SECTION 2.0

PROJECT DESCRIPTION

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2.0 PROJECT DESCRIPTION

The Star-Orion South Diamond Project (the Project) is described in this Section. This description includes the rationale, the background and the context of the Project.

2.1 INTRODUCTION

The Project consists of the following major components (Figure 2.1-1):

1. Star Kimberlite open pit;
2. Orion South Kimberlite open pit;
3. overburden and rock storage pile;
4. coarse processed kimberlite (Coarse PK) pile;
5. fine processed kimberlite containment facility (PKCF);
6. processing plant with live stockpile; and
7. infrastructure.

2.1.1 Project Synopsis

The Project involves the excavation of two open pits: one to mine the Star Kimberlite deposit and the other to mine the Orion South Kimberlite deposit. The excavation in each pit will involve the removal of overburden material sufficient to access the underlying kimberlite ore which is the primary source for diamonds. Collectively, the construction and operation of these two open pit mines to commercially extract diamonds forms the rationale for the Project. In conjunction with the mining operation there is a requirement to build and operate a Process Plant facility to extract the diamonds from the ore and to provide ancillary structures and services in support of the Project.

Overburden material from the Star and Orion South open pits will be removed predominantly using an in-pit crush and convey system (IPCC). Hydraulic shovels will be used to place material into a mobile crusher, which will feed a conveyor system to transport material to a stacker at the overburden and rock storage piles. Initial removal of organics, as well as stripping of the upper soft sand and clay layers, will be accomplished via truck and shovel. This will allow establishment of the overburden and rock storage pile to a size suitable for deployment of the overburden stacker, as well as the removal of the softer material from the pit footprint thus alleviating mobility (traffic) issues for the IPCC in the upper layers of overburden. The overburden and rock storage pile is designed to contain up to 1,770 Mt of material (or 943 Mbcm) including overburden, country rock and low grade kimberlite, and be up to 60 m high.

Kimberlite with be excavated using a separate system. Hydraulic shovels will load heavy haul trucks, which will in turn use a short haul to dump ore into an in-pit semi-mobile sizer. The sizer will then feed the kimberlite onto an ore conveyor for transport to the plant. The 45,000 t/day processing plant will receive ore from the live stockpile conveyer, and liberate diamonds from the kimberlite host rock using autogenous grinding (AG) mills, dense media separation, and x-ray, grease and Laser Raman recovery. The live stockpile will contain enough coarse ore to provide the plant with 24 hours of live feed. This pile is designed to be a cone 42 m high and 109 m in diameter.

Fine processed kimberlite (Fine PK) from the AG mills will be pumped in two separate pipes (one containing material between 0.25 mm and 1 mm, and the other containing material less than 0.25 mm) via slurry to the processed kimberlite containment facility (PKCF). A starter berm approximately 20 m high will be built from surficial sand. Berms will then be built up in lifts as needed from the 0.25 to 1 mm size fraction, once dewatered by hydrocyclones. The PKCF is designed to contain 135 million cubic meters (m^3) of material within the facility, including 28.5 million m^3 of material within the berms, and be up to 60 m high. The PKCF design includes additional storage for the processing of inferred kimberlite and contingency kimberlite, which was not considered in the feasibility study (FS) (Shore 2011a and 2011b).

Coarse processed kimberlite (Coarse PK) between 1 mm and 45 mm from the AG milling process will be sent to the dense media separation (DMS) circuit. The DMS circuit sorts the kimberlite by density into a heavy concentrate and floats; the lighter floats will be transported to the Coarse PK pile, and the heavy concentrate will be sent to the diamond recovery circuit. Diamonds will be separated from the concentrate using magnetic sorting, X-ray sorting, grease belts and Laser Raman spectroscopy (i.e., a method that measures the unique changes in light wave characteristics as light interacts with a particular material). Processed kimberlite greater than 8 mm will be transported to the Coarse PK pile and will be stockpiled separately within the pile for potential re-processing. The Coarse PK pile is designed to contain up to 80 million m^3 of material and be a maximum of 50 m above the existing ground surface.

The majority of process water required in the plant will be supplied by pit dewatering, supplemented by recycled water from the PKCF to the plant. Potable water requirements will be supplied by surficial runoff collected and treated on site. Potable water requirements may be supplemented by wells placed in the upper surficial sands close to the pit limits, thus providing a form of seepage control into the pits. Seepage from the PKCF and the Coarse PK pile will be treated using natural wetlands (i.e., wetland treatment), pumped back into the PKCF or discharged to the environment depending on water quality. Excess dewatering flows will be directed to the Saskatchewan River via a pipeline and diffuser. Surficial groundwater and site runoff from the plant site will be collected in a separate settling pond and used for flow supplementation, site activities (i.e., dust control) or directly discharged.

When the Star pit is complete, all Fine PK and process water, as well as some overburden and country rock from Orion South will be back-filled into the Star pit, thus reducing the environmental impact. The overburden and rock storage pile is designed to contain all overburden from Orion South as a contingency; however backfilling will be implemented as much as feasible.

2.2 BACKGROUND

This Section presents a description of Shore Gold Inc.'s, exploration, resource/reserve estimates, existing facilities and corporate approach to developing the Project.

2.2.1 Exploration and Determination of the Resource/Reserve Estimate

The Project area has undergone exploration for kimberlites since 1989 to prove the resource/reserve and determine economic potential for mining. Intensive exploration focused on two separate kimberlite deposits, Star and Orion South, using similar methods. The primary activities that were undertaken to define and estimate the resource/reserves were:

- core drilling with microdiamond sampling;
- mini-bulk sampling using large diameter drilling (LDD); and
- bulk sampling from underground activities via shaft sinking and drifting.

