

TABLE OF CONTENTS

(VOLUME 1)

EXECUTIVE SUMMARY	E.1
1.0 INTRODUCTION.....	1-1
1.1 PROJECT TITLE AND PROPOSER	1-2
1.2 PROJECT OVERVIEW	1-5
1.2.1 About the Sisson Deposit.....	1-5
1.2.2 Project Summary and Location	1-5
1.2.3 Project Schedule	1-9
1.3 PROJECT APPROACH AND COMMITMENTS	1-9
1.3.1 Project Team	1-10
1.3.2 Principles of Responsible Mineral Development	1-11
1.3.3 Project Governance and Oversight	1-11
1.3.4 Public, Stakeholder, and Aboriginal Engagement	1-11
1.3.5 Sustainable Development and the Precautionary Approach	1-13
1.3.6 Benefits to Canadians.....	1-15
1.4 PURPOSE AND ORGANIZATION OF THE EIA REPORT	1-17
1.4.1 Tables of Concordance.....	1-18
2.0 PROJECT PLANNING AND MANAGEMENT.....	2-1
2.1 ABOUT NORTHCLIFF RESOURCES	2-1
2.2 ABOUT TUNGSTEN AND MOLYBDENUM.....	2-1
2.2.1 Tungsten	2-1
2.2.2 Molybdenum	2-4
2.3 RATIONALE AND NEED FOR THE PROJECT	2-6
2.4 PROJECT PURPOSE.....	2-7
2.5 PROJECT ALTERNATIVES	2-7
2.5.1 Alternatives to the Project	2-7
2.5.2 Alternative Means of Carrying Out the Project	2-7
2.6 PROJECT PLANNING AND MANAGEMENT STRATEGIES	2-7
2.6.1 Design Standards and Codes	2-8
2.6.2 Environmental Protection Measures	2-8
2.6.3 Planning for Closure	2-9
2.6.4 Follow-up and Monitoring Program	2-10
2.7 THE ROLE OF THE EIA REPORT	2-10
3.0 PROJECT DESCRIPTION.....	3-1
3.1 OVERVIEW	3-1
3.1.1 Project Summary	3-1
3.1.2 Geographic Location.....	3-2
3.1.2.1 Property Ownership	3-2

3.1.2.2	Land Tenure.....	3-2
3.1.3	The Sisson Deposit.....	3-4
3.1.3.1	Property History	3-4
3.1.3.2	Ore Body.....	3-5
3.1.3.3	Geological Resource and Mine Life.....	3-7
3.1.4	Project Schedule	3-8
3.2	DESCRIPTION OF MAJOR PROJECT COMPONENTS AND FACILITIES	3-8
3.2.1	Development of Project Design Since April 2011	3-10
3.2.2	Open Pit Mine.....	3-12
3.2.2.1	Mine Development and Mining Methods	3-12
3.2.2.1.1	Open Pit Design	3-13
3.2.2.2	Blasting and Ore Extraction.....	3-14
3.2.2.3	Primary Crushing and Conveying to Ore Processing Plant.....	3-14
3.2.2.4	Mobile Equipment Fleet.....	3-15
3.2.2.5	Stockpiles and Storage Areas	3-15
3.2.3	Ore Processing Plant.....	3-15
3.2.3.1	Concentrator Process Facilities	3-16
3.2.3.2	Reclaim Water Clarification	3-18
3.2.3.3	Tailings Disposal	3-18
3.2.3.4	Ammonium Paratungstate (APT) Production Facilities	3-18
3.2.3.5	Reagent Storage	3-20
3.2.4	Mine Waste and Water Management.....	3-20
3.2.4.1	Mine Waste	3-20
3.2.4.2	Water Management.....	3-20
3.2.4.3	Tailings Storage Facility (TSF)	3-21
3.2.4.3.1	Overview	3-21
3.2.4.3.2	Elements of the TSF	3-22
3.2.4.3.3	Design Basis for the TSF	3-25
3.2.5	Ancillary Facilities	3-27
3.2.5.1	On-Site Buildings	3-27
3.2.5.1.1	Process Buildings	3-27
3.2.5.1.2	Administration Building	3-29
3.2.5.1.3	Laboratory Building	3-29
3.2.5.1.4	Truck Shop and Warehouse	3-30
3.2.5.1.5	Fuel Storage and Distribution	3-31
3.2.5.1.6	Site Mixed Explosives (SME) Plant and Storage.....	3-31
3.2.5.2	Process Control System.....	3-33
3.2.5.3	Access Roads	3-33
3.2.5.3.1	Existing Road Network	3-33
3.2.5.3.2	Realignment of the Fire Road	3-34
3.2.5.3.3	Site Access Road	3-34
3.2.5.3.4	Internal Site Roads	3-34
3.2.5.4	Water Supply and Distribution	3-34

3.2.5.4.1	Process Water	3-37
3.2.5.4.2	Fresh Water.....	3-37
3.2.5.4.3	Fire Protection	3-37
3.2.5.5	Sewage Treatment and Garbage Disposal.....	3-38
3.2.5.6	Security and Fencing	3-38
3.2.5.7	Power Supply	3-38
3.2.5.8	Quarry.....	3-45
3.2.5.9	Logistics and Transportation	3-45
3.3	ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT.....	3-45
3.3.1	Project Location and Mining Method.....	3-45
3.3.2	Alternative Locations for Processing Plant.....	3-45
3.3.3	Alternative Locations for Tailings Storage Facility	3-46
3.3.3.1	Tailings Management Objectives	3-46
3.3.3.2	Site Selection Criteria.....	3-46
3.3.3.3	Technically and Economically Feasible Alternatives.....	3-47
3.3.3.4	Evaluation of TSF Site Alternatives	3-48
3.3.3.5	Factors for Analyzing TSF Site Alternatives	3-55
3.3.3.5.1	Environmental Factors	3-55
3.3.3.5.2	Technical Factors	3-56
3.3.3.5.3	Economic Factors	3-58
3.3.3.5.4	Other Factors Considered.....	3-58
3.3.3.6	Scoring and Weighting the Factors in Comparing the TSF Site Alternatives	3-59
3.3.3.7	TSF Site Alternatives Analysis Results.....	3-59
3.3.4	Alternative Tailings Management Technologies.....	3-60
3.3.4.1	Conventional Slurry Tailings.....	3-60
3.3.4.2	Thickened (Paste) Tailings Disposal	3-61
3.3.4.3	Filtered Dry Stack Tailings Disposal	3-62
3.3.4.4	Summary.....	3-63
3.3.5	Alternative TSF Embankment Designs	3-63
3.3.6	Alternatives for Low Grade Ore Storage and Waste Rock Storage	3-65
3.3.7	Alternative Means and Routes for Transporting Personnel, Equipment, Supplies, Materials, and Products	3-65
3.3.8	Alternative Electrical Transmission Line Routes	3-66
3.3.8.1	Guiding Principles	3-66
3.3.8.2	Route Evaluation Methods	3-67
3.3.8.2.1	Data Sources.....	3-67
3.3.8.2.2	Rankings	3-67
3.3.8.3	Constraints.....	3-68
3.3.8.4	Potential Routes.....	3-69
3.3.8.5	Route Alternatives Analysis Results	3-70
3.3.9	Alternative Options for Decommissioning, Reclamation and Closure.....	3-77
3.3.10	Alternative Options for Fish Habitat Compensation.....	3-78

