



**STAR-ORION SOUTH DIAMOND PROJECT  
ENVIRONMENTAL IMPACT STATEMENT**

**TABLE OF CONTENTS**

## **SECTION 1.0 - INTRODUCTION**

1.0	INTRODUCTION .....	1-1
1.1	Overview.....	1-1
1.2	The Proponent.....	1-3
1.3	Application Background.....	1-4
1.4	Study Strategy .....	1-4
1.5	Project Overview .....	1-7
1.5.1	Location.....	1-8
1.5.2	Land Ownership and Development Rights .....	1-8
1.5.3	Capital and Operating Costs.....	1-9
1.5.4	Labour Force Requirements for Construction and Operation.....	1-10
1.5.5	Mine Life.....	1-10
1.5.6	Key Project Changes .....	1-10
1.6	Need For and Purpose of the Project.....	1-11
1.7	Legal and Regulatory Framework .....	1-11
1.7.1	Saskatchewan's Environmental Assessment Act.....	1-12
1.7.2	Canadian Environmental Assessment Act.....	1-13
1.7.3	Canada-Saskatchewan Agreement on EA Cooperation .....	1-14
1.7.4	Relationships to Regional Land and Resource Management Planning Process .....	1-14
1.7.5	Other Legislation.....	1-14
1.7.6	List of Permits and Approvals .....	1-19
1.8	Company Policies.....	1-21
1.8.1.1	Human Resources.....	1-21
1.8.1.2	Procurement.....	1-25
1.9	Scope of the Assessment and Study Areas .....	1-27
1.10	Public Engagement and Information Distribution .....	1-28
1.11	Aboriginal Considerations.....	1-29
1.12	Table of Concordance .....	1-29
1.13	References .....	1-43

## **SECTION 2.0 - PROJECT DESCRIPTION**

2.0	PROJECT DESCRIPTION .....	2-5
2.1	Introduction .....	2-5
2.1.1	Project Synopsis .....	2-7
2.2	Background .....	2-8
2.2.1	Exploration and Determination of the Resource/Reserve Estimate .....	2-8
2.2.2	Existing Facilities .....	2-10
2.2.3	Corporate Approach.....	2-10
2.3	Context .....	2-11
2.3.1	Diamond Mining in Canada .....	2-11
2.3.2	Mining Industry in Saskatchewan .....	2-14
2.4	Project Details .....	2-14

2.4.1	Project Rationale.....	2-14
2.4.2	Alternative Means of Carrying Out the Project .....	2-14
2.4.3	Technical Issues and New Technologies .....	2-14
2.4.3.1	New Technology.....	2-15
2.4.3.2	Technical Issues.....	2-15
2.4.4	Project Location .....	2-16
2.4.4.1	Mineral Reserve Description .....	2-20
2.4.4.2	Mineral Reserve Estimate as of July, 2011 .....	2-21
2.4.5	Project Economics .....	2-22
2.5	Construction Phase Activities.....	2-23
2.5.1	Preparatory Activities .....	2-24
2.5.1.1	Decommissioning and Removal of Existing Facilities .....	2-24
2.5.1.2	Lars Road Relocation.....	2-24
2.5.1.3	Site Clearing and Timber Removal .....	2-26
2.5.2	Surface Water Management.....	2-26
2.5.3	Access Corridor .....	2-26
2.5.3.1	Gas Pipeline Corridor .....	2-29
2.5.4	Production Power Line and Electrical Supply .....	2-29
2.5.5	Plant Site Facilities .....	2-33
2.5.5.1	Processing Plant .....	2-33
2.5.5.2	Potable Water Treatment .....	2-33
2.5.5.3	Bulk Sample Plant .....	2-34
2.5.5.4	Fuel and Lubricant Storage .....	2-34
2.5.5.5	Fuel distribution .....	2-35
2.5.5.6	Administrative Buildings .....	2-35
2.5.5.7	Maintenance and Technical Services Building.....	2-35
2.5.5.8	Warehouse and Cold Storage Building .....	2-36
2.5.5.9	Vehicle Wash Facility, Fire and Emergency Response Building	2-36
2.5.5.10	Interpretive Centre.....	2-37
2.5.5.11	Security Gatehouse.....	2-37
2.5.5.12	Helicopter Landing Pads .....	2-37
2.5.5.13	Coarse Ore Stockpile .....	2-37
2.5.5.14	Recovery Rejects Pile .....	2-37
2.5.5.15	Explosives Mixing and Storage Facilities .....	2-38
2.5.5.16	Solid Waste Incinerator and Sewage Lagoon .....	2-39
2.5.6	Temporary Construction Camp.....	2-40
2.5.7	Construction Phase Wastes and Emissions .....	2-40
2.5.7.1	Construction Waste Management.....	2-40
2.5.7.2	Construction Emissions.....	2-40
2.5.8	Construction Management Policies .....	2-41
2.5.8.1	Construction Security .....	2-41
2.5.8.2	Construction Health and Safety.....	2-41
2.5.8.3	Construction Environmental Management.....	2-42
2.5.9	Employment Opportunities.....	2-42
2.6	Operations Phase.....	2-43
2.6.1	Concept and Schedule.....	2-43
2.6.2	Mining Method .....	2-45
2.6.2.1	Use of Explosives .....	2-46

