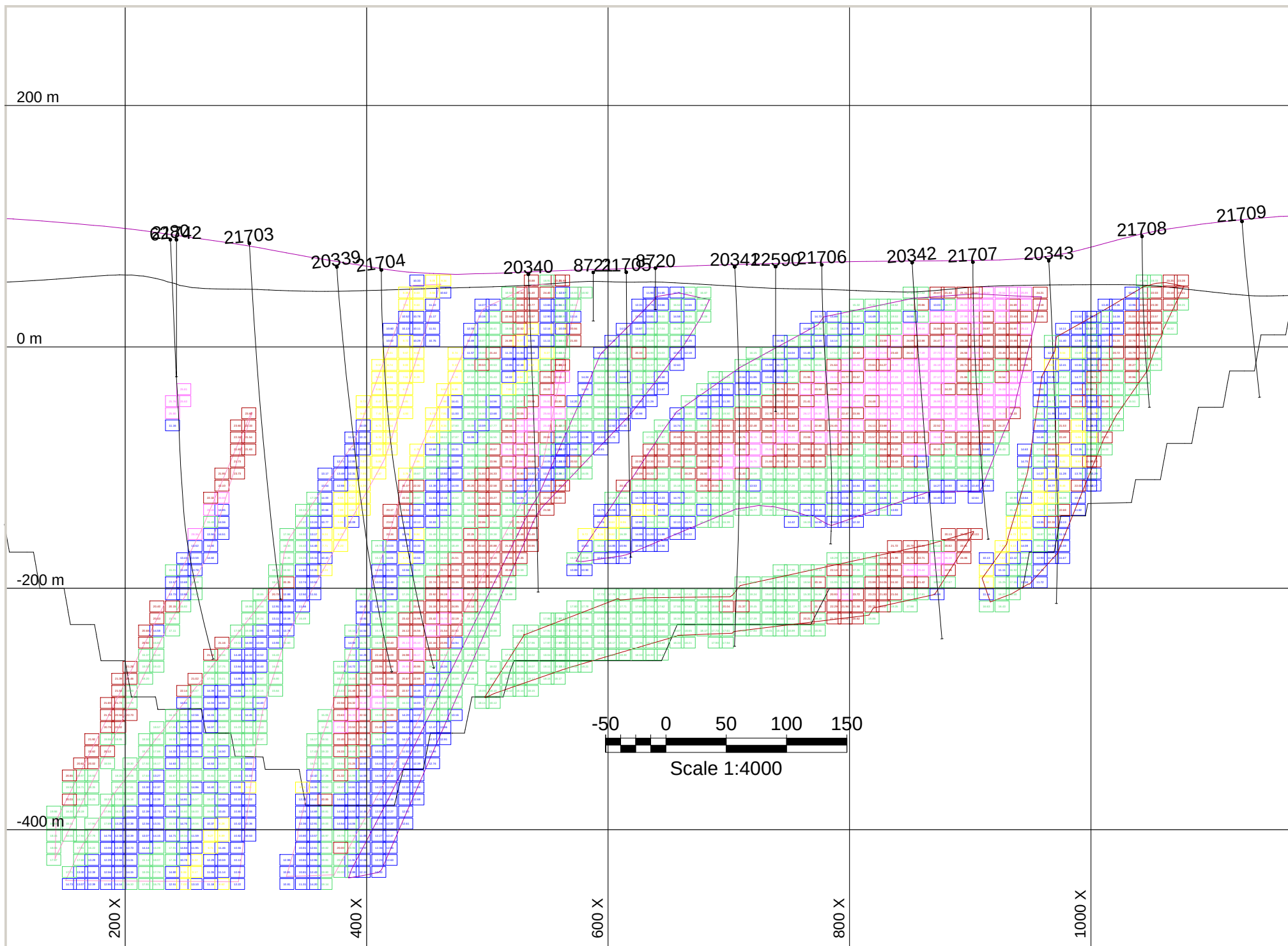
Section 3a- MagFe Blocks and Pit Outline



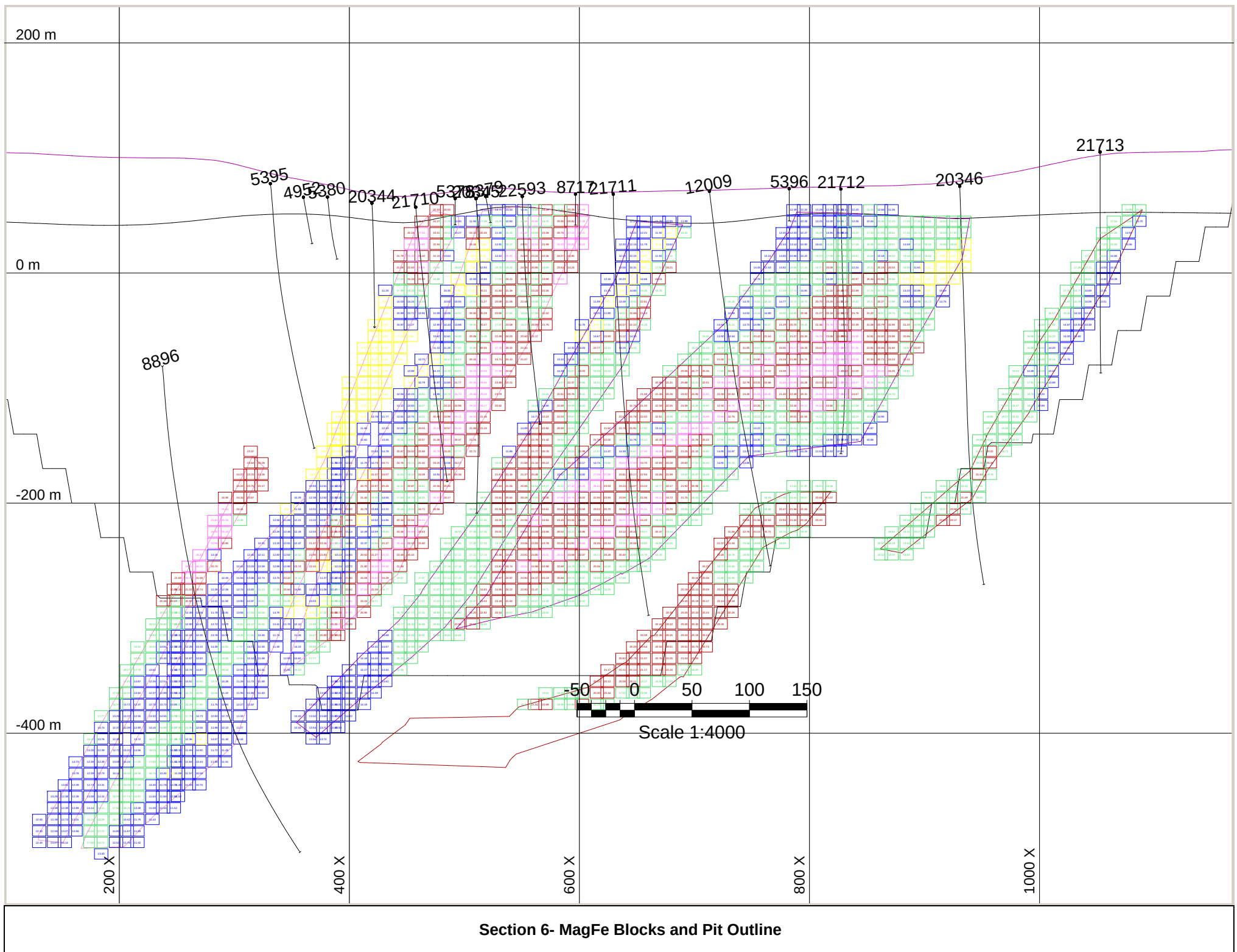


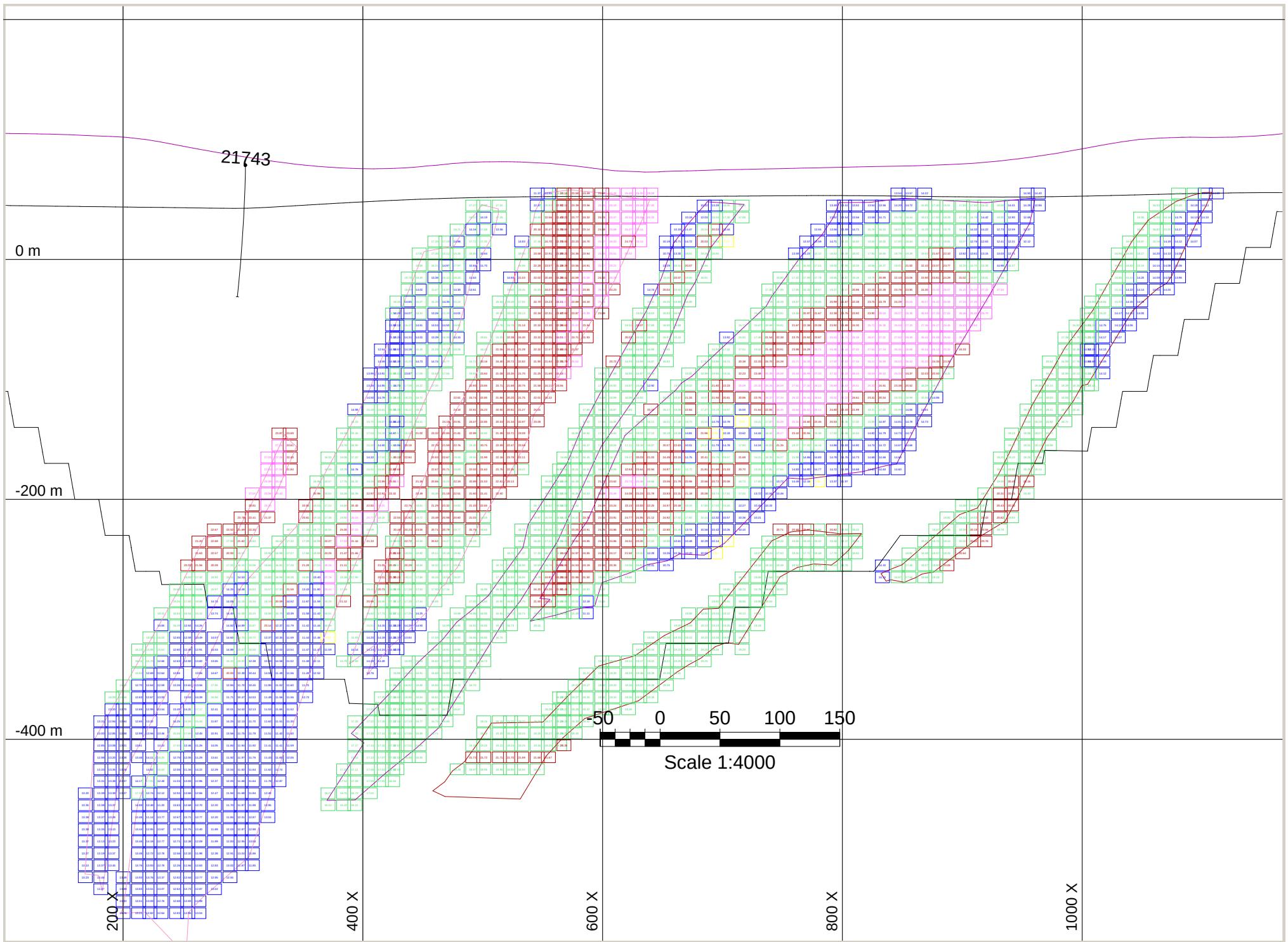