3.4	DESCRIPTION OF PROJECT PHASES AND ACTIVITIES	3-79
3.4.1	Construction	3-82
3.4.1.1	Site Preparation of Open Pit, Tailings Storage Facility (TSF), and Buildings and Ancillary Facilities	3-82
3.4.1.1.1	Surveying	3-83
3.4.1.1.2	Geotechnical Investigations	3-83
3.4.1.1.3	Clearing	3-83
3.4.1.1.4	Grubbing	3-83
3.4.1.1.5	Removal and Stockpiling of Topsoil and Overburden	3-83
3.4.1.1.6	Grading and Leveling	3-84
3.4.1.2	Physical Construction and Installation of Project Facilities	3-84
3.4.1.2.1	Construction of Surface Facilities	3-84
3.4.1.2.2	Quarrying, Aggregate Crushing, and Concrete Batch Plant	3-84
3.4.1.2.3	Development of Starter Pit and Initial Ore Stockpile	3-84
3.4.1.2.4	Establishment of Stockpiles and Storage Areas	3-85
3.4.1.2.5	Construction of Engineered Drainage and Diversion Channels	3-85
3.4.1.2.6	Loss of Bird and Sisson Brooks	3-85
3.4.1.2.7	TSF Preparation	3-85
3.4.1.2.8	Construction of TSF Embankments, Water Management Ponds, and Ponding of Start-up Water	3-88
3.4.1.2.9	Establishment of Water Management System	3-91
3.4.1.2.10	Equipment Installation	3-91
3.4.1.3	Physical Construction of Transmission Lines and Associated Infrastructure	3-91
3.4.1.4	Physical Construction of Realigned Fire Road, New Site Access Road, and Internal Site Roads	3-93
3.4.1.4.1	Construction of Watercourse Crossings	3-93
3.4.1.5	Implementation of Fish Habitat Compensation Initiatives	3-94
3.4.1.6	Emissions and Wastes	3-94
3.4.1.6.1	Air Contaminant Emissions	3-94
3.4.1.6.2	Sound and Vibration Emissions	3-98
3.4.1.6.3	Surface Run-Off	3-100
3.4.1.6.4	Solid Waste Disposal	3-100
3.4.1.7	Transportation	3-100
3.4.1.8	Employment and Expenditure	3-101
3.4.2	Operation	3-102
3.4.2.1	Mining	3-102
3.4.2.1.1	Open Pit Mine Operation	3-102
3.4.2.1.2	Drilling	3-103
3.4.2.1.3	Mining Schedule	3-106
3.4.2.1.4	Detailed Mine Plan	3-107
3.4.2.2	Ore Processing	3-107
3.4.2.2.1	Milling/Grinding	3-107

3.4.2.2.2	Flotation.....	3-115
3.4.2.2.3	Tungsten Concentrate Refining to APT.....	3-116
3.4.2.2.4	Packaging.....	3-120
3.4.2.2.5	Reagents	3-120
3.4.2.3	Mine Waste and Water Management	3-121
3.4.2.3.1	Tailings Storage Facility.....	3-121
3.4.2.3.2	Tailings Storage in TSF	3-122
3.4.2.3.3	Waste Rock Storage in TSF	3-123
3.4.2.3.4	Water Management in the TSF	3-123
3.4.2.3.5	Dewatering of the Open Pit.....	3-125
3.4.2.3.6	Collection and Management of Mine Contact Water	3-125
3.4.2.3.7	Surplus Water Treatment, Release and Monitoring.....	3-125
3.4.2.3.8	Fresh Water Supply	3-125
3.4.2.4	Linear Facilities Presence, Operation and Maintenance.....	3-125
3.4.2.4.1	Operation and Maintenance of the Transmission Lines	3-125
3.4.2.4.2	Operation and Maintenance of Site Access Road and Internal Site Roads.....	3-126
3.4.2.5	Emissions and Wastes	3-127
3.4.2.5.1	Air Contaminant Emissions.....	3-127
3.4.2.5.2	Sound and Vibration Emissions	3-135
3.4.2.5.3	Treated Surplus Water Release.....	3-136
3.4.2.5.4	Mining Waste Disposal	3-136
3.4.2.5.5	Non-Mining Solid Waste Disposal	3-137
3.4.2.6	Transportation.....	3-137
3.4.2.7	Employment and Expenditure	3-138
3.4.3	Decommissioning, Reclamation and Closure.....	3-139
3.4.3.1	Site Description at Closure.....	3-139
3.4.3.2	Activities during Decommissioning, Reclamation and Closure.....	3-140
3.4.3.2.1	Decommissioning	3-140
3.4.3.2.2	Reclamation.....	3-141
3.4.3.2.3	Closure	3-142
3.4.3.2.4	Post-Closure.....	3-143
3.4.3.3	Emissions and Wastes	3-143
3.4.3.4	Transportation.....	3-143
3.4.3.5	Employment and Expenditure	3-143

4.0	REGULATORY FRAMEWORK, SCOPING, AND CONSULTATION AND ENGAGEMENT.....	4-1
4.1	REGULATORY FRAMEWORK.....	4-1
4.1.1	Environmental Impact Assessment.....	4-1
4.1.1.1	Canadian Environmental Assessment Act.....	4-1
4.1.1.2	New Brunswick Environmental Impact Assessment Regulation	4-3
4.1.1.3	Harmonized Environmental Impact Assessment	4-4

4.1.1.4	Terms of Reference	4-5
4.1.2	Other Legislation Applicable to the Project	4-5
4.1.2.1	Federal.....	4-5
4.1.2.1.1	<i>Fisheries Act</i>	4-5
4.1.2.1.2	<i>Explosives Act</i>	4-6
4.1.2.2	Provincial	4-6
4.1.2.2.1	New Brunswick Clean Air Act – Air Quality Regulation	4-6
4.1.2.2.2	New Brunswick Clean Environment Act – Water Quality Regulation.....	4-6
4.1.2.2.3	New Brunswick Clean Water Act – Watercourse and Wetland Alteration Regulation	4-6
4.1.3	Other Approvals, Permits, and Authorizations.....	4-7
4.2	SCOPE OF ASSESSMENT	4-10
4.2.1	Scope of the Project	4-10
4.2.2	Factors to be Considered.....	4-11
4.2.2.1	Federal Environmental Assessment.....	4-11
4.2.2.2	Provincial Environmental Impact Assessment	4-12
4.2.3	Scope of Factors to be Considered.....	4-13
4.3	CONSULTATION AND ENGAGEMENT	4-13
4.3.1	Engagement Methods and Activities	4-14
4.3.1.1	Public and Stakeholder Engagement	4-14
4.3.1.1.1	Public and Stakeholder Engagement Tools	4-14
4.3.1.2	Aboriginal Engagement	4-23
4.3.1.2.1	Indigenous and Traditional Knowledge	4-24
4.3.1.2.2	Project Information and Traditional Knowledge Study Open House Events	4-24
4.3.1.2.3	First Nations Environmental Assessment Working Group (FNEAWG)	4-25
4.3.2	Summary of Key Issues Raised During Stakeholder Consultation and First Nations Engagement Activities	4-26
4.3.3	Assertions of Aboriginal and Treaty Rights to Northcliff by Aboriginal Peoples	4-33
4.3.4	Future Consultation and Engagement Plans.....	4-34
4.4	SELECTION OF VALUED ENVIRONMENTAL COMPONENTS	4-34
4.5	IDENTIFICATION OF OTHER PROJECTS OR ACTIVITIES THAT HAVE BEEN OR WILL BE CARRIED OUT	4-35
5.0	ENVIRONMENTAL IMPACT ASSESSMENT METHODS	5-1
5.1	OVERVIEW OF APPROACH	5-2
5.2	SCOPING OF THE ASSESSMENT	5-5
5.2.1	Rationale for Selection of Valued Environmental Component, Regulatory Context, and Issues Raised During Engagement.....	5-6
5.2.2	Selection of Environmental Effects and Measurable Parameters	5-6
5.2.3	Temporal Boundaries	5-7
5.2.4	Spatial Boundaries.....	5-7
5.2.5	Administrative and Technical Boundaries	5-8