Core drilling was conducted on an approximately 100 m[1] spaced grid over the kimberlites to define the geology and to determine the kimberlite thickness and tonnage. Where the results of the core drilling and microdiamond sampling justified the collection of additional information by further sampling, LDD and underground bulk sampling were conducted. The LDD obtained 'mini-bulk' samples of kimberlite from the thicker central core of the kimberlite and underground bulk sampling recovered a sufficient sample volume to estimate diamond grade and price.

The preparation of a NI 43-101 compliant resource estimate and the estimation of a diamond valuation required the collection and assessment of a significant amount of diamonds. At the Star Kimberlite, an underground bulk sampling program was started in 2003 consisting of sinking a 4.5 m diameter shaft (the Star shaft) into the kimberlite and excavating approximately 75,000 tonnes of kimberlite from the vertical shaft and underground drifts. This tonnage was required to recover sufficient diamonds to determine a statistically valid estimate of diamond grade and price across the resource. The shaft and lateral excavation also allowed Shore to obtain an accurate 3-D representation of the variability and type of kimberlite intersected over a wide area. Underground sampling from the Star Kimberlite was completed in April, 2007.

[1] Boreholes spaced on a grid 100 metres apart in each direction.

Exploration on the Orion South Kimberlite followed a similar methodology as described above, including the sinking of a 4.5 m diameter shaft to a depth of 212 m beginning in July, 2007. Lateral drifting at a depth of 186 m below surface was completed in February, 2009; 23,468 t were excavated.

Shore constructed an exploration Bulk Sample Plant (BSP) with DMS, X-ray and grease recovery to process the kimberlite and recover diamonds from the kimberlite collected from the LDD mini-bulk samples and from the underground bulk samples. In addition, a fines management area (FMA) to contain Fine PK less than 0.5 mm was also constructed in close proximity to the exploration BSP. The exploration BSP and FMA operated from 2003 until 2009.

The exploration BSP is a scaled-down version of a production plant. Kimberlite was crushed and washed then sorted by density (via DMS) to obtain a heavy concentrate. The heavy concentrate containing diamonds then went to X-ray and grease recovery to extract the diamonds. Water and ferrosilicon (FeSi) were the main media components used in processing.

The exploration BSP produced two by-products: fines, and low density, coarser PK. The fines (0 to 0.5 mm fraction) were deposited in the FMA while the coarser PK (0.5 to 6 mm) was stockpiled to allow access for future assessment and additional sampling if required. With the exception of FeSi and small amounts of flocculants and coagulants, all materials released by the exploration BSP occurred naturally in the kimberlite or water. The exploration BSP was effectively a pilot plant, which allowed Shore to use real data to support impact predictions, and to refine processing methods. For example, due to experience gathered during the exploration phase, the use of flocculants or coagulants is not planned for the Project.

All of the exploration done to date has provided valuable information about the potential effects of full scale development on the environment. For example, ground and surface water monitoring results provided data for use in impact predictions.

The NI 43-101 compliant mineral reserve estimate (P&E 2010) and the Feasibility Study (FS; Shore 2011) for the Project are the basis for planning described herein.

2.2.2 Existing Facilities

The area occupied by current exploration activities is approximately 70 ha. The exploration programs required the construction of a number of facilities associated with various activities and infrastructure:

- fenced operational area;

- offices, camp and mine dry;
- workshops;
- core/sample storage shed;
- exploration bulk sample plant (BSP) facility;
- FMA;
- generators;
- fuel storage tanks;
- used oil storage tanks;
- hazardous waste and dangerous goods storage container; and
- exploration shafts and underground drifts at Star and Orion South.

2.2.3 Corporate Approach

Shore is committed to developing the Project in an environmentally responsible manner. Safety and environmental protection are of paramount importance to Shore in all areas of its operations. Shore has adopted the following environmental policy statement:

> *"Shore recognizes and respects the inherent value of our environment, and is committed to reducing our effects on the environment through strategic planning, implementation of best management practices and innovation, while striving to continually improve the quality of our environmental practices."*

Throughout the project planning process and the environmental impact assessment (EIA), several options have been considered, presented and discussed. Shore is committed to meaningful engagement with provincial and federal regulators, the Aboriginal community, and other surrounding communities. Shore has considered information gathered through this engagement and, in conjunction with analyses performed as part of the EIA and preliminary/final feasibility studies, determined preferred options for final analysis in the EIA (Section 3.0, Evaluation of Project Options).

A conceptual safety, health and environmental management system (SHEMS) has been developed (Section 7.0, Environmental Management System), based on Shore's safety, health, and environmental procedures established during exploration. The SHEMS will provide the umbrella structure for environmental protection plans which will include, but are not necessarily limited to, the following:

- health and safety plan;
- water management plan;
- hazardous, domestic, and industrial waste management plan;

- spill response plan;
- emergency response plan;
- explosives management plan;
- fuel management plan;
- vegetation management plan;
- wildlife management plan;
- socio-economic management plan;
- closure and reclamation plan; and
- environmental monitoring plan.

Parallel to development of a comprehensive SHEMS, Shore will work with local Aboriginal communities and other local communities to build upon existing relationships to develop effective outreach programs whereby concerns can be vetted and resolved and those persons or communities directly affected kept informed of key developments and results of monitoring programs.

2.3 CONTEXT

The context of the Project is discussed below in relation to diamond mining in Canada and the mining industry in Saskatchewan.