Section 4- MagFe Blocks and Pit Outline

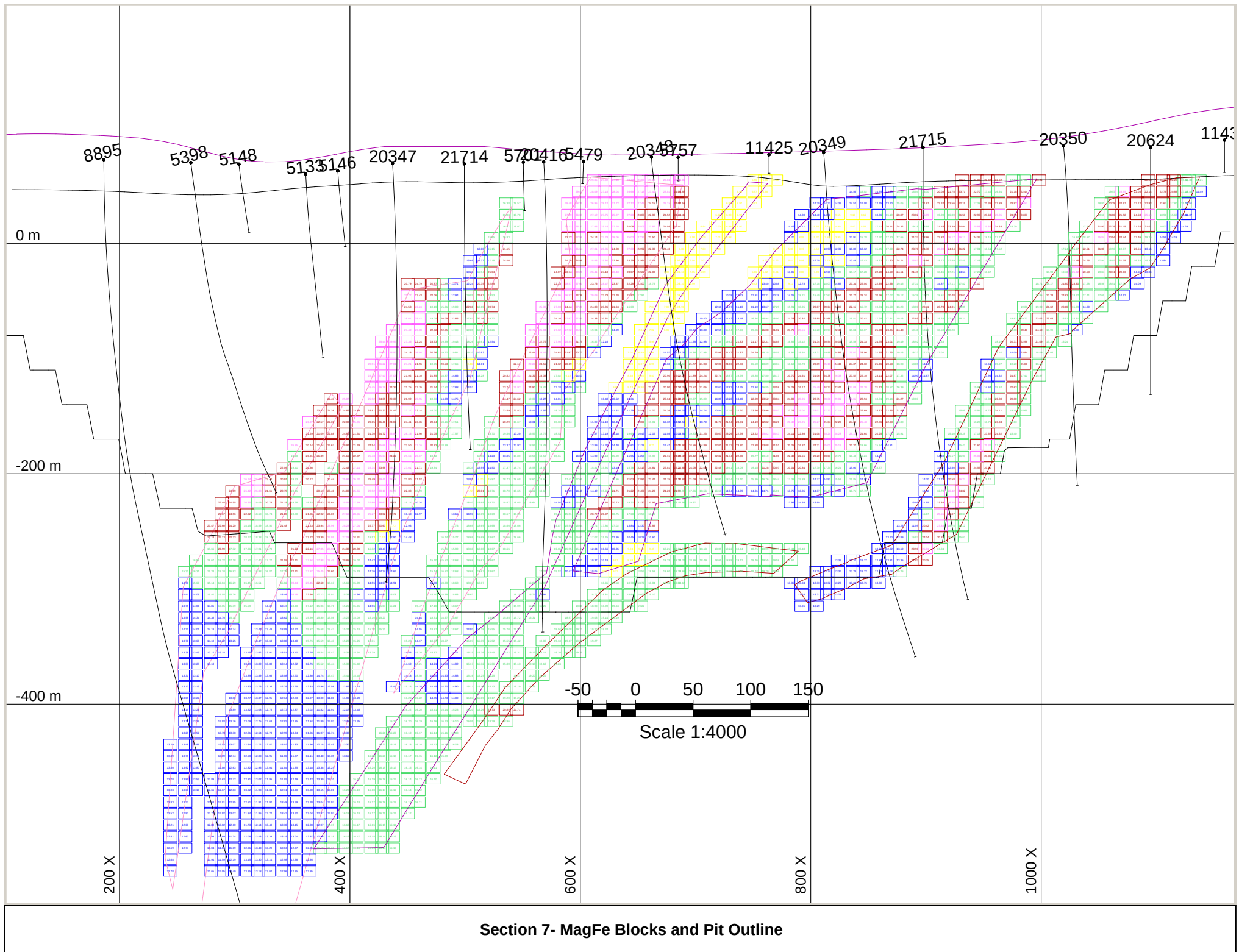


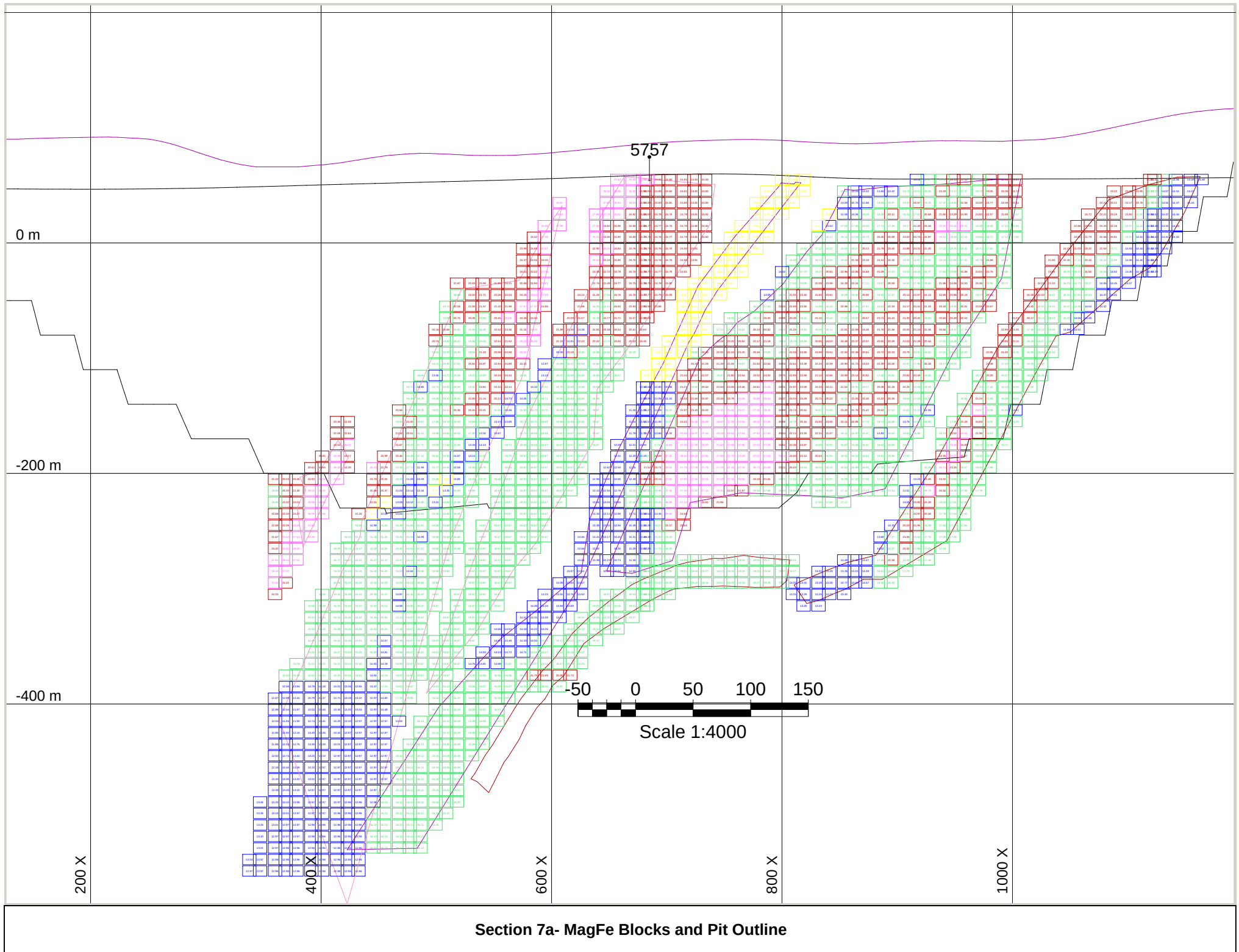


Section 5- MagFe Blocks and Pit Outline











Appendix C

Risk Register

BLACK IRON RISK REGISTER

N°	Risk Title	Risk Description	Category	Consequence (Description)	Probability	Manageability	Mitigation	Comment
1.	Environmental Permitting	1.1. Delays in the process to obtain municipal and regional environmental permits	Schedule	1.1.1. Missing construction schedule, delayed project start up	Medium	Medium	1.1.1.1 Select credible/reputable consultant for assisting with the environmental permits	Clarification on difference between domestic and international standards