5.2.6	Thresholds for Determining the Significance of Residual Environmental Effects	5-8
5.3	EXISTING CONDITIONS.....	5-9
5.4	ENVIRONMENTAL EFFECTS ASSESSMENT	5-9
5.4.1	Potential Project-VEC Interactions	5-9
5.4.2	Assessment of Project-Related Environmental Effects	5-10
5.4.2.1	Potential Project Environmental Effects Mechanisms.....	5-10
5.4.2.2	Mitigation of Project Environmental Effects	5-13
5.4.2.3	Characterization of Residual Project Environmental Effects	5-13
5.4.3	Assessment of Cumulative Environmental Effects	5-14
5.4.3.1	Identification of Other Projects or Activities	5-14
5.4.3.2	Screening for Cumulative Environmental Effects.....	5-15
5.4.3.3	Cumulative Environmental Effects Mechanisms.....	5-17
5.4.3.3.1	Use of Temporal Cases	5-17
5.4.3.4	Mitigation of Cumulative Environmental Effects.....	5-19
5.4.3.5	Characterization of Residual Cumulative Environmental Effects	5-19
5.5	DETERMINATION OF SIGNIFICANCE	5-19
5.5.1	Determination of Significance of Residual Project Environmental Effects	5-19
5.5.2	Determination of Significance of Residual Cumulative Environmental Effects.....	5-20
5.6	FOLLOW-UP OR MONITORING	5-20
5.7	POTENTIAL ACCIDENTS, MALFUNCTIONS AND UNPLANNED EVENTS	5-20
6.0	ENVIRONMENTAL SETTING (SUMMARY OF EXISTING CONDITIONS).....	6-1
6.1	OVERVIEW	6-1
6.2	HISTORICAL SETTING	6-2
6.2.1	Pre-Contact Period	6-2
6.2.2	Historic Period	6-3
6.2.2.1	Subsistence	6-4
6.2.2.2	Infrastructure.....	6-9
6.2.3	Present Day.....	6-10
6.3	BIOPHYSICAL SETTING	6-11
6.3.1	Physiography and Geology.....	6-11
6.3.1.1	Topography and Drainage.....	6-12
6.3.1.2	Surficial Geology and Soils	6-13
6.3.1.3	Bedrock Geology.....	6-17
6.3.1.3.1	Seismicity	6-18
6.3.2	Atmospheric Environment.....	6-23
6.3.2.1	Climate.....	6-23
6.3.2.2	Air Quality	6-26
6.3.2.3	Sound Quality	6-26
6.3.3	Water Resources	6-26
6.3.3.1	Local Watersheds	6-27
6.3.3.2	Surface Water Quality	6-27
6.3.3.3	Groundwater	6-27

6.3.4	Aquatic Environment.....	6-28
6.3.4.1	Water Quality	6-28
6.3.4.2	Sediment Quality	6-28
6.3.4.3	Fish and Fish Habitat	6-28
6.3.4.4	Fish Resource Use.....	6-33
6.3.5	Terrestrial, Vegetated, and Wetland Environment.....	6-33
6.3.5.1	Ecoregions	6-33
6.3.5.2	Vegetation and Rare Plants	6-34
6.3.5.3	Wetlands.....	6-34
6.3.5.4	Wildlife and Wildlife Habitat.....	6-39
6.3.5.4.1	Birds	6-40
6.3.5.5	Environmentally Sensitive Areas	6-40
6.4	SOCIOECONOMIC SETTING	6-43
6.4.1	Demographic Overview	6-43
6.4.1.1	Population	6-43
6.4.1.1.1	Population Distribution.....	6-44
6.4.1.1.2	Aboriginal Population.....	6-45
6.4.1.1.3	Visible Minorities.....	6-46
6.4.1.2	Education.....	6-46
6.4.1.3	Employment and Income.....	6-47
6.4.2	Economic Activity.....	6-48
6.4.3	Labour	6-48
6.4.4	Land and Resource Use	6-49
6.4.4.1	Local Planning	6-49
6.4.4.2	Industrial, Commercial, and Institutional Land Use.....	6-50
6.4.4.3	Residential Land Use	6-50
6.4.4.4	Recreation.....	6-50
6.4.5	Community Services and Infrastructure	6-50
6.4.5.1	Housing and Accommodation.....	6-50
6.4.5.1.1	Private Dwellings	6-50
6.4.5.1.2	Housing Starts	6-51
6.4.5.1.3	Affordable Housing	6-51
6.4.5.1.4	Temporary Accommodations	6-52
6.4.5.2	Public Infrastructure	6-52
6.4.5.2.1	Health Administration.....	6-52
6.4.5.2.2	Community Programs	6-55
6.4.5.2.3	Public Health	6-56
6.4.5.2.4	Extra-Mural Program	6-56
6.4.5.3	Emergency Services	6-56
6.4.5.3.1	Ambulance Services	6-56
6.4.5.3.2	Policing Services	6-57
6.4.5.3.3	Fire Protection	6-57
6.4.6	Heritage Resources	6-58

6.4.6.1	Built Heritage	6-58
6.4.6.2	Palaeontological Resources	6-61
6.4.6.3	Archaeological Resources	6-61
6.4.7	Transportation and Transportation Infrastructure	6-61
6.4.7.1	Road	6-61
6.4.7.2	Rail.....	6-62
6.4.7.3	Ports	6-63
6.4.7.4	Air	6-63
7.0	SUMMARY OF KEY PREDICTIVE STUDIES	7-1
7.1	AIR QUALITY MODELLING	7-3
7.1.1	Dispersion and Deposition Modelling Methodology.....	7-3
7.1.1.1	Model Selection.....	7-3
7.1.1.2	Model Inputs	7-3
7.1.1.2.1	Meteorological Data.....	7-4
7.1.1.2.2	Receptor Grid and Terrain Data.....	7-5
7.1.1.2.3	Point Source Characteristics and Emissions Data	7-5
7.1.1.2.4	Building Downwash	7-9
7.1.1.2.5	Model Outputs, Data Processing, and Interpretation of Results	7-10
7.1.1.3	Establishing Background Conditions	7-10
7.1.2	Dispersion and Deposition Modelling Results	7-12
7.1.2.1	Construction Phase.....	7-12
7.1.2.2	Operation	7-15
7.2	GREENHOUSE GAS (GHG) EMISSIONS	7-15
7.2.1	Project GHG Emissions Compared to New Brunswick, Canadian, and Global GHG Emissions	7-15
7.2.2	Project GHG Emissions Compared to Other Mining Operations in Canada	7-15
7.2.3	GHG Emissions Intensity from the Project	7-17
7.2.4	Loss of Carbon Dioxide Sinks	7-17
7.3	SOUND QUALITY AND VIBRATION MODELLING	7-19
7.3.1	Modelling Methodology	7-19
7.3.1.1	Sound	7-19
7.3.2	Modelling Results	7-25
7.3.2.1	Construction.....	7-25
7.3.2.1.1	Sound	7-25
7.3.2.1.2	Vibration	7-29
7.3.2.1.3	Sound and Vibration from Blasting.....	7-29
7.3.2.2	Operation	7-29
7.3.2.2.1	Sound	7-29
7.3.2.2.2	Vibration	7-33
7.3.2.2.3	Sound and Vibration from Blasting.....	7-33
7.4	FISH HABITAT LOSS AND COMPENSATION.....	7-35
7.4.1	Overview	7-35