2.3.1 Diamond Mining in Canada

Diamonds are most commonly found in volcanic rocks called kimberlite. The FalC area in Saskatchewan hosts one of the most extensive kimberlite fields in the world.

Currently there are four producing diamond mines in Canada: Ekati, Diavik and Snap Lake, all located in the Northwest Territories, and the Victor Mine in Northern Ontario. The Jericho Mine in Nunavut ceased operations in early 2008. Two other projects, Gahcho Kué in the Northwest Territories and Renard in Quebec, have entered the regulatory approval process. Canada’s diamond industry has become an industry worth more than $2 billion per year. Canadian diamond production was approximately 17.0 million carats in 2007 and 14.8 million carats in 2008 (NRCAN 2008).

The methods proposed to extract diamonds from kimberlite for the Project are similar to those used in other Canadian diamond mines as well as in most diamond producing mines worldwide. Table 2.3-1 summarizes the key project components for existing, proposed, and closed Canadian diamond mines. The Project is included in Table 2.3-1 for context.

Table 2.3-1: Canadian Diamond Projects

Mine	Plant Capacity (tonnes per day)	Mine Type	Projected Life of Mine (Years)	Fine PK Management	Water Management
Star-Orion South	45,000	Open Pit	20+	Unlined facility on surficial sands followed by a polishing pond prior to discharge	Discharge of pre-mining groundwater and all contact water to a settling pond prior to discharge to the environment
Ekati	13,000	Open Pit / Underground	25+	Unlined facility on bedrock followed by a polishing pond prior to discharge	All contact water to a PKCF; diluted discharge to environment
Diavik	3,000	Open Pit / Underground	25+	Unlined facility on bedrock	All contact water to a PKCF; filtered for suspended solids and phosphorus and discharged to environment
Jericho[a]	2,000	Open Pit / Underground	N/A	Unlined facility on bedrock, followed by a polishing pond prior to discharge	All contact water to a PKCF; diluted and discharged to environment
Snap Lake	6,000	Underground	20	Paste fines to on land storage for ultimate disposal underground	All contact water to treatment pond; filtered for suspended solids, discharged to environment
Victor	7,000	Open Pit	12	Fines discharged to an unlined facility on bedrock; followed by a polishing pond prior to discharge	Discharge of pre-mining groundwater directly to the environment; during mining, all contact water flows to a settling pond prior to discharge

Note: [a] Ceased production in early 2008.

2.3.2 Mining Industry in Saskatchewan

Mining is Saskatchewan's third largest industry in terms of value of sales (after oil & gas and agriculture). The total value of mineral sales in 2007 was $4.6 billion (Government of Saskatchewan 2008); potash accounts for approximately three quarters of production value, with the remainder consisting primarily of uranium, coal and gold production. Saskatchewan has a wealth of mineral resources including diamonds, platinum and palladium, rare earth elements, copper, zinc, nickel, sodium and potassium sulphates and mineralized brines. Saskatchewan's mining industry leaves a very small footprint utilizing approximately 0.1% of available land in the province.

Some mining activities involve potentially hazardous chemicals, mill reagents, or emissions which can present substantial tailings, water, waste management, and air quality issues. While these are successfully managed and carefully monitored in Canada and Saskatchewan, it should be noted that diamond processing employs only non-hazardous reagents.

2.4 PROJECT DETAILS

The details of the Project are described in this Section and include a description of the Project rationale, alternative means of carrying out the Project, technical issues and new technologies, Project location, surface leases, and mineral dispositions.

2.4.1 Project Rationale

As described in Section 1.6 (Need For and Purpose of the Project), based on the NI 43-101 compliant Reserve Estimate and Feasibility Study (described further in Section 2.4.5) on Star and Orion South, Project economics have proven robust. As such, construction of the Project is expected to create economic activity in the region (Sections 2.5.9 & 2.6.14), generate revenue for the provincial economy and return value to Shore. The Project will be the only large resource development in the area, and provide needed economic diversification to the surrounding communities.

2.4.2 Alternative Means of Carrying Out the Project

Open pit mining is the only economically feasible method of extracting and producing diamonds from the Star and South Orion kimberlite ore bodies. Project options describing selected mining scenarios are described in Section 3.0 (Evaluation of Project Options).

2.4.3 Technical Issues and New Technologies

Each project presents its own unique challenges and issues, and the proposed Star-Orion South Diamond Project is no different. Although the basic components and technologies proposed are similar to those used in other mines worldwide, the specific combinations and customizations of these components have been tailored to the geology and setting of the Star and Orion South kimberlites as described below.

Most diamond mines in Canada are relatively high grade but have low kimberlite tonnage, with deposits hosted in high strength bedrock. In comparison, this Project contains lower grade relative to other Canadian mining projects, but average grades compared to worldwide diamond projects. In contrast to other Canadian diamond projects, this project contains high reserve tonnage hosted by relatively weak host rocks. As such, operations have been designed using different criteria than those used elsewhere to optimize this Project. Mining techniques developed for other minerals (iron ore, coal etc.) that rely on high volume were more applicable to the Project than methods used at other Canadian diamond mines. The consideration of the high volume of overburden movement, ore extraction, and processing is an overriding issue in the Project design and implementation.

2.4.3.1 New Technology

Shore is not proposing any new or unproven technology for the Project. While each component is proven technology, these technologies have been integrated in a unique way to optimize mining and processing performance based on the specific characteristics of the ore.