2.6.2.2	Backfilling .....	2-49
2.6.2.3	Pit Slopes in the Overburden Soils.....	2-53
2.6.2.4	Pit Slopes in the Sub-Overburden Rock .....	2-56
2.6.2.5	Pit Design .....	2-56
2.6.3	Kimberlite Processing .....	2-62
2.6.3.1	Autogenous Grinding, Washing and Classification .....	2-63
2.6.3.2	Dense Medium Separation (DMS) Feed Preparation .....	2-64
2.6.3.3	DMS Module Operation.....	2-64
2.6.3.4	Recovery Circuit .....	2-64
2.6.3.5	Water and Mass Balance .....	2-65
2.6.3.6	Bulk Sampling Plant (BSP).....	2-69
2.6.4	Overburden and Rock Storage .....	2-71
2.6.5	Processed Kimberlite Containment Facility (PKCF) .....	2-71
2.6.6	Storage for Coarse Processed Kimberlite (Coarse PK) .....	2-74
2.6.7	Unprocessed Kimberlite Stockpile .....	2-75
2.6.8	Conveyor System.....	2-75
2.6.9	Water Management .....	2-75
2.6.9.1	Water Input.....	2-78
2.6.10	Gravel Extraction .....	2-80
2.6.11	Products .....	2-81
2.6.12	Wastes and Emissions.....	2-81
2.6.12.1	Operation Phase Wastes .....	2-81
2.6.12.2	Operations Phase Emissions .....	2-81
2.6.13	Management Policies.....	2-82
2.6.13.1	Operations Security .....	2-82
2.6.13.2	Operations Health and Safety .....	2-84
2.6.13.3	Environmental Management .....	2-86
2.6.14	Employment Opportunities.....	2-86
2.7	Decommissioning, Closure and Reclamation Phase .....	2-87
2.8	Accidents and Malfunctions.....	2-89
2.8.1	Non-anthropogenic Events .....	2-89
2.8.2	Catastrophic Events.....	2-89
2.9	References .....	2-90

### **SECTION 3.0 - EVALUATION OF PROJECT OPTIONS AND ALTERNATIVES**

3.0	EVALUATION OF PROJECT OPTIONS AND ALTERNATIVES .....	3-1
3.1	Alternatives for the Star-Orion South Diamond Project.....	3-1
3.2	Processing .....	3-2
3.2.1	Fine PK Management .....	3-2
3.3	Mining Method .....	3-3
3.4	Coarse and Fine PK Storage, AND Overburden and Rock STORAGE Facilities....	3-3
3.4.1	Regulatory and Legal Context- Site Selection .....	3-3
3.4.2	Coarse PK Storage .....	3-4
3.4.3	Processed Kimberlite Containment Facility (PKCF) .....	3-5

3.4.4	Overburden and Rock Storage Pile .....	3-6
3.4.5	Conclusion .....	3-7
3.5	Water Management.....	3-7
3.5.1	Regulatory and Legal Context- Water Management .....	3-8
3.5.1.1	Regulatory Gap .....	3-8
3.5.1.2	The Fisheries Act .....	3-8
3.5.1.3	Legal Interpretation of 34(1) defining a deleterious substance .....	3-10
3.5.1.4	Permitted Diamond Mines in Canada .....	3-12
3.5.1.5	Toxicity Testing.....	3-14
3.5.1.6	History of Recent Discussion about the Use of sub-lethal testing .....	3-14
3.5.1.7	Chronic Toxicity Testing and the Receiving Environment	3-18
3.5.1.8	Conclusions.....	3-18
3.5.2	Process Plant Water Supply .....	3-19
3.5.3	Pit Dewatering.....	3-20
3.5.4	Water Management Strategy .....	3-21
3.5.5	Water Disposal.....	3-22
3.5.5.1	Water Discharge.....	3-23
3.5.6	Other Components.....	3-24
3.6	Road Access .....	3-25
3.7	Power Line Right of Way .....	3-28
3.8	Gas Line Corridor .....	3-29
3.8.1	Options.....	3-29
3.8.2	Recommendations .....	3-31
3.9	Construction Camp.....	3-32
3.9.1	Options.....	3-33
3.9.2	Assessment of Options .....	3-34
3.9.3	Recommendations .....	3-36
3.10	References .....	3-36