7.4.2	Direct Habitat Loss	7-35
7.4.2.1	Methodology: Estimating Direct Habitat Loss	7-36
7.4.2.2	Results: Direct Habitat Loss	7-36
7.4.2.3	Summary of Direct Habitat Loss.....	7-41
7.4.3	Indirect Habitat Loss	7-41
7.4.3.1	Indirect Habitat Loss in Residual Watercourse Segments	7-42
7.4.3.2	Indirect Habitat Loss in Napadogan Brook	7-44
7.4.3.3	Indirect Habitat Loss in McBean Brook.....	7-52
7.4.3.4	Summary of Indirect Habitat Loss	7-55
7.4.4	Total Estimated Fish Habitat Loss	7-56
7.4.5	Fish Habitat Compensation.....	7-56
7.4.5.1	Regulatory Overview	7-56
7.4.5.2	Estimated Amount of Fish Habitat Compensation Required	7-57
7.4.5.3	Fish Habitat Compensation Opportunities	7-57
7.4.5.4	Summary of Conceptual Fish Habitat Compensation Plan	7-61
7.5	GEOCHEMICAL CHARACTERIZATION OF WASTE MATERIALS	7-63
7.5.1	ML/ARD Assessment Methods	7-63
7.5.1.1	Geological Context for ML/ARD Potential.....	7-63
7.5.1.2	Barren Rock, Pit Walls, and Mid-Grade Ore	7-64
7.5.1.3	Quarry Rock (Borrow)	7-65
7.5.1.4	Tailings	7-65
7.5.1.5	QA/QC Measures.....	7-66
7.5.1.6	ARD Potential Classification Criteria	7-66
7.5.2	Sisson Waste Material ML/ARD Characterization	7-66
7.5.2.1	Barren Rock Characterization	7-66
7.5.2.2	Pit Walls Characterization	7-68
7.5.2.3	Mid-Grade Ore Characterization	7-68
7.5.2.4	Quarry Rock Characterization	7-69
7.5.2.5	Tailings ML/ARD Potential	7-69
7.5.3	Drainage Chemistry Predictions.....	7-70
7.6	WATER QUALITY AND WATER BALANCE MODELLING	7-73
7.6.1	Water Management Plan	7-73
7.6.1.1	General	7-73
7.6.1.1.1	Water Management during Construction.....	7-73
7.6.1.1.2	Water Management during Operation	7-73
7.6.1.1.3	Water Management during Decommissioning, Reclamation and Closure	7-74
7.6.2	Operational Water Balance Model	7-76
7.6.2.1	General	7-76
7.6.2.2	Model Inputs and Assumptions	7-77
7.6.2.2.1	Climatic Conditions	7-77
7.6.2.3	Water Balance Results.....	7-80
7.6.3	Predictive Water Quality Model.....	7-81

7.6.3.1	Introduction and Modelling Objectives	7-81
7.6.3.2	Figure 7.6.3 Water Quality Model Nodes Close-Up	7-83
7.6.3.3	Project Timeline	7-84
7.6.3.3.1	Operation (Years 1-27)	7-84
7.6.3.3.2	Closure (Years 28-39)	7-84
7.6.3.3.3	Post-Closure (Years 40 Onward)	7-85
7.6.3.4	Mass Balance and Water Quality Model Description	7-85
7.6.3.4.1	Water Quality Calculations	7-85
7.6.3.4.2	Parameters	7-86
7.6.3.5	Inputs and Assumptions	7-86
7.6.3.5.1	General	7-86
7.6.3.5.2	Climate, Hydrology, and Groundwater	7-87
7.6.3.5.3	Geochemical Source Terms	7-87
7.6.3.5.4	Water Treatment Plant	7-88
7.6.3.5.5	Baseline Water Quality	7-88
7.6.3.6	Results	7-90
7.6.3.6.1	General	7-90
7.6.3.6.2	Guidelines for Comparison	7-91
7.6.3.6.3	Results	7-92
7.7	HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT (HHERA)	7-113
7.7.1	Human Health and Ecological Risk Assessment Methodology	7-114
7.7.2	Project Site Characterization and Environmental Quality Model Predictions	7-117
7.7.2.1	Contaminants of Potential Concern (COPCs)	7-118
7.7.2.1.1	COPC Identification	7-118
7.7.2.1.2	COPC Screening Based on Soil Quality Guidelines	7-121
7.7.2.1.3	COPC Screening Based on Relative Toxic Potential of Ore	7-121
7.7.2.1.4	COPC Screening Based on Water Quality Guidelines	7-122
7.7.2.1.5	Summary of COPC Screening	7-122
7.7.2.2	Existing and Predicted Future Contaminant Concentrations in the Environment	7-125
7.7.2.2.1	Air	7-127
7.7.2.2.2	Soil	7-129
7.7.2.2.3	Surface Water	7-130
7.7.2.2.4	Groundwater	7-131
7.7.2.2.5	Vegetation	7-131
7.7.2.2.6	Soil Invertebrates	7-133
7.7.2.2.7	Small Mammals	7-134
7.7.2.2.8	Game	7-135
7.7.2.2.9	Fish Tissue	7-137
7.7.2.2.10	Sediment	7-138
7.7.2.2.11	Benthic Invertebrates	7-139
7.7.3	Human Health Risk Assessment (HHRA)	7-140
7.7.3.1	Problem Formulation	7-140

7.7.3.1.1	Receptor Identification and Characterization.....	7-140
7.7.3.1.2	Exposure Pathway Screening and Conceptual Site Model.....	7-143
7.7.3.2	Hazard Assessment	7-146
7.7.3.2.1	Toxicological Reference Values (TRVs).....	7-146
7.7.3.2.2	Selection of TRVs.....	7-147
7.7.3.3	Exposure Assessment.....	7-150
7.7.3.3.1	Exposure Point Concentrations (EPCs)	7-150
7.7.3.3.2	Calculation of Average Daily Dose.....	7-150
7.7.3.4	Risk Characterization	7-151
7.7.3.4.1	Non-Cancer Causing Contaminants	7-151
7.7.3.4.2	Cancer-Causing Contaminants	7-152
7.7.3.4.3	Risk Characterization Results	7-152
7.7.3.4.3.1	Human Health Risks via Inhalation – Criteria Air Contaminants (CACs) ...	7-152
7.7.3.4.3.2	Human Health Risks via Inhalation – Non-Criteria Air Contaminants (non-CACs).....	7-154
7.7.3.4.3.3	Human Health Risks via Ingestion and Dermal Contact with Soil.....	7-156
7.7.3.4.3.4	Human Health Risks via Ingestion of Water	7-157
7.7.3.4.3.5	Human Health Risks via Ingestion of Food	7-159
7.7.3.5	Uncertainty Analysis.....	7-164
7.7.3.5.1	Uncertainties in Toxicological Information.....	7-164
7.7.3.5.2	Sensitive Populations	7-164
7.7.3.5.3	Uncertainties in Exposure Assessment.....	7-165
7.7.3.5.4	Receptor Characteristics.....	7-165
7.7.3.5.5	Uncertainties in Risk Characterization	7-165
7.7.4	Ecological Health Assessment (ERA)	7-166
7.7.4.1	Ecological Receptor Identification and Characterization	7-166
7.7.4.2	Ecological Receptor Profiles	7-168
7.7.4.2.1	Masked Shrew.....	7-168
7.7.4.2.2	Meadow Vole.....	7-168
7.7.4.2.3	Snowshoe Hare	7-169
7.7.4.2.4	Red Fox.....	7-169
7.7.4.2.5	American Mink.....	7-169
7.7.4.2.6	Moose.....	7-170
7.7.4.2.7	Black Bear	7-170
7.7.4.2.8	American Robin	7-171
7.7.4.2.9	Red-tailed Hawk	7-171
7.7.4.2.10	American Black Duck.....	7-171
7.7.4.2.11	Belted Kingfisher	7-172
7.7.4.2.12	Ruffed Grouse	7-172
7.7.4.2.13	Bald Eagle	7-173
7.7.4.2.14	Soil Invertebrates and Terrestrial Plants	7-173
7.7.4.2.15	Benthic Invertebrates.....	7-173
7.7.4.3	Ecological Receptor Locations	7-174