2.4.3.2 Technical Issues

Technical issues encountered in the Project design include defining slopes of the pit, management of water from the Mannville aquifer and selection of processing methods for the various kimberlite units.

Overburden Pit Slopes

The Star and Orion South open pits require removal of considerable quantities of glacial and pre-glacial overburden, consisting of sand, silty clay, till, and in some areas, shale. The slope of an open pit is dictated by the strength of the materials in the side wall, and overall design is often controlled by the weakest layer.

In the case of the Project, the load limiting layer is the sheared zone of the Colorado Group shale in direct contact with, and below, the till. When the glaciers advanced over the shale, the shearing action reworked the top of the shale, thus reducing its strength (Section 5.2.1, Deposit and Local Area Geology). As a result, this sheared zone is the most likely layer to cause slope instability, and required careful consideration in slope design (P&E 2009a).

In comparison to an open pit located in bedrock, the slope angles for the Project are calculated to be shallower. Shallower pit wall angles require removal of more material and result in larger open pit areas, which lead to increases in the Project footprint and operating costs.

Mannville Water Management

The top of the Mannville Group lies approximately 150 m to 190 m below surface in the region of the proposed pits and contains a significant amount of groundwater as a confined aquifer. Since this aquifer is under pressure, it is necessary to depressurize this zone to ensure safe working conditions in the pits.

Pit dewatering from within the Mannville Group is expected to produce up to 130,000 m^3/day of water (Section 6.2.6 Hydrogeology and Geology). This volume of water requires careful consideration in the development of a water management system that will meet processing plant water requirements, and adequately address any potential environmental effects.

Processing Various Types of Kimberlite Units

As described in Section 5.2.1 (Deposit and Local Area Geology), the Star and Orion South kimberlite bodies are composed of many different eruptive events, with each event having its own characteristics. The plant requires enough flexibility to process hard and soft kimberlite units, all while minimizing diamond breakage. These criteria were difficult to meet using jaw or cone crushing. As a result, autogenous grinding (AG) was selected as the main comminution tool (Section 3.0, Evaluation of Project Options).

2.4.4 Project Location

The Project is located in central Saskatchewan within the FalC Provincial Forest, approximately 60 km east of the City of Prince Albert (Figure 2.4-1). The kimberlites are located immediately north of the Saskatchewan River, and downstream of the convergence of the North and South Saskatchewan Rivers. All land within the Provincial Forest is held by the Crown.

Surface Leases and Mineral Dispositions

The surface leases for the Project currently total 92.23 ha. Additional surface leases will be acquired to cover the mineral lease boundaries after all regulatory approvals are received.

The mineral dispositions shown in Figure 2.4-2 are those included within the area of the proposed surface lease covering the Project. Forty-nine mineral dispositions, covering a total area of 10,879 ha, are included within the proposed surface lease area. This proposed surface lease will include all Project areas, except the access road.

Geology and Mineral Reserve

The Project lies near the northeastern edge of the Phanerozoic Interior Platform that extends from the Rocky Mountains in the west to the Precambrian Canadian Shield in the northeast. The Phanerozoic cover consists of basal Cambro-Devonian dolomitic carbonate rocks and clastic sedimentary rocks succeeded by Cretaceous shale and sandstone. The entire area is overlain by Quaternary glacial deposits ranging from 40 m in thickness close to the Saskatchewan River and up to 120 m in thickness elsewhere. In the FalC area, a northwest-trending kimberlite province that is approximately 50 km long by 30 km wide has been identified. Sixty nine kimberlitic bodies have been discovered to date in the FalC kimberlite province.

2.4.4.1 Mineral Reserve Description

Based on surface and underground core drilling and underground mapping data, the Star and Orion South kimberlite deposits contain two distinct types of kimberlite:

- eruptive kimberlite phases; and
- kimberlitic sedimentary rocks.

The eruptive kimberlites of the Star Kimberlite are sub-divided into five main phases: Cantuar Kimberlite, Pense Kimberlite, Early Joli Fou Kimberlite (EJF), Mid Joli Fou Kimberlite (MJF) and Late Joli Fou Kimberlite (LJF). The eruptive kimberlites of the Orion South Kimberlite are sub-divided into five main phases: Cantuar Kimberlite, Pense Kimberlite, EJF, LJF and Viking Kimberlite.

Each phase has distinct physical and chemical properties that enable their mapping and stratigraphic correlation in three dimensions within each kimberlite complex. It is important to note, however, that two stratigraphically equivalent kimberlite phases (e.g., Pense Kimberlite on Star and Orion South) may not have any genetic relationship and each may have very different diamond grade and carat value characteristics. Some of the stratigraphically equivalent kimberlite units (e.g., EJF on Star and Orion South) do, however, have similarities in mineral constituents, mantle signatures, chemistry and diamond distribution that suggest a genetic relationship.

The Star Kimberlite deposit is dominated by crater facies rocks, which include well-defined pyroclastic flows that radiate away from the crater. The sheet-like Cantuar Kimberlite and the Pense Kimberlite are kimberlites deposited from pyroclastic flows from nearby kimberlite volcanoes. The EJF is a combination of vent filling pyroclastics and pyroclastic flows away from the crater. The MJF is a crater facies vent filling pyroclastic kimberlite; the LJF is a pyroclastic flow.

Within the Orion South Kimberlite, the phases have cross-cutting relationships near conduits, but are stacked vertically within the volcanic edifice and crater / extra-crater deposits. Several conduits, feeding different units, have been identified on Orion South.