## **SECTION 4.0 - PUBLIC AND ABORIGINAL ENGAGEMENT**

4.0	PUBLIC AND ABORIGINAL ENGAGEMENT .....	4-1
4.1	Public and Aboriginal Engagement Approach and Objectives.....	4-1
4.1.1	Regulatory Requirements .....	4-3
4.1.2	Understanding of Aboriginal Engagement Obligations and Responsibilities .....	4-4
4.2	Selection and Overview of Project Participants.....	4-5
4.3	Shore Engagement Methods and Activities .....	4-7
4.3.1	Diamond Development Advisory Committee .....	4-7
4.3.2	Community Open Houses.....	4-10
4.3.2.1	Open Houses – 2009 .....	4-11
4.3.2.2	Open Houses – 2010 .....	4-13
4.3.3	Project Newsletter - The Star Explorer .....	4-15
4.3.4	News Releases .....	4-16

4.3.5	Web Page .....	4-16
4.3.6	Media Coverage, Newspaper Notices and Articles .....	4-17
4.3.7	Site Tours.....	4-17
4.3.8	Employees and Contractors.....	4-19
4.3.9	Speaking Engagements.....	4-19
4.3.10	Environmental Interests Workshop .....	4-20
4.4	First Nation and Métis Engagement Methods and Activities.....	4-21
4.4.1	Information Gathering Agreements.....	4-30
4.4.2	Other Agreements with Aboriginal Parties.....	4-32
4.4.3	Aboriginal Employment Development Program Workplace Partnership Agreement - Fort à la Corne Partnership Agreement.....	4-33
4.4.4	Northern Career Quest - Aboriginal Skills and Employment Program.	4-34
4.5	Public, Community and Stakeholder Engagement Outcomes .....	4-34
4.5.1	Aboriginal Technical Comments .....	4-36
4.6	Engagement Activities Planned.....	4-36
4.7	Engagement Activities Planned - First Nations and Métis .....	4-37
4.8	References .....	4-38

## **SECTION 5.0 - PROJECT SETTING AND BASELINE CHARACTERIZATION**

5.0	PROJECT SETTING AND BASELINE CHARACTERIZATION .....	5-1
5.1	Overview.....	5-1

### **Section 5.2 - Physical Environment**

5.2	Physical Environment .....	5.2-1
5.2.1	Deposit and Local Area Geology .....	5.2-1
5.2.1.1	Regional Geology.....	5.2-1
5.2.1.2	Regional Overburden and Country Rock .....	5.2-2
5.2.1.3	Star Kimberlite Geology .....	5.2-4
5.2.1.4	Orion South Geology .....	5.2-7
5.2.2	Soils and Terrain.....	5.2-10
5.2.2.1	Introduction.....	5.2-10
5.2.2.2	Information Sources and Methods .....	5.2-10
5.2.2.3	Results.....	5.2-19
5.2.3	Metal Leaching and Acid/Akaline Rock Drainage .....	5.2-38
5.2.3.1	Introduction.....	5.2-38
5.2.3.2	Geology .....	5.2-38
5.2.3.3	Approach to ML/AARD Characterization.....	5.2-40
5.2.3.4	Methods .....	5.2-42
5.2.3.5	ABA Results .....	5.2-46
5.2.3.6	Metal Leaching .....	5.2-57
5.2.3.7	Conclusions .....	5.2-66
5.2.4	Air Quality and Meteorology.....	5.2-67

5.2.4.1	Introduction.....	5.2-67
5.2.4.2	Air Quality Methods .....	5.2-68
5.2.4.3	Continuous Particulate Monitoring Results .....	5.2-70
5.2.4.4	Passive Sampling Monitoring Results.....	5.2-72
5.2.4.5	Air Quality Results From Other Studies .....	5.2-73
5.2.4.6	Meteorology Methods.....	5.2-74
5.2.4.7	Meteorology Results.....	5.2-74
5.2.5	Background Noise Assessment.....	5.2-78
5.2.5.1	Introduction.....	5.2-78
5.2.5.2	Environmental Acoustics .....	5.2-78
5.2.5.3	Methods.....	5.2-78
5.2.5.4	Background Sound Level Results .....	5.2-81
5.2.6	Surface Water Hydrology.....	5.2-82
5.2.6.1	Introduction.....	5.2-82
5.2.6.2	Information Sources and Methodology .....	5.2-83
5.2.6.3	Description of Project Area Watershed .....	5.2-87
5.2.6.4	Regional Data.....	5.2-94
5.2.6.5	Mean Monthly and Annual Flows .....	5.2-94
5.2.6.6	Ten-year Return Period 7-Day Average Low Flows.....	5.2-96
5.2.6.7	Return Period Peak Flows.....	5.2-97
5.2.6.8	Climate Change.....	5.2-99
5.2.6.9	Summary .....	5.2-99
5.2.7	Groundwater Resources .....	5.2-100
5.2.7.1	Introduction.....	5.2-102
5.2.7.2	Regional Geology .....	5.2-102
5.2.7.3	Overview of Regional Hydrogeology .....	5.2-108
5.2.7.4	Regional Setting of the Project Site .....	5.2-110
5.2.7.5	Review of Hydrogeology Investigations for Projects in Surrounding Area .....	5.2-115
5.2.7.6	Previous Hydrogeology Investigations at the Project Site and Preliminary Groundwater Flow Models.....	5.2-121
5.2.7.7	2010 Groundwater Flow Model .....	5.2-143
5.2.7.8	2010 20-day pumping test.....	5.2-146
5.2.7.9	2011 Deep Isotopic and Chemical Profile Analysis....	5.2-146
5.2.7.10	2011 Groundwater Flow Model .....	5.2-148
	5.2.7.11.....Conceptual Hydrogeologic Model and Baseline Summary .....	5.2-153
5.2.8	Surface Water Quality.....	5.2-154
5.2.8.1	Introduction.....	5.2-154
5.2.8.2	Information Sources and Methodology .....	5.2-155
5.2.8.3	Sediment Quality .....	5.2-159
5.2.8.4	Surface Water Quality .....	5.2-161
5.2.8.5	Sediment Quality .....	5.2-166
5.2.8.6	Summary .....	5.2-168