7.7.4.3.1	Exposure Pathway Screening	7-174
7.7.4.4	Exposure Assessment.....	7-178
7.7.4.4.1	Calculation of Average Daily Dose.....	7-178
7.7.4.5	Hazard Assessment	7-178
7.7.4.6	Toxicological Reference Values	7-179
7.7.4.7	Ecological Risk Characterization	7-180
7.7.4.7.1	Risk Characterization for Terrestrial Ecological Receptors.....	7-181
7.7.4.7.2	Risk Characterization for Aquatic Ecological Receptors.....	7-192
7.7.4.7.3	Risk Characterization for Semi-Aquatic Ecological Receptors	7-196
7.7.4.7.4	Risk Characterization for Soil Invertebrates and Terrestrial Plants.....	7-201
7.7.4.7.5	Risk Characterization for the Sediment Community	7-202
7.7.4.8	Ecological Risk Uncertainty Assessment.....	7-206
7.7.4.8.1	Habitat Survey and Receptor Selection	7-206
7.7.4.8.2	Utilization of Receptors as Sentinels to Represent Other Organisms.....	7-206
7.7.4.8.3	Receptor-Specific Toxicity Data	7-206
7.7.4.8.4	Food Chain Interactions.....	7-207
7.7.4.8.5	Wildlife Exposure Factors	7-207
7.7.4.8.6	Measurement Endpoints from the Toxicity Data.....	7-207
7.7.4.8.7	Modelling Assumptions	7-207
7.7.5	Summary	7-208

LIST OF TABLES**(VOLUME 1)**

Table E.1	Summary of the Significance of Residual Environmental Effects	E-7
Table 1.3.1	Project Team – Sisson Project	1-10
Table 2.2.1	Estimated Tungsten Mine Production by Major Producing Country (2012)	2-3
Table 2.2.2	Estimated Molybdenum Mine Production by Major Producing Country (2012)	2-5
Table 3.1.1	Mineral Claims Held By Northcliff	3-4
Table 3.1.2	Mineral Resource Estimate	3-7
Table 3.2.1	Mobile Mining Equipment	3-15
Table 3.3.1	Results of TSF Site Alternatives Analysis	3-59
Table 3.3.2	Potential Route Ranking Calculation Example	3-68
Table 3.3.3	Electrical Transmission Line Route Alternatives Analysis Results	3-70
Table 3.4.1	Description of Project Phases, Activities, and Physical Works	3-79
Table 3.4.2	TSF Staging	3-89
Table 3.4.3	Heavy Equipment Used – Construction	3-95
Table 3.4.4	Criteria Air Contaminant (CAC) Emissions – Fuel Combustion in On-site Construction Equipment – Construction	3-95
Table 3.4.5	Greenhouse Gas (GHG) Emissions – Fuel Combustion in On-site Construction Equipment – Construction	3-96
Table 3.4.6	Criteria Air Contaminant (CAC) Emissions – Vehicle Fuel Combustion – Construction	3-97
Table 3.4.7	Greenhouse Gas (GHG) Emissions – Vehicles Fuel Combustion – Construction	3-97
Table 3.4.8	Particulate Matter from Unpaved Roads – Construction	3-98
Table 3.4.9	Sound Inventory – Construction	3-99
Table 3.4.10	Project Traffic – Construction	3-99
Table 3.4.11	Typical Equipment Vibration (Peak Particle Velocity) – Construction	3-99
Table 3.4.12	Average Daily Traffic (ADT) Generated During Construction	3-101
Table 3.4.13	Construction Expenditures	3-102
Table 3.4.14	Mining Schedule by Phase and Year, and Total Kilotonnes (kt) Mined	3-106
Table 3.4.15	Ore Processing Reagents	3-120
Table 3.4.16	Heavy Equipment Used – Operation	3-128
Table 3.4.17	Criteria Air Contaminant (CAC) Emissions – Fuel Combustion in Mining and Support Equipment – Operation	3-128
Table 3.4.18	Greenhouse Gas (GHG) Emissions – Fuel Combustion in Mining and Support Equipment – Operation	3-129
Table 3.4.19	Criteria Air Contaminant (CAC) Emissions – Vehicle Fuel Combustion – Operation	3-129
Table 3.4.20	Greenhouse Gas (GHG) Emissions – Vehicle Fuel Combustion – Operation	3-130
Table 3.4.21	Particulate Matter Emissions – Primary Crusher – Operation	3-130
Table 3.4.22	Point Source Emissions – APT Plant – Operation	3-131

Table 3.4.23	Point Source Criteria Air Contaminant (CAC) Emissions – Package Boiler – Operation	3-131
Table 3.4.24	Point Source Metals Emissions – Package Boiler – Operation	3-131
Table 3.4.25	Point Source Greenhouse Gas (GHG) Emissions – Package Boiler – Operation	3-131
Table 3.4.26	Criteria Air Contaminant (CAC) Emissions – Explosive Detonation – Operation	3-132
Table 3.4.27	Particulate Matter Emissions – Material Handling and Transfer Points – Operation	3-132
Table 3.4.28	Particulate Matter from Unpaved Roads – Operation	3-133
Table 3.4.29	Particulate Matter Emissions – Crushed Ore Stockpile – Operation	3-133
Table 3.4.30	Particulate Matter Emissions – TSF Beaches – Operation	3-134
Table 3.4.31	Average Trace Metals Concentration in the Ore.....	3-134
Table 3.4.32	Sound Inventory – Operation	3-135
Table 3.4.33	Project Traffic – Operation	3-136
Table 3.4.34	Average Daily Traffic (ADT) Generated During Operation.....	3-137
Table 3.4.35	Total Operating Expenditures.....	3-138
Table 3.4.36	Operating Expenditures by Year	3-138
Table 4.1.1	<i>Law List Regulations</i> Triggers for the Project	4-2
Table 4.1.2	Potential Legislation and Permits, Approvals, and Authorizations That May Apply to the Project.....	4-7
Table 4.3.1	Summary of FNEAWG Meetings Held.....	4-26
Table 4.3.2	Summary of Key Issues or Concerns Identified by the Public and Stakeholder Groups During Consultation and Engagement Activities, and Associated Responses or Actions Taken	4-27
Table 4.3.3	Summary of Key Issues or Concerns Identified by Aboriginal Groups During Consultation and Engagement Activities, and Associated Responses or Actions Taken	4-30
Table 4.5.1	Other Projects or Activities for Consideration of Cumulative Environmental Effects.....	4-36
Table 5.2.1	Example: Measurable Parameters for (<i>Name of VEC</i>)	5-6
Table 5.4.1	Example: Potential Project Environmental Effects to the (<i>Name of VEC</i>)	5-9
Table 5.4.2	Example: Summary of Residual Project-Related Environmental Effects on (<i>Name of VEC</i>).....	5-11
Table 5.4.3	Criteria for Identification of Other Projects or Activities That Have Been or Will Be Carried Out, for the Cumulative Environmental Effects Assessment	5-14
Table 5.4.4	Example: Potential Cumulative Environmental Effects to the (<i>Name of VEC</i>).....	5-16
Table 5.4.5	Example: Summary of Residual Cumulative Environmental Effects on the (<i>Name of VEC</i>).....	5-18
Table 5.7.1	Example: Potential Interactions between VECs and (<i>Accident / Malfunction / Unplanned Event 1</i>)	5-21