Results of the core drilling (to determine extent and volume of kimberlite), large diameter drilling (to determine spatial distribution of grade) and underground sampling (to confirm LDD grades and obtain diamond price information) were combined to produce NI 43-101 compliant resource estimates for each of Star and Orion South kimberlite bodies. Details of the Star and Orion South Resource Estimate can be found in a Technical Report prepared by Shore (P&E 2009a and 2009b). This was used to determine probable reserves within the context of a NI 43-101 compliant feasibility study. These estimates form the basis of the Project, and are used to determine Project economics.

Shore commissioned WWW International Diamond Consultants Ltd (WWW) to complete valuation studies of the Star and Orion South diamond parcels. Variable diamond prices were provided by kimberlite unit relative to the WWW February, 2011 price book. Table 2.4-1 below summarizes those prices determined by WWW and used for the Star Orion South Mineral Resource Estimate effective as of July, 2011.

Table 2.4-1: The Parcel and Model Price Details for the Star and Orion South Kimberlites (February, 2011)

Deposit	Kimberlite Lithology	Model Price (US$/ct)	Model Price plus 15% (US$/ct)	Minimum Price (US$/ct)	High Price (US$/ct)
Star	MJF-LJF	$198	$225	$106	$290
	EJF	$225	$259	$176	$296
	Pense	$175	$201	$131	$224
	Cantuar	$355	$408	$281	$499
Orion South	EJF	$192	$221	$149	$258
	Pense	$129	$148	$94	$177

2.4.4.2 Mineral Reserve Estimate as of July, 2011

The Star – Orion South Diamond Project updated Mineral Reserve Estimate was derived from the Mineral Resource dollar value per tonne block models created for the Star and Orion South Kimberlite deposits. Utilizing feasibility-level operating costs for mining, processing and General and Administration (G&A), along with engineered pit slopes, pit optimizations were undertaken to derive pit shells for design purposes for each deposit. The phased pit designs developed include allowance for vehicle access ramps, conveyor ramps, and berms. The resulting open pit design surfaces for Star and Orion South were subsequently utilized to determine the mineralization contained within the resource models that was amenable for conversion to Mineral Reserves by dollar value-cut-off. Only material in the Measured and Indicated resource categories were converted with dilution and losses applied to determine the Reserve.

A summary of the Mineral Reserve for the Star – Orion South Diamond Project as of July, 2011 (Read et al. 2011) is shown in Table 2.4-2.

Table 2.4-2: Probable Mineral Reserve Estimate per Kimberlite Unit Detail for Star – Orion South Diamond Project, effective July, 2011

Deposit	Kimberlite Unit	Ore (mt)	Carats (m)	Ore Grade (cpht)
Star	LJF	4.078	0.093	2.3
	MJF	22.403	1.057	4.7
	EJF-Inner	88.364	13.554	15.3
	EJF-Outer	33.783	3.039	9
	Pense	7.802	1.203	15.4
	Cantuar	9.460	1.440	15.2
Star total		**165.890**	**20.386**	**12.3**
Orion South	EJF Inner	62.040	9.986	16.1
	EJF Outer	17.362	1.680	9.7
	Pense	33.688	2.328	6.9
Orion South total		**113.090**	**13.994**	**12.4**
Total		**278.980**	**34.380**	**12.3**

Notes: The Mineral Reserves have a 1 millimetre bottom screen size cut-off.
cpht - carats per hundred tonnes.
mt – million tonnes.

In addition to the entire Mineral Reserve, an estimated total of 80 million tonnes of Inferred Resources containing a total of approximately 9.1 million carats would be excavated as per the pit designs for the Star and Orion South Kimberlites. The cost of excavation of these Inferred Resources is included but processing costs and resultant revenue cannot be included as NI 43-101 only permits revenue derived from Indicated Resources to be reported. As mining progresses, it is likely that this material will be processed. The kimberlite in the Inferred category may be stored separately in one corner of the overburden pile, leaving it accessible for any potential future processing.

2.4.5 Project Economics

The economic basis for the Project was calculated as part of the Star-Orion South Diamond Project Feasibility Study (Shore 2011b). This study concluded the following:

- Probable Mineral Reserves of 279 million diluted tonnes at a weighted average grade of 12.3 carats per hundred tonnes (cpht) containing 34.4 million carats at a weighted average price of US$242 per carat over the Life of Mine (LOM);
- total diamond production of 34.4 million carats over a 20 year LOM;

- robust Project economics over the LOM due to proximity to infrastructure (electric power, paved highways, railroads, water and labour) in Saskatchewan;
- a Net Present Value (NPV) of $2.14 billion (using a 7 percent discount rate) for an Internal Rate of Return (IRR) of 16.4 percent before taxes and royalties and an after-taxes and royalties NPV of $1.27 billion with an IRR of 13.7 percent; and
- pre-production capital cost of $1.9 billion with a total capital cost of $2.5 billion (including direct and indirect costs) over the LOM and an initial capital cost payback period of 5.3 years.

2.5 CONSTRUCTION PHASE ACTIVITIES

The construction phase will begin once a positive production decision is made and all required permits are received. The proposed site construction activities described in this Section include:

- removal of existing exploration facilities at Star and potentially at Orion South;
- site clearing and timber removal;
- construction of water management facilities;
- construction of an access corridor;
- construction of a natural gas line;
- construction of a power line;
- construction of a processing plant with a capacity of 45,000 tonnes per day;
- construction of a 30 tonne per hour (tph) bulk sample plant (BSP);
- construction of warehousing and administrative buildings;
- construction of a maintenance and technical services building;
- construction of a vehicle wash facility, warm-up shed and fire and emergency response building;
- construction of an interpretive centre;
- construction of security facilities (gatehouse);
- construction of helicopter landing pads;
- construction of explosives mixing and storage facilities;
- construction of fuel storage and distribution facilities;
- construction of a solid waste incinerator and sewage lagoon; and
- installation of a temporary construction camp.