							1.1.1.2 Make assumptions for major project parameters (final pit depth, pellet plant etc..)	
							1.1.1.3 Create environmental road map	
							1.1.1.4 Create a dedicated team dealing with all the environmental issues	
							1.1.1.5 Accelerate baseline monitoring program	
							1.1.1.6 Begin discussion with Ukrainian authorities and start land acquisition	
2.	Land Requirements	2.1. Inability to acquire additional land required by the project	Schedule/CAPEX	2.1.1. Delay in project start up and direct impact on CAPEX	Medium	Medium	2.1.1.1 Confirm project land requirements	Be aware of politics and system delays
							2.1.1.2 Develop road map for land acquisition	
							2.1.1.3 Select reputable and experienced service provider	
3.	Electric Power	3.1. Local grid inability to support project power requirements	Schedule/CAPEX	3.1.1. Delayed plant start up	Low	Medium	3.1.1.1 Start early negotiation with Government and Private suppliers	
				3.1.2. Increased CAPEX to build power line connection to the local grid	Medium	Medium	3.1.1.2 Establish power requirements and benchmark against existing projects	
							3.1.1.3 Establish grid accessibility	
4.	Railway Transportation	4.1. Insufficient capacity in rail network to support project requirements	CAPEX	4.1.1. Increased CAPEX to build rail spur	Low	Medium	4.1.1.1 Establish project rail requirements	Questionable availability/quality of local equipment
			Schedule	4.1.2 Delayed project start up	Medium	Medium	4.1.1.2. Buy our own rail cars	
							4.1.1.3 Seek an agreement with Ukranian iron ore producers (Metinvest, Ferrexpo) to participate in joint projects of Odessa port expansion.	
5.	Port Facilities	5.1. Insufficient capacity in existing ports to accommodate project requirements	CAPEX	5.1.1. Increased CAPEX to build our own port or an expansion to an existing port.	Low	Medium	5.1.1.1 Examine port expansion options or location for a new port	
			Schedule	5.1.2. Delayed project start up due to port construction	Medium	Medium	5.1.1.2 Identify alternative shipping options	
6.	Procurement of Long Lead Equipment	6.1. Delays in delivery of long lead equipment	Schedule	6.1.1. Delayed construction and plant start up	Medium	High	6.1.1.1 Use local suppliers	
							6.1.1.2 Start equipment selection and sizing ASAP	
							6.1.1.3 Identify long lead equipment early	
							6.1.1.4 Use Letters of intent to secure manufacturing spots to critical equipment	
7.	Construction	7.1 Lack of local construction materials	Schedule	7.1.1 Delayed construction and plant start up	Low	High	7.1.1.1 Identify critical materials	
		7.2 Low construction productivity	Schedule	7.2.1 Delayed construction and plant start up	High	High	7.2.1.1 Employ front End Execution Planning using experienced contractors	
							7.2.1.2 Engage reputable and experienced contractor for the plant construction	
							7.2.1.3 Finalize construction strategy early in Feasibility phase	
8.	Process	8.1. Inability to meet salable product specification	Market	8.1.1. Impact marketability	Low	High	8.1.1.1 Identify salable product specs through advanced marketing study	
		8.2 Low recovery rates	OPEX	8.2.1. High OPEX resulting in Lower project cash flow	Medium	Medium	8.2.1.1 More test work including pilot plant	
		8.3 Test work producing unrepresentative data	OPEX	8.3.1 Under designing process equipment	Low	High	8.3.1.1 More test work or pilot plant	
		8.4 High levels of deleterious materials in final product	OPEX	8.4.1 Limited market and lower revenue	Medium	Medium	8.4.1 1 Identify potential design solutions early in the design process	
							8.4.1.1 More test work to confirm efficiency of potential design solutions	
							8.4.1.1 Identify potential solutions	
9	Geology, Database and Assays	9.1 Incorrect interpretation of mineralized domains or units	Valuation	9.1.1 Incorrect resource estimate	Medium	Medium	9.1.1.1 More drilling	Drill additional holes as a check on the interpretation - i.e., higher drillhole density