## **Section 5.3 - Biological Environment**

5.3	Biological Environment.....	5.3-1
5.3.1	Fisheries and Aquatic Resources .....	5.3-1
5.3.1.1	Introduction.....	5.3-1
5.3.1.2	Information Sources and Methods .....	5.3-2
5.3.1.3	Results.....	5.3-8
5.3.1.4	Rare and Listed Species .....	5.3-39
5.3.1.5	Summary .....	5.3-40
5.3.2	Vegetation and Plant Communities .....	5.3-41
5.3.2.1	Introduction.....	5.3-41
5.3.2.2	Information Sources and Methods .....	5.3-41
5.3.2.3	Field Surveys.....	5.3-43
5.3.2.4	Classification of Vegetation Types .....	5.3-46
5.3.2.5	Species Composition and Abundance .....	5.3-46
5.3.2.6	Old Growth Forest .....	5.3-47
5.3.2.7	Riparian Habitat.....	5.3-47
5.3.2.8	Riparian Management Areas.....	5.3-47
5.3.2.9	Rare Plant Potential .....	5.3-48
5.3.2.10	Historical Use Plant Potential.....	5.3-48
5.3.2.11	Baseline Conditions.....	5.3-48
5.3.2.12	Species at Risk.....	5.3-57
5.3.2.13	Historical Use Plant Potential .....	5.3-65
5.3.2.14	Summary .....	5.3-67
5.3.3	Wildlife and Habitat.....	5.3-67
5.3.3.1	Introduction.....	5.3-68
5.3.3.2	Information Sources and Methods .....	5.3-68
5.3.3.3	Field Program Results and Baseline Conditions .....	5.3-73
5.3.3.4	Summary .....	5.3-106
5.3.4	Biodiversity.....	5.3-107
5.3.4.1	Introduction.....	5.3-107
5.3.4.2	Background .....	5.3-108
5.3.4.3	Biodiversity Indicator Selection .....	5.3-112
5.3.4.4	Methods .....	5.3-118
5.3.4.5	Baseline Conditions.....	5.3-122
5.3.4.6	Summary .....	5.3-162

## **Section 5.4 - Human Environment**

5.4	Human Environment.....	5.4-1
5.4.1	Social and Economic .....	5.4-1
5.4.1.1	Introduction.....	5.4-1
5.4.1.2	Information Sources and Methods .....	5.4-2
5.4.1.3	Population and Demographics .....	5.4-4
5.4.1.4	Employment and Economy .....	5.4-10
5.4.1.5	Housing .....	5.4-27
5.4.1.6	Transportation .....	5.4-32

5.4.1.7	Utilities and Physical Community Infrastructure.....	5.4-37
5.4.1.8	Health and Protective Services .....	5.4-40
5.4.1.9	Community and Social Services.....	5.4-46
5.4.1.10	Community Well-Being and Quality of Life.....	5.4-54
5.4.2	Traditional Land Use.....	5.4-61
5.4.2.1	Introduction.....	5.4-62
5.4.2.2	Assertion of Traditional Territories .....	5.4-62
5.4.2.3	Information Gathering Agreements with First Nations and Métis Regions.....	5.4-65
5.4.3	Non Traditional Land and Resource Use.....	5.4-74
5.4.3.1	Introduction.....	5.4-74
5.4.3.2	Information Sources and Methodology .....	5.4-74
5.4.3.3	Land Use Planning Areas.....	5.4-75
5.4.3.4	Environmentally Important Areas .....	5.4-80
5.4.3.5	Disturbance .....	5.4-81
5.4.3.6	Access .....	5.4-82
5.4.3.7	Industrial and Commercial Land Uses .....	5.4-83
5.4.3.8	Outdoor Recreation .....	5.4-89
5.4.4	Human Health .....	5.4-99
5.4.4.1	Introduction.....	5.4-99
5.4.4.2	Information Sources and Methodology .....	5.4-99
5.4.4.3	Community Health.....	5.4-100
5.4.4.4	Environmental Health .....	5.4-101
5.4.4.5	First Nations Health .....	5.4-107
5.4.4.6	Worker Health (Occupational Health and Safety) .....	5.4-108
5.4.5	Archaeology and Heritage Resources .....	5.4-109
5.4.5.1	Methods.....	5.4-109
5.4.5.2	Results.....	5.4-111