Table 6.3.1	Summary of Bedrock Geology Information	6-17
Table 6.3.2	Climate Normals – Fredericton Airport (1971-2001)	6-25
Table 6.3.3	Species At Risk and Species of Conservation Concern with Records Near the Project	6-40
Table 6.4.1	Population and Population Change: New Brunswick, York County, and Carleton County, 2006-2011	6-43
Table 6.4.2	Aboriginal and Visible Minority Population: New Brunswick, York County, and Carleton County, 2006	6-46
Table 6.4.3	Population of Selected New Brunswick Aboriginal Communities (Maliseet), 2012.....	6-46
Table 6.4.4	Incomes in New Brunswick, York County, and Carleton County, 2006	6-47
Table 6.4.5	Labour Force Characteristics: New Brunswick, York County, and Carleton County, 2006	6-49
Table 7.1.1	Dispersion Model Input Parameters – Construction Phase, Point Sources.....	7-6
Table 7.1.2	Dispersion Model Input Parameters – Construction Phase, Volume Sources.....	7-6
Table 7.1.3	Dispersion Model Input Parameters – Operation Phase, Point Sources	7-9
Table 7.1.4	Dispersion Model Input Parameters – Operation Phase, Area Sources.....	7-9
Table 7.1.5	Dispersion Model Input Parameters – Operation Phase, Volume Sources	7-9
Table 7.1.6	Ambient Background Criteria Air Contaminants (CAC) Concentrations Used for Modelling	7-11
Table 7.1.7	Ambient Background Non-Criteria Air Contaminant (Non-CAC) Concentrations Used for Modelling	7-12
Table 7.1.8	Dispersion Modelling Results – Maximum Predicted Ground-Level Concentrations of Criteria Air Contaminants (CACs) – Construction Phase – On-site Project Sources	7-13
Table 7.1.9	Dispersion Modelling Results – Maximum Predicted Ground-Level Concentrations of Criteria Air Contaminants (CACs) – Construction Phase – Off-site Access Road Dust Emissions	7-14
Table 7.1.10	Dispersion Modelling Results – Maximum Predicted Ground-Level Concentrations of Criteria Air Contaminants (CACs) – Operation Phase – On- Site Project Sources.....	7-16
Table 7.1.11	Dispersion Modelling Results – Maximum Predicted Ground-Level Concentrations of Criteria Air Contaminants (CACs) – Operation Phase – Off- site Access Road Dust Emissions	7-25
Table 7.1.12	Dispersion Modelling Results – Maximum Predicted Ground-Level Concentrations of Non Criteria Air Contaminants (Non-CACs) – Operation Phase.....	7-26
Table 7.1.13	Dispersion Modelling Results – Maximum Predicted 10-minute Ground-level Concentrations of Odorous Compounds – Operation Phase – Project Alone	7-1
Table 7.2.1	Comparison of Estimated Project GHG Emissions to Provincial and Global Totals.....	7-15
Table 7.2.2	Summary of Reported GHG Emissions from Canadian Mines - 2010	7-16
Table 7.3.1	Construction Sound Modelling Results – 1-h L _{eq}	7-26

Table 7.3.2	Construction Sound Modelling Results – Percent Highly Annoyed	7-26
Table 7.3.3	Operation Sound Modelling Results – 1-h L _{eq}	7-30
Table 7.3.4	Operation Sound Modelling Results – Percent Highly Annoyed	7-30
Table 7.3.5	Estimated Sound Pressure Levels and Peak Particle Velocities Associated with Blasting.....	7-33
Table 7.4.1	Direct Habitat Loss of Watercourses in the PDA	7-39
Table 7.4.2	Reduction in Watershed Area for Residual Stream Segments	7-42
Table 7.4.3	Indirect Loss to Residual Stream Segments.....	7-43
Table 7.4.4	Flow Scenarios for HADD Modelling in Lower Napadogan Brook.....	7-44
Table 7.4.5	Scenario Stream Flow Rates (m ³ /s) under Baseline Conditions (Pre-development) Case	7-50
Table 7.4.6	Scenario Stream Flow Rates (m ³ /s) under Future Conditions (Development) Case	7-50
Table 7.4.7	Reduction of Stream Flow Rates (m ³ /s) and Percentage Reductions (%) of Future Conditions Compared to Baseline Conditions	7-50
Table 7.4.8	Estimated Total Reductions to Habitat Areas for Various Flow Scenarios	7-52
Table 7.4.9	Predicted Flow Reductions in McBean Brook Watershed.....	7-55
Table 7.4.10	Summary of Indirect Loss by Category.....	7-56
Table 7.4.11	Summary of Habitat Loss by Category	7-56
Table 7.5.1	Summary of Major Rock Types Expected in Barren Rock at Sisson	7-63
Table 7.6.1	Operational Water Balance Flow Path Descriptions	7-77
Table 7.6.2	Average Hydrometeorological Inputs	7-77
Table 7.6.3	Summary of Water Balance Model Timeline.....	7-81
Table 7.6.4	Applicable Water Quality Guidelines and Regulations	7-91
Table 7.7.1	Summary of Non-CAC Contaminant of Potential Concern Screening.....	7-123
Table 7.7.2	Maximum 1-hour COPC Concentrations in Ambient Air (mg/m ³).....	7-127
Table 7.7.3	Maximum 24-hour COPC Concentrations in Ambient Air (mg/m ³).....	7-128
Table 7.7.4	Maximum Annual Average COPC Concentrations in Ambient Air (mg/m ³)	7-128
Table 7.7.5	Concentrations in Soil at HHERA Grid G8 (mg/kg dry weight)	7-129
Table 7.7.6	Concentrations in Surface Water at HHERA Grid G8 (mg/L)	7-130
Table 7.7.7	Concentrations in Browse at HHERA Grid G8 (mg/kg wet weight)	7-132
Table 7.7.8	Concentrations in Forage at HHERA Grid G8 (mg/kg wet weight)	7-132
Table 7.7.9	Concentrations in Berries at HHERA Grid G8 (mg/kg wet weight)	7-133
Table 7.7.10	Concentrations in Soil Invertebrates at HHERA Grid G8 (mg/kg wet weight)	7-134
Table 7.7.11	Concentrations in Small Mammals at HHERA Grid G8 (mg/kg wet weight)	7-135
Table 7.7.12	Concentrations in Wild Game at HHERA Grid G8 (mg/kg wet weight).....	7-136
Table 7.7.13	Concentrations in Whole Fish Tissues at HHERA Grid G8 (mg/kg wet weight) ...	7-137
Table 7.7.14	Concentrations in Fish Carcass Tissues at HHERA Grid G8 (mg/kg wet weight)	7-138
Table 7.7.15	Concentrations in Sediment at HHERA Grid G8 (mg/kg dry weight).....	7-139
Table 7.7.16	Concentrations in Benthic Invertebrates at HHERA Grid G8 (mg/kg wet weight)	7-139