		9.2 Incorrect grade interpolation within defined mineralization domains	Valuation	9.1.2 Lowers accuracy of Mineral Resource estimate from the standpoint of grades	Medium	Medium	9.2.1.1 Check & validate grade interpolation techniques	Re-do grade interpolation

9	Geology, Database and Assays	9.3 Past and future assays inaccurate	Valuation	9.1.4 Lower accuracy of Mineral Resource estimate and grade distribution	Low	High	9.3.1.1 Review QA/QC data and completion of twin holes to validate previous drilling. Proper QA/QC and outside assaying (secondary lab) for new drilling.	Conduct second half core sampling and re-assaying program
10.	Geotechnical / Hydrogeology	10.1 Poor ground conditions may impact pit expansion	Valuation	10.1.1 Actual pit slope characteristics may differ from Whittle shell impacting pit size and stripping	Medium	Medium	10.1.1.1 Initiate geotechnical/hydrogeology testing programs at early stage of project development	Collect info from nearby operating mines
							10.1.1.2 Ensure slope domains are properly defined	Detailed Geotechnical analysis of host rock
11.	Resource Valuation	11.1 Higher percentage of Measured Resources	Schedule/OPEX	11.1.1 Reduction of in pit resources and mine life	Low	High	11.1.1.1 More selective drilling to upgrade resource classification	
		11.2 Future infill drilling and metallurgical testing may not validate current 3D model	Schedule/OPEX	11.2.1 Lack of correlation of iron (and other) grades to rock type in database and 3-D model	Medium	Medium	11.2.1.1 Update 3D model interpretation based on new drilling	Need to fully understand different mineralization types and zones
							11.2.1.2 Modify categorization/tonnage/mining plan in affected area	
							11.2.1.3 Bulk sample and pilot plant testing to confirm metallurgical assumptions	Proper and complete metallurgical test work and geological understanding is required
		11.3 Pit size sensitivity to pit optimization parameters	Valuation	11.1.3 Potential reduction of inpit resources	Medium	Medium	11.3.1.1 Sensitivity analysis	Proper analysis of all input parameters and costs
		11.4 Proximity to waste piles, adjacent properties and existing infrastructure may limit pit expansion	Schedule/OPEX	11.4.1 Inability to extract all the mineral resource. Reduction of mine life.	High	Medium	11.4.1.1 Identify options to relocate power line and rail to allow pit expansion	
11.4.1.2 Detailed site survey								
12.	Project Financing	12.1 Initial investment higher than expected.	Financing	12.1.1. Inability to raise sufficient funds	Medium	High	12.1.1.1 Seek early Offtake partner	
		12.2 Change in market conditions.		12.1.2. Lower than anticipated selling prices	Medium	Medium	12.1.1.2 Black Iron should undertake a more detailed and focused marked study. A local Consultant should be used to obtain local materials, labour quotes and trends for the area.	
13	Government Administration	13.1 Delays in obtaining government approvals for various permits and authorizations.	Schedule	13.1.1. Delayed project start up	Medium	Medium	13.1.1.1 Follow legal procedure	
							13.1.1.2 Create a dedicated government relations team	
							13.1.1.3 Select credible/reputable service provider	
							13.1.1.4 Prepare approvals road map	
14	Competing Mines	14.1 Delayed Project approvals due to interference from competing mines in the area	Schedule	14.1.1 Delayed Project completion and startup	High	Medium	14.1.1.1 Raise public awareness of project benefits	
		14.1.1.2 Seek investment support from ERDB and IMF						
		14.2 Limited site access caused by interface with neighbours.			Medium	Medium	14.1.1.3 Start negotiation early in process.	
15	Expropriation	15.1 Legal issues, local politics and resistance with regards to resettlement of the communities within 2 km of the open-pit mine	Schedule/ CAPEX	15.1.1. Delayed project start up and Increased CAPEX	Low	Medium	15.1.1.1 Understand the legal process, prepare a detailed road map and create a dedicated team to address issues.	