## **Section 5.5 - References**

## **SECTION 6.0 - EFFECTS ASSESSMENT**

6.1	Overview and Methods.....	6-1
6.1.1	Introduction .....	6-1
6.1.2	Environmental Impact Assessment Scope .....	6-1
6.1.3	Scope of the Project.....	6-2
6.1.4	Assessment Methods.....	6-2
6.1.4.1	Approach .....	6-2
6.1.4.2	Issues and Interests Identification and Scoping .....	6-3
6.1.4.3	Issues Scoping .....	6-4
6.1.5	Effects Assessment .....	6-4
6.1.5.1	Identification of Project Components and Activities to be Assessed .....	6-4
6.1.5.2	Selection of Valued Components .....	6-6
6.1.5.3	Temporal and Spatial Boundaries.....	6-8
6.1.5.4	Cases to Assess.....	6-10

6.1.5.5	Effect Attributes .....	6-10
6.1.5.6	Determining the Significance of Environmental Effects ...	6-13
6.1.6	Cumulative Environmental Effects Assessment.....	6-14
6.1.7	Follow-up and Monitoring.....	6-16
6.1.8	Assessment of Impacts of Accidents and Malfunctions.....	6-16
6.1.9	Effects of the Environment on the Project .....	6-17

## **Section 6.2 - Physical Environment**

6.2	Physical Environment .....	6.2-1
6.2.1	Terrain, Soils and Geology .....	6.2-1
6.2.1.1	Introduction.....	6.2-1
6.2.1.2	Scoping and Effects Identification.....	6.2-1
6.2.1.3	Effects Confirmation .....	6.2-6
6.2.1.4	Valued Components.....	6.2-9
6.2.1.5	Effects Assessment.....	6.2-10
6.2.1.6	Mitigation .....	6.2-36
6.2.2	Air Quality.....	6.2-46
6.2.2.1	Introduction.....	6.2-46
6.2.2.2	Scoping, Issues Identification and Confirmation .....	6.2-46
6.2.2.3	Project Emission Sources Description .....	6.2-50
6.2.2.4	Boundaries of the Study Area .....	6.2-68
6.2.2.5	Mitigation .....	6.2-73
6.2.2.6	Residual Effects.....	6.2-74
6.2.2.7	Cumulative Effects .....	6.2-75
6.2.3	Noise Impact Assessment .....	6.2-75
6.2.3.1	Introduction.....	6.2-76
6.2.3.2	Boundaries of the Study Area .....	6.2-76
6.2.3.3	Noise Criteria and Standards .....	6.2-77
6.2.3.4	Noise Sources .....	6.2-79
6.2.3.5	Noise Effects .....	6.2-83
6.2.3.6	Effects on Humans and Wildlife .....	6.2-87
6.2.3.7	Mitigation .....	6.2-90
6.2.3.8	Residual Effects.....	6.2-91
6.2.4	Hydrology .....	6.2-92
6.2.4.1	Project Methodology.....	6.2-92
6.2.4.2	Potential Effects.....	6.2-95
6.2.4.3	Mitigation .....	6.2-104
6.2.4.4	Residual Effects.....	6.2-105
6.2.4.5	Cumulative Effects .....	6.2-108
6.2.4.6	Closure .....	6.2-108
6.2.5	Navigable Waters.....	6.2-110
6.2.5.1	Introduction.....	6.2-111
6.2.5.2	Water Discharge Outfall .....	6.2-111
6.2.5.3	Access Corridor .....	6.2-113
6.2.6	Regional Geology and Hydrogeology .....	6.2-114
6.2.6.1	Introduction.....	6.2-115
6.2.6.2	Scoping and Effects Identification .....	6.2-116