Table 7.7.17	Human Receptor Characteristics.....	7-141
Table 7.7.18	Rationale for Exposure Pathway Inclusion in the HHRA.....	7-143
Table 7.7.19	Acute Inhalation Toxicological Reference Values	7-147
Table 7.7.20	Chronic Inhalation Toxicological Reference Values (Non-Carcinogens)	7-148
Table 7.7.21	Chronic Inhalation Toxicological Reference Values (Carcinogens).....	7-150
Table 7.7.22	Maximum Acute and Chronic Inhalation Human Health Risks – Criteria Air Contaminants (CACs)	7-153
Table 7.7.23	Acute and Chronic Inhalation Health Risks at Selected Receptor Locations – Criteria Air Contaminants (CACs).....	7-153
Table 7.7.24	Maximum Acute and Chronic Inhalation Human Health Risks – Non-Criteria Air Contaminants (non-CACs).....	7-154
Table 7.7.25	Acute and Chronic Inhalation Human Health Risks at Selected Receptor Locations – Non-Criteria Air Contaminants (non-CACs)	7-155
Table 7.7.26	Maximum Carcinogenic Human Health Risks Associated with Inhalation	7-156
Table 7.7.27	Maximum Non-Carcinogenic Human Health Risks to Toddlers Associated with Soil Exposure.....	7-156
Table 7.7.28	Maximum Carcinogenic Human Health Risks Associated with Soil Exposure	7-157
Table 7.7.29	Maximum Non-Carcinogenic Human Health Risks Associated with Ingestion of Water	7-158
Table 7.7.30	Maximum Carcinogenic Human Health Risks Associated with Ingestion of Water	7-158
Table 7.7.31	Maximum Non-Carcinogenic Human Health Risks Associated with Ingestion of Food.....	7-159
Table 7.7.32	Maximum Non-Carcinogenic Human Health Risks Associated with Ingestion of Game, Fish, and Vegetation.....	7-159
Table 7.7.33	Maximum Carcinogenic Health Risks Associated with Ingestion of Food	7-160
Table 7.7.34	Maximum Carcinogenic Human Health Risks Associated with Ingestion of Game, Fish, and Vegetation.....	7-161
Table 7.7.35	Ecological Receptors Identified as Key Indicators of Risk	7-167
Table 7.7.36	Rationale for Exposure Pathway Inclusion in the ERA	7-174
Table 7.7.37	Maximum Overall Risk Quotients for the Masked Shrew	7-181
Table 7.7.38	Maximum Overall Risk Quotients for the Meadow Vole	7-182
Table 7.7.39	Maximum Overall Risk Quotients for the Snowshoe Hare	7-182
Table 7.7.40	Maximum Overall Risk Quotients for the Red Fox	7-183
Table 7.7.41	Maximum Overall Risk Quotients for the Moose.....	7-183
Table 7.7.42	Maximum Overall Risk Quotients for the Black Bear	7-184
Table 7.7.43	Maximum Overall Risk Quotients for the American Robin	7-184
Table 7.7.44	Maximum Overall Risk Quotients for the Red-tailed Hawk	7-185
Table 7.7.45	Maximum Overall Risk Quotients for the Ruffed Grouse	7-185
Table 7.7.46	Maximum Overall Risk Quotients for the Bald Eagle	7-186
Table 7.7.47	Maximum Overall Risk Quotients for the Mink.....	7-192
Table 7.7.48	Maximum Overall Risk Quotients for the American Black Duck.....	7-195
Table 7.7.49	Maximum Overall Risk Quotients for the Belted Kingfisher.....	7-195

Table 7.7.50	Maximum Overall Risk Quotients for Soil Invertebrates.....	7-201
Table 7.7.51	Maximum Overall Risk Quotients for Terrestrial Plants	7-202
Table 7.7.52	Comparison Sediment Concentrations to Canadian Sediment Quality Guidelines	7-205

LIST OF FIGURES**(VOLUME 1)**

Figure E.1	Project Location	E-3
Figure 1.1.1	Project Location	1-3
Figure 1.2.1	Project Development Area (PDA).....	1-7
Figure 1.3.1	Northcliff's Principles of Responsible Mineral Development	1-12
Figure 2.2.1	Primary Uses for Tungsten in Selected Industrialized Nations	2-2
Figure 2.2.2	Worldwide Tungsten Production and Demand	2-3
Figure 2.2.3	Primary Molybdenum Uses	2-4
Figure 2.2.4	Major Molybdenum Producing Regions.....	2-5
Figure 3.1.1	Land Tenure Map, Sisson Project	3-3
Figure 3.1.2	Simplified Geology Map of the Sisson Deposit Area.....	3-6
Figure 3.2.1	Site Layout.....	3-9
Figure 3.2.2	Overview of Major Changes in the Sisson Mine Layout Since April 2011	3-11
Figure 3.2.3	Cross-Sectional Schematic of Open Pit Wall with Geotechnical Design Parameters	3-13
Figure 3.2.4	Open Pit Phase Design.....	3-14
Figure 3.2.5	Simplified Block Diagram of the Ore Concentrator Plant	3-17
Figure 3.2.6	Simplified Block Diagram of the Ammonium Paratungstate (APT) Plant Process.....	3-19
Figure 3.2.7	Typical Cross-Section of TSF Embankments	3-23
Figure 3.2.8	Process Plant Location, and Locations of Site Access Road and Internal Site Roads	3-28
Figure 3.2.9	Schematic of Administration Building	3-29
Figure 3.2.10	Schematic of Laboratory Building.....	3-30
Figure 3.2.11	Schematic of Truck Shop and Warehouse	3-30
Figure 3.2.12	Conceptual Site Mixed Explosives (SME) Facility Layout.....	3-32
Figure 3.2.13	Primary Site Access (PSA) Route and Secondary Site Access (SSA) Route	3-35
Figure 3.2.14	Location of Realigned Fire Road.....	3-39
Figure 3.2.15	Alignments for the New 138 kV Transmission Line and Relocated 345 kV Transmission Line	3-41
Figure 3.2.16	Typical Wood Pole H-frame Structure	3-44
Figure 3.3.1	Location of Alternatives for the TSF	3-49
Figure 3.3.2	TSF Alternative 1b	3-51
Figure 3.3.3	TSF Alternative 1c.....	3-53
Figure 3.3.4	TSF Construction Methods.....	3-64
Figure 3.3.5	Potential Route A for an Electrical Transmission Line	3-71
Figure 3.3.6	Potential Route B for an Electrical Transmission Line	3-73
Figure 3.3.7	Potential Route C for an Electrical Transmission Line	3-75
Figure 3.4.1	End of Period (EoP) Map, Pre-production Year -1 (Mill Start-up).....	3-108
Figure 3.4.2	End of Period (EoP) Map, Production Year 1	3-109
Figure 3.4.3	End of Period (EoP) Map, Production Year 5	3-110
Figure 3.4.4	End of Period (EoP) Map, Production Year 10	3-111