In addition to the above, there are activities that bridge the construction and operations phases. These activities include:

- overburden removal and excavation at Star and Orion South;
- construction of other mine support facilities (e.g., internal roads and conveyors);
- development of a live ore stockpile and recovery reject pile within the plant footprint;
- construction of dewatering facilities and installation of dewatering wells and/or dewatering trenches/collectors;
- construction of an overburden and rock storage pile and a Coarse PK pile;
- potential gravel screening and washing facility;
- construction of containment facilities for mine water, process water and Fine PK; and
- construction of surface water management ditches.

2.5.1 Preparatory Activities

Preparatory activities include decommissioning of existing facilities, site clearing and timber removal. These are described below.

2.5.1.1 Decommissioning and Removal of Existing Facilities

Existing facilities (listed in Section 2.2.3) will be removed and decommissioned prior to construction, with the exception of the office facilities at Star, which may be used as a construction office. Useful material will be recycled, reused for construction, or sold if possible. In addition, the Lars Road fire tower, operated by the Saskatchewan Ministry of Environment (SMOE), lies within the proposed overburden and rock storage pile and will be relocated or removed depending on SMOE requirements. Shore acknowledges that Relocation of the Lars Road fire tower (English tower) is required and Shore will assume the cost of replacement, relocation and any other incidental costs related to providing adequate protection during the installation.

2.5.1.2 Lars Road Relocation

The proposed overburden and rock storage pile lies on top of Lars Road (see Figure 2.5-3). In order to maintain public access, Lars Road will be relocated around the perimeter of the overburden pile to link up to the southern portion of the road. There is the possibility that existing trails from the Twin Lakes area could be upgraded to connect to the south part of Lars Road, depending on results of ongoing community engagement.

2.5.1.3 Site Clearing and Timber Removal

The construction site will be prepared by site clearing and timber removal where needed. Within the Project area, trees will be left on site whenever safe to do so to break up sight lines, reduce wind speeds, and assist with dust control. All merchantable timber will be scaled according to the applicable permits, and sent for processing where possible, including a potential bio-fuel plant at Nipawin. Shore has signed a MoU with Nipawin

Biomass for use of wood residue if the timing of operations overlap. In addition, if Nipawin Biomass is not able to accept material, there is the potential for Prince Albert Pulp to use wood fibre from the Project for power generation or for pulp. Beneficial uses of slash and non-merchantable timber include stockpiling for future reclamation and creation of temporary security berms around operating areas. The security berms would be created by an approximately 20-30 m push back of non-merchantable wood and brush. A fire break of approximately 15 m around the outside of the berm would be created.

2.5.2 Surface Water Management

The Project will include one water diversion: the redirection of the East Ravine. The East Ravine will be impacted by the site access road and the Star open pit. The site access road will cross through the East Ravine with a substantial embankment and culvert. Mining of the Star pit will result in the removal of a portion of the East Ravine. In the initial stages of pre-stripping on Star, the middle reach of the ravine will be cleared and graded to provide an access ramp to the Star pit. All ravine water will be temporarily diverted to flow to its natural outlet. As the Star pit progresses, this natural outlet will be blocked and water from the upper reaches of the East Ravine will be diverted to a catchment pond bounded by a mine haul road and pumped directly to a polishing pond, used for site activities (i.e., dust suppression) or used to supplement flows in local drainages. At closure the middle reaches of the East Ravine will be re-established so that catchment water flows into the Star pit which in turn discharges into the undisturbed lower reaches of the East Ravine, and eventually flows into the Saskatchewan River. The culvert installed in the access road embankment will be sized to allow flow from the upper reach of the East Ravine to the lower portion of the ravine. The culvert under the access road is designed to be 1600 mm x 88 m long buried by 20 m of fill. The mine haul road will be removed at closure and the natural drainage re-established.

2.5.3 Access Corridor

An access corridor encompassing a roadway, communication lines, and a natural gas pipeline is proposed. It will extend from Highway 55 near Smeaton south to the current bridge at the White Fox River on Shipman Trail.

Once in the forest, the corridor will approximately follow the existing alignment of Shipman Trail for approximately 4.6 km, then follow the height of land along the drainage divide between English Creek and Caution Creek, then proceed south to the proposed mine site (Figure 2.5-2). This alignment reduces stream crossings and potential environmental impacts. The road will be constructed along existing rural municipality rights-of-way (ROWs) north of the forest, with approximately 9 km built over existing provincial grid roads. Within the FalC forest, approximately 21.9 km will be built off grid. Discussions with the Rural Municipality of Torch River indicate that an existing grid ROW elsewhere in the FalC forest will be exchanged for the proposed ROW alignment. The access corridor will cross an existing high pressure natural gas line south of Highway 55, the White Fox River at the northern boundary of the forest and the upper reach of the East Ravine.

The new access corridor will be approximately 30.9 km long, and will occupy approximately 127 ha. Up to 19 small borrow areas (each 1 ha or smaller) are planned for kilometres 1 to 8, 11 to 20 and 23. The exact locations have not yet been determined, but will be shown in the construction permit applications. The estimated total borrow area is 15.8 ha.