6.2.6.3	Effects Confirmation .....	6.2-118
6.2.6.4	Effects Assessment.....	6.2-119
6.2.6.5	Mitigation Measures .....	6.2-130
6.2.6.6	Residual Effects.....	6.2-130
6.2.6.7	Follow-up and Monitoring .....	6.2-133
6.2.6.8	Effects of the Environment on the Project.....	6.2-133
6.2.6.9	Conclusions .....	6.2-133
6.2.7	Surface Water Quality.....	6.2-134
6.2.7.1	Introduction.....	6.2-134
6.2.7.2	Scoping, Issues Identification and Confirmation .....	6.2-135
6.2.7.3	Valued Components.....	6.2-139
6.2.7.4	Applicable Regulations, Standards and Guidelines ....	6.2-140
6.2.7.5	Surface Water Quality .....	6.2-140
6.2.7.6	Sediment Quality .....	6.2-159
6.2.7.7	Potential Effects of Road Transportation .....	6.2-159
6.2.7.8	Mitigation and Management.....	6.2-160
6.2.7.9	Residual Effects Assessment.....	6.2-163
6.2.8	Environmental Health.....	6.2-163
6.2.8.1	Screening and Identification of Chemicals of Potential Concern in Surface Water .....	6.2-163
6.2.8.2	Ecological Conceptual Site Exposure Model and Potential Receptors at the Site.....	6.2-168
6.2.8.3	Toxicity Testing of Discharge Water.....	6.2-174
6.2.8.4	Summary .....	6.2-176

### **Section 6.3 - Biological Environment**

6.3	Biological Environment.....	6.3-1
6.3.1	Fish and Aquatic Resources .....	6.3-1
6.3.1.1	Scoping, Issues Identification and Confirmation .....	6.3-2
6.3.1.2	Valued Components.....	6.3-4
6.3.1.3	Applicable Regulations, Standards and Guidelines .....	6.3-7
6.3.1.4	Effects Assessment Methods .....	6.3-8
6.3.1.5	Effects Assessment.....	6.3-8
6.3.1.6	Mitigation and Management .....	6.3-18
6.3.1.7	Residual Effects Assessment.....	6.3-22
6.3.1.8	Summary of Residual Effects .....	6.3-30
6.3.2	Vegetation and Plant Communities .....	6.3-43
6.3.2.1	Introduction.....	6.3-43
6.3.2.2	Assessment Criteria and Valued Components (VC) .....	6.3-44
6.3.2.3	Issues Scoping .....	6.3-45
6.3.2.4	Cumulative Effects .....	6.3-47
6.3.2.5	Effects Assessment.....	6.3-47
6.3.2.6	Summary of Residual Effects .....	6.3-66
6.3.3	Wildlife.....	6.3-68
6.3.3.1	Introduction.....	6.3-68
6.3.3.2	Scoping, Issues Identification and Confirmation .....	6.3-68

6.3.3.3	Valued Components (VCs).....	6.3-69
6.3.3.4	Effects Assessment.....	6.3-71
6.3.3.5	Other Effects Considered .....	6.3-93
6.3.3.6	Other Species Guilds Considered.....	6.3-93
6.3.3.7	Mitigation Measures .....	6.3-97
6.3.3.8	Summary of Residual Effects on VCs .....	6.3-101
6.3.4	Biodiversity.....	6.3-113
6.3.4.1	Issue Scoping and Assessment .....	6.3-113
6.3.4.2	Assessment Methods .....	6.3-114
6.3.4.3	Effects Assessment.....	6.3-117
6.3.4.4	Summary of Biodiversity Effects.....	6.3-139

## **Section 6.4 - Human Environment**

6.4	Human Environment.....	6.4-1
6.4.1	Socio-Economic Effects .....	6.4-1
6.4.1.1	Proposed Facilities and Activities Being Assessed.....	6.4-1
6.4.1.2	Issues Scoping .....	6.4-1
6.4.1.3	Temporal and Spatial Boundaries .....	6.4-4
6.4.1.4	Assessment Methodology .....	6.4-5
6.4.1.5	Project Description .....	6.4-8
6.4.1.6	Provincial Economic Effects .....	6.4-12
6.4.1.7	Saskatchewan Government Revenues .....	6.4-18
6.4.1.8	Regional Employment and Income .....	6.4-22
6.4.1.9	Regional Demographics .....	6.4-32
6.4.1.10	Transportation .....	6.4-34
6.4.1.11	Housing .....	6.4-48
6.4.1.12	Regional Services .....	6.4-54
6.4.1.13	Regional Infrastructure .....	6.4-58
6.4.1.14	Family and Community Well-Being .....	6.4-60
6.4.1.15	Mitigation and Monitoring .....	6.4-63
6.4.1.16	Residual Effects.....	6.4-68
6.4.2	Traditional Land Use.....	6.4-74
6.4.2.1	Introduction.....	6.4-74
6.4.2.2	Effects Assessments .....	6.4-78
6.4.2.3	Mitigation .....	6.4-118
6.4.3	Non Traditional Land and Resource Use.....	6.4-118
6.4.3.1	Introduction.....	6.4-118
6.4.3.2	Scoping, Effects Identification, and Confirmation.....	6.4-118
6.4.3.3	Valued Components .....	6.4-121
6.4.3.4	Effects Assessment.....	6.4-121
6.4.3.5	Summary of Residual Effects .....	6.4-132
6.4.3.6	Summary .....	6.4-132
6.4.4	Visual Assessment.....	6.4-133
6.4.4.1	Introduction.....	6.4-133
6.4.4.2	Methods.....	6.4-133
6.4.4.3	Visibility.....	6.4-133