Figure 3.4.5	End of Period (EoP) Map, Production Year 20	3-112
Figure 3.4.6	End of Period (EoP) Map, Production Year 27 (Life-of-Mine)	3-113
Figure 3.4.7	Simplified Concentrator Process Flowsheet	3-114
Figure 3.4.8	Simplified Ammonium Paratungstate (APT) Plant Flowsheet	3-117
Figure 3.4.9	Schematic of Mine Operational Water Balance	3-124
Figure 5.1.1	Summary of Stantec EIA Methodology.....	5-4
Figure 6.3.1	Eastern Physiographic Regions	6-12
Figure 6.3.2	Major Soil Units near the Project	6-15
Figure 6.3.3	Bedrock Geology	6-19
Figure 6.3.4	Historical Seismicity of New Brunswick and Surrounding Regions	6-21
Figure 6.3.5	Earthquakes within New Brunswick, September 2011-September 2012	6-23
Figure 6.3.6	Nashwaak River Watershed and its Sub-watersheds	6-29
Figure 6.3.7	Watersheds near the Project.....	6-31
Figure 6.3.8	Ecoregions of New Brunswick.....	6-35
Figure 6.3.9	Wetlands near the Project	6-37
Figure 6.3.10	Terrestrial Habitats near the Project	6-41
Figure 6.4.1	Population by Gender and Age Group, New Brunswick, 2011	6-44
Figure 6.4.2	First Nations Communities in New Brunswick	6-45
Figure 6.4.3	Education Level: New Brunswick, 2006.....	6-47
Figure 6.4.4	New Brunswick Health Networks.....	6-53
Figure 6.4.5	RCMP Jurisdictions, New Brunswick.....	6-59
Figure 6.4.6	New Brunswick Railways	6-62
Figure 7.1.1	Receptor Grid for Dispersion and Deposition Modelling	7-7
Figure 7.1.2	Maximum Predicted 1-Hour Ground-Level Concentrations of Nitrogen Dioxide – Construction Phase – Project Plus Background	7-17
Figure 7.1.3	Maximum Predicted 24-Hour Ground-Level Concentrations of Total Particulate Matter – Construction Phase – Project Plus Background.....	7-19
Figure 7.1.4	Maximum Predicted 24-Hour Ground-Level Concentrations of Particulate Matter Less Than 10 Microns – Construction Phase – Project Alone.....	7-21
Figure 7.1.5	Maximum Predicted 24-Hour Ground-Level Concentrations of Particulate Matter Less Than 2.5 Microns– Construction Phase – Project Plus Background.....	7-23
Figure 7.1.6	Maximum Predicted 1-Hour Ground-Level Concentrations of Nitrogen Dioxide – Operation Phase – Project Plus Background.....	7-3
Figure 7.1.7	Maximum Predicted 24-Hour Ground-Level Concentrations of Total Particulate Matter – Operation Phase – Project Plus Background.....	7-5
Figure 7.1.8	Maximum Predicted 24-Hour Ground-Level Concentrations of Particulate Matter Less Than 10 Microns – Operation Phase – Project Alone.....	7-7
Figure 7.1.9	Maximum Predicted 24-Hour Ground-Level Concentrations of Particulate Matter Less Than 2.5 Microns – Operation Phase – Project Plus Background.....	7-9
Figure 7.1.10	Maximum Predicted 24-Hour Ground-Level Concentrations of Cadmium – Operation Phase – Project Plus Background.....	7-11
Figure 7.1.11	Maximum Predicted 24-Hour Ground-Level Concentrations of Naphthalene – Operation Phase – Project Plus Background.....	7-13

Figure 7.3.1	Noise Sensitive Receptor Locations	7-21
Figure 7.3.2	Sisson Project: Primary Site Access (PSA) Road and Secondary Site Access (SSA) Road.....	7-23
Figure 7.3.3	Sound Pressure Level Estimates – Construction Phase.....	7-27
Figure 7.3.4	Sound Pressure Level Estimates – Operation Phase	7-31
Figure 7.4.1	Location of Directly Affected Fish Habitat and Catchment Areas of Residual Stream Segments	7-37
Figure 7.4.2	Location of Developed Flow Statistics	7-47
Figure 7.4.3	Sample Transect Cross-Section from HEC-RAS Model	7-49
Figure 7.4.4	Simulated Change in Wetted Perimeter for a Sample Transect.....	7-51
Figure 7.4.5	Location of Stream Flow Estimation Node in McBean Brook Watershed.....	7-53
Figure 7.4.6	Location of Potential Large-Scale Fish Habitat Compensation Opportunities	7-59
Figure 7.5.1	Carbonate NP Versus Sulphide AP	7-66
Figure 7.5.2	Humidity Cell Leachate pH for Barren Rock and Mid-Grade Ore Samples	7-67
Figure 7.5.3	Pit wall NPRs by Drill Hole and Depth	7-68
Figure 7.5.4	Tailings NP Versus AP Comparison	7-69
Figure 7.6.1	Operational Water Balance Model Schematic Flow Sheet.....	7-76
Figure 7.6.2	Water Quality Model Nodes	7-82
Figure 7.6.3	Water Quality Model Nodes Close-Up.....	7-83
Figure 7.6.4	Predicted Sodium Concentrations at Downstream Nodes by Project Phase.....	7-94
Figure 7.6.5	Predicted Manganese Concentrations at Downstream Nodes by Project Phase.....	7-96
Figure 7.6.6	Predicted Fluoride Concentrations at Downstream Nodes by Project Phase	7-98
Figure 7.6.7	Predicted Aluminum Concentrations at Downstream Nodes by Project Phase....	7-100
Figure 7.6.8	Predicted Arsenic Concentrations at Downstream Nodes by Project Phase.....	7-102
Figure 7.6.9	Predicted Cadmium Concentrations at Downstream Nodes by Project Phase ...	7-104
Figure 7.6.10	Predicted Chromium Concentrations at Downstream Nodes by Project Phase ...	7-106
Figure 7.6.11	Predicted Copper Concentrations at Downstream Nodes by Project Phase	7-108
Figure 7.6.12	Predicted Selenium Concentrations at Downstream Nodes by Project Phase	7-110
Figure 7.6.13	Predicted Lead Concentrations at Downstream Nodes by Project Phase.....	7-112
Figure 7.7.1	Health Risk Components.....	7-114
Figure 7.7.2	Human Health and Ecological Risk Assessment Framework	7-116
Figure 7.7.3	Receptor Grid for HHERA	7-119
Figure 7.7.4	Conceptual Site Model for Human Health	7-145
Figure 7.7.5	Conceptual Site Model for Ecological Receptors.....	7-177
Figure 7.7.6	Distribution of Risk Quotients within the HHERA Study Area for the Masked Shrew.....	7-188
Figure 7.7.7	Distribution of Risk Quotients within the HHERA Study Area for the Meadow Vole	7-190
Figure 7.7.8	Distribution of Risk Quotients within the HHERA Study Area for the American Robin	7-193
Figure 7.7.9	Distribution of Risk Quotients within the HHERA Study Area for the American Black Duck.....	7-197

Figure 7.7.10	Distribution of Risk Quotients within the HHERA Study Area for the Belted Kingfisher.....	7-199
Figure 7.7.11	Distribution of Risk Quotients within the HHERA Study Area for Soil Invertebrates.....	7-203
Figure 7.7.12	Distribution of Risk Quotients within the HHERA Study Area for Terrestrial Plants.....	7-204