Construction of the access corridor will begin as soon as the required permitting is in place, as completion will be necessary to support other contemplated construction activities. All material required for the Project will be delivered to site by road. Rail could be used to deliver material to Choiceland, and then delivered to site by road.

Access Road

Provincial secondary highway grade standards will be followed for the construction of the access road. The access road will be constructed for a 110 km/h design speed and will be posted to a speed limit of 80 km/h or 90 km/h, meeting Ministry of Highways and Infrastructure standards. Two 3.7 m driving lanes plus paved 2 m shoulders are proposed for additional safety and ease of maintenance. Back and side slopes will be 4H:1V, with a minimum ditch grade of 1%. Right-of-way width will be an average of 46 m. Equalization culverts will be installed as needed.

White Fox River Crossing

The preferred option for crossing the White Fox River is widening of the existing bridge. Currently, there is a 17.9 m by 4.9 m wide steel bridge manufactured by Armtec / Rapid-Span Solutions. The bridge was constructed in 2007 based on a CS750 truck (CSA S6-88) standard. The bridge is supported by rubber bearing pads and precast concrete sills placed on steel bins containing compacted fill.

To widen the existing bridge, one additional bin cell wall will be installed adjacent to each of the existing exterior bin walls at the abutments. The existing bin wall wingwalls will be removed and reconnected to the new exterior bin walls. The resulting abutments will be 15.2 m wide. The old bridge will be realigned and connected to the new bridge superstructure to create a clear width of 12 m between the rails, and a roadway width of 11.4 m. The bridge deck will be steel coated with an epoxy-bonded anti-skid deck wearing surface by the manufacturer. W-beam guardrails will also be installed. This option will minimize in-stream works, and could be installed in the winter to further reduce potential environmental effects.

2.5.3.1 Gas Pipeline Corridor

A small 10 cm (4 inch) gas branch line is proposed within the access corridor ROW from a TransGas trunk line south of Highway 55 near Shipman to the site. The gas pipeline ROW is included in the road ROW. The location of the ROW is shown on Figure 2.5-2. No additional facilities are anticipated to be required for the gas line. Natural gas will only be used to provide building heat and fuel the incinerator. Heating requirements are estimated at 87,500 gigajoules (GJ) annually.

2.5.4 Production Power Line and Electrical Supply

SaskPower is evaluating supply options to provide the required electrical power to the site (Figure 2.5-3). The SaskPower Preliminary Project Description is attached as Appendix 2-A (SaskPower 2010). Shore estimates that the Project will require nominal loads of 97 megawatts (MW) during construction and pre-stripping and up to 106 MW for production. The options considered by SaskPower range from 15.6 km to 18.5 km of power line, connecting to an existing power line in the forest, southeast of the site across the Saskatchewan River. Final alignment will be determined by SaskPower through a separate application process for the power line. The SaskPower application will be subject to a parallel environmental assessment pursuant to the applicable environmental regulations. As such, the power line is assessed in a more general fashion in the EIS as an ancillary development in order to capture the full extent of the Project.

The electrical system for the Project can be divided into three basic areas: main substation; distribution network; and utilization systems (Figure 2.5-4). The main substation will be used to transform the incoming 230 kV transmission voltage, provided by SaskPower, into the site distribution voltage(s), requiring three 50 / 66 / 83 MVA 230 kV to 25 kV power transformers. The distribution network will be used to distribute electrical services at 25 kV to all the remote electrical rooms, and the mining area. A backup genset will provide power for essential services and anti-freeze protection to specific equipment. The utilization systems will be used to distribute electrical services to various extraction plant and mining loads at various voltages.

2.5.5 Plant Site Facilities

The processing plant, the administrative building, maintenance shop and technical offices, warehouse, security buildings, lube storage, truck wash and emergency response building, and the helipads will be located within the plant site footprint (Figure 2.5-1). The total footprint of the plant site and associated buildings will be approximately 37 ha.

All buildings will comply with applicable regulations and codes, including:

- *National Building Code of Canada* (2005);

- *The Mines Regulations*, Saskatchewan (2003);
- *Occupational Health and Safety Regulations*, Saskatchewan (1996);
- *National Fire Code of Canada* (1995);
- *Canadian Electrical Code* (2009); and
- *Environmental Management and Protection Act*, Saskatchewan (2002).

2.5.5.1 Processing Plant

The footprint of the process plant is approximately 123 m by 143 m and the recovery section is 53.7 m high. This footprint also incorporates the new BSP (Section 2.5.5.3) as part of the overall structure. The process plant building will be a structural steel frame building founded on concrete grade beams and slabs supported by concrete piles bearing on the harder tills below the surficial sands and clays. Conveyors and equipment for autogenous grinding, classification, dense media separation (DMS), diamond recovery and reject disposal will be assembled and installed. The plant will be constructed to a nameplate capacity of 16.425 Mtpa.

Construction of the plant will commence with site clearing and levelling, utilizing till from pit stripping operations for engineered fill under the plant foundations. Concrete piles and footings will be placed for structural steel support as well as directly under the larger AG mills. The entire shell will be constructed prior to assembly of the equipment. Buried services (water, gas, and septic lines) will be installed prior to erection of the plant building and tied in upon completion of the connecting components in the plant.

The operation of the processing plant is described in Section 2.6.3 (Kimberlite Processing).

2.5.5.2 Potable Water Treatment

The water treatment system will be located south of the plant building. This will allow for the provision of potable water during the construction phase of the remaining buildings, for hygiene and fire protection. A 25 m^3 potable water storage tank will provide enough water for one 12-hour shift. The treatment system assumes a 50 m^3/day water requirement based on peak loading expected from two 250 person shifts per day, and 50 L per person per shift. As the only source of potable water on site, complete redundancy will be built in.