6.4.4.4	Visual Sensitivity.....	6.4-133
6.4.4.5	Visual Magnitude .....	6.4-134
6.4.4.6	Visual Effects Assessment .....	6.4-134
6.4.4.7	Existing Visual Environment.....	6.4-135
6.4.4.8	Results.....	6.4-135
6.4.4.9	Visual Effects Assessment.....	6.4-138
6.4.5	Human Health .....	6.4-139
6.4.5.1	Introduction.....	6.4-139
6.4.5.2	Valued Components.....	6.4-140
6.4.5.3	Effects Assessment.....	6.4-141
6.4.5.4	Residual Effects.....	6.4-161
6.4.6	Archaeology and Heritage Resources .....	6.4-166
6.4.6.1	Effects Assessment.....	6.4-166
6.4.6.2	Monitoring and Future Mitigation.....	6.4-169

## **Section 6.5 - Human Environment**

6.5	Effects of the Environment on the project .....	6.5-1
6.5.1	Natural Hazards .....	6.5-1
6.5.1.1	Introduction.....	6.5-1
6.5.1.2	Information Sources and Methodology .....	6.5-1
6.5.1.3	Forest Fires .....	6.5-2
6.5.1.4	Floods.....	6.5-3
6.5.1.5	Terrain Stability.....	6.5-4
6.5.1.6	Weather and Climate Extremes .....	6.5-5
6.5.2	Effects Assessment .....	6.5-6
6.5.2.1	Forest Fires .....	6.5-7
6.5.2.2	Terrain Stability.....	6.5-7
6.5.2.3	Floods.....	6.5-8
6.5.2.4	Extreme Weather Events .....	6.5-10
6.5.3	Climate Change .....	6.5-10
6.5.3.1	Regional Climate Change .....	6.5-11
6.5.3.2	Effects of Climate Change on the Project .....	6.5-12

## **Section 6.6 - References**

## **SECTION 7.0 - ENVIRONMENTAL MANAGEMENT SYSTEM**

7.0	SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT SYSTEM.....	7-1
7.1	Introduction.....	7-1
7.2	Environmental Risk Management .....	7-2
7.2.1	Risk Assessment .....	7-2
7.2.1.1	Methodology .....	7-2
7.2.1.2	Framework.....	7-3

7.2.2	Assessment of Hazards .....	7-4
7.2.3	Critical Events .....	7-5
	7.2.3.1    Wildfire.....	7-6
	7.2.3.2    Hazardous Goods Spill.....	7-6
	7.2.3.3    Slope Failure- Southern Wall of Star Pit .....	7-6
	7.2.3.4    Slope failure – Other walls of Star Pit and Orion South Pit	7-7
	7.2.3.5    Slope failure – Overburden and Rock Storage Pile .....	7-7
	7.2.3.6    Slope failure – Coarse PK Pile .....	7-7
	7.2.3.7    Berm Failure – PKCF .....	7-8
	7.2.3.8    Collapse of Underground Works during Mining .....	7-8
	7.2.3.9    Explosives Magazine Fire .....	7-8
7.3	Sustainability Management Plan .....	7-9
7.3.1	Introduction .....	7-9
7.3.2	Scope .....	7-9
	7.3.2.1    Values.....	7-9
7.3.3	Vision Statement.....	7-10
	7.3.3.1    Goals .....	7-10
7.3.4	Sustainability Policy .....	7-12
7.3.5	Sustainability Objectives .....	7-13
7.3.6	Implementation .....	7-14
7.4	Monitoring and Follow-up Plan .....	7-15
7.4.1	Introduction .....	7-15
7.4.2	Biophysical Monitoring .....	7-15
	7.4.2.1    Air Quality Monitoring .....	7-16
	7.4.2.2    Noise Monitoring .....	7-17
	7.4.2.3    Soil Quality Monitoring .....	7-17
	7.4.2.4    Vegetation, Wildlife Habitat and Wildlife .....	7-18
	7.4.2.5    Hydrogeology and Hydrology .....	7-20
	7.4.2.6    Surface Water Quality .....	7-21
	7.4.2.7    Field and Laboratory Procedures for Water Quality.....	7-24
	7.4.2.8    Fisheries and Aquatic Resources.....	7-25
	7.4.2.9    Waste Water.....	7-26
	7.4.2.10    Sediment Sampling .....	7-27
	7.4.2.11    Reclamation and Revegetation .....	7-27
	7.4.2.12    Geochemical Drainage.....	7-28
	7.4.2.13    Geotechnical Stability .....	7-28
7.4.3	Socio-Economic Monitoring .....	7-28
	7.4.3.1    First Nations, Métis and the General Public.....	7-29
	7.4.3.2    Worker Health Monitoring.....	7-30
7.4.4	Auditing and Continual Improvement.....	7-30
7.4.5	Record Keeping and Reporting .....	7-31
7.5	Closure and Reclamation Plan.....	7-31
7.5.1	Reclamation Objectives .....	7-31
7.5.2	Merchantable timber .....	7-31
7.5.3	General Soil Salvage .....	7-32
7.5.4	Non-merchantable vegetation, woody debris and perimeter berms....	7-32
7.5.5	Revegetation .....	7-33
	7.5.5.1    On-Going Revegetation Trials.....	7-35
7.5.6	Development and Reclamation of Site Facilities .....	7-36