A combination of media and membrane filtration will be used to treat shallow groundwater in compliance with the Saskatchewan Drinking Water Quality Standards and Objectives. Iron, manganese and arsenic will be removed using chemical oxidation followed by media filtration and then ultra / nano filtration. Wastes from the media filters and membranes will be placed in the process plant pump box for disposal in the PKCF.

2.5.5.3 Bulk Sample Plant

Shore will construct a new Bulk Sample Plant (BSP) attached to the main plant. The BSP will be approximately 110 m long, by 36 m wide, with a maximum height of 26 m.

The BSP will contain a milling circuit incorporating a 4.88 m by 2.13 m AG mill to simulate the milling technology in the process plant. The DMS circuit in the BSP will consist of a 420 mm diameter, pump-fed cyclone, drain and rinse screens for the cyclone products, a magnetic separator for ferrosilicon reclamation, a densifier to remove excess water from the ferrosilicon, a densitometer and a demagnetizing coil. The recovery circuit will contain a wet high intensity magnetic separator (WHIMS), a double pass wet X-ray machine, a grease belt with a grease recycling unit, an infra-red dryer, a dry high intensity magnetic separator (HIMS), a Laser Raman sorter and a glove box for hand sorting.

2.5.5.4 Fuel and Lubricant Storage

The plant site will have 150,000 L diesel fuel storage capacity (2 x 75,000 L above-ground double walled storage tanks) and a 10,000 L gasoline above-ground double walled storage tank (Figure 2.5-1), and an in-pit 60,000 L diesel fuel above-ground double walled storage tank and lubrication station). The tanks will be located in the secure main site, with delivery occurring outside the plant secure area (see Section 2.6.13.1, Security). A valve station 2 m x 1.5 m x 2 m high with spill containment will be constructed for delivery of gasoline and diesel. A similar building will allow delivery of bulk oil, lubricants and coolant. Lubricants and fuel will be transferred via truck to mobile equipment as needed throughout the site.

Motor oil and other lubricants will be delivered to site in bulk and stored to meet one month of demand. Anticipated quantities stored on site are:

- engine oil - 25,000 L (tank);
- transmission oil - 25,000 L (tank);
- hydraulic oil - 25,000 L (tank);
- gear oil - 1,600 L (tote);
- wheel motor oil - 1,600 L (tote);
- grease - 1,600 L (tote);
- open gear grease - 1,600 L (tote); and
- coolant - 1,600 L (tote).

These materials will be distributed from the bulk lubricant storage building to the maintenance building via pumps and carbon steel pipes to hose reels installed between two maintenance bays to serve each simultaneously.

The bulk lubricants building (Figure 2.5-1) will be of steel frame and metal sheet clad construction, approximately 23 m x 21.5 m, and 6 m high. The dimensions will allow for the lubrication truck to drive into the building for loading.

A 35,000 L used oil tank (inside the oil storage area) and a 5,000 L used coolant tank (outside the bulk lubricants building) are planned.

2.5.5.5 Fuel distribution

Fuel will be transported to site by road, and transferred via a manifold system outside of the secured portion of the plant site. There will be re-fuelling stations both at the plant site and in-pit to increase truck efficiency and to reduce fuel consumption. Fuel will be delivered from the main fuel storage location to the in-pit tank via an onsite fuel and lube truck.

2.5.5.6 Administrative Buildings

The administration building will be a single storey building measuring about 68 m by 30 m (2,050 m^2) with a five story security tower. This building will contain the main security entrance and lobby, health centre, conference rooms, visitor change rooms and administrative offices. The health centre will contain a waiting area, an examination room, observation room and treatment room. The administration area will house offices for Human Resources, Accounting, Payroll, and Senior Management, as well as a lunch room, conference room, archive area and mechanical room. The security tower will house IT personnel, a mechanical and electrical room and the main security operations and observation centre.

This building will be constructed as a pre-engineered steel frame building with metal siding and a commercial finish.

The administration building will be connected to the maintenance facility and the process plant by exterior covered walkways.

2.5.5.7 Maintenance and Technical Services Building

The maintenance and technical services building will provide service bays and offices for both the mine and process plant maintenance requirements and the Technical Services group offices. The building will contain two areas, a maintenance area (50 m by 145.2 m or 7,260 m^2) and office/dry area (43 m by 107 m or 4,634 m^2). The building has been designed with large equipment service bays on the north side, light equipment and component rebuild bays on the south side, one drive through bay for the largest mobile equipment and a welding / plate shop on the west end. Overhead 50 t capacity cranes will service the large equipment bays, plate and welding shops, with 10 t capacity overhead cranes servicing the light equipment and component rebuild areas. A 6 m wide centre aisle runs between the large and light equipment bays from the mine office to the welding / plate shop. Within the maintenance area, an oxygen and acetylene system will distribute those gases to 12 welding stations. Welding fume exhaust and truck exhaust systems will maintain appropriate air quality. A compressed air system will also be in place. Lubrication transfer systems will be installed for service in each bay.

The office / mine dry section will contain the mine operations offices, technical services and the mine dry. The mine dry is designed to accommodate up to 360 employees in the mine and maintenance departments, with moveable walls to reflect suitable space for the actual proportion of male and female employees. The office section will contain 2 conference rooms, 14 offices and open space for a muster area.

This building will be a pre-engineered steel