7.5.6.1	Plant Site .....	7-36
7.5.6.2	Processed Kimberlite Containment Facility (PKCF).....	7-36
7.5.6.3	Overburden and Rock Storage Pile.....	7-38
7.5.6.4	Pit Areas .....	7-40
7.6	References .....	7-47

## **SECTION 8.0 - RESIDUAL EFFECTS SUMMARY**

8.0	RESIDUAL EFFECTS SUMMARY .....	8-1
8.1	Introduction .....	8-1
8.2	Quantitative Versus Qualitative Assessment .....	8-1
8.2.1	Evaluation of Effects Using Established Thresholds .....	8-2
8.2.2	Evaluation of Effects without Using Established Thresholds.....	8-2

## **SECTION 9.0 - CUMULATIVE EFFECTS ASSESSMENT**

9.0	CUMULATIVE EFFECTS ASSESSMENT .....	9-1
9.1	Approach .....	9-1
9.2	Methods .....	9-1
9.2.1	Cumulative Effects Assessment Framework .....	9-1
9.2.2	Temporal and Spatial Boundaries .....	9-2
9.2.3	Determination of Incremental Effects.....	9-3
9.2.4	Cumulative Effects Assessment Significance Rating .....	9-3
9.2.5	Other Projects and Human Activities Considered in the CEA .....	9-4
9.2.5.1	Historical Projects and Activities .....	9-4
9.2.5.2	Existing Projects .....	9-5
9.2.5.3	General Land Use .....	9-5
9.2.5.4	Reasonably Foreseeable Future Projects.....	9-8
9.2.6	Effects Analysis.....	9-9
9.3	Project Residual Effects On Valued Components.....	9-9
9.3.1	Projects Considered for Cumulative Effects .....	9-9
9.3.1.1	Hypothetical Future Projects .....	9-14
9.3.2	Cumulative Effects Assessment Valued Components .....	9-14
9.4	Determination of Cumulative Effects .....	9-18
9.4.1	Climate and Air Quality .....	9-18
9.4.2	Noise .....	9-19
9.4.3	Hydrology .....	9-19
9.4.4	Geology and Hydrogeology .....	9-19
9.4.5	Surface Water Quality .....	9-19
9.4.6	Terrain and Soils.....	9-20
9.4.7	Fisheries and Aquatic Resources .....	9-20
9.4.7.1	Streams .....	9-20
9.4.7.2	Saskatchewan River.....	9-21
9.4.8	Vegetation and Plant Communities .....	9-21

9.4.9	Wildlife and Habitat .....	9-22
9.4.10	Environmental Health .....	9-22
9.4.11	Biodiversity .....	9-22
9.4.12	Social and Economic Effects .....	9-24
9.4.13	Traditional Knowledge and Traditional Land Use .....	9-25
9.4.14	Non-traditional Land Use .....	9-26
9.4.14.1	Disturbance .....	9-27
9.4.14.2	Access .....	9-27
9.4.14.3	Non-Consumptive Recreational Use .....	9-27
9.4.15	Visual and Aesthetic Resources .....	9-28
9.4.16	Human Health .....	9-28
9.4.17	Heritage Resources .....	9-28
9.4.18	Summary of Project Residual Effects Overlapping Spatially and Temporally with Future/Foreseeable Human Activities .....	9-28
9.5	Mitigation, Monitoring and Management Strategies .....	9-30
9.6	Level of Certainty .....	9-31
9.7	Limitations .....	9-31
9.8	References .....	9-31

## **SECTION 10.0 - CONCLUSIONS**

10.0	CONCLUSIONS .....	10-2
10.1	Conclusions .....	10-2
10.2	Commitments .....	10-3
10.2.1	General Commitments .....	10-3
10.2.2	Construction .....	10-7
10.2.3	Operations .....	10-9
10.2.4	Closure .....	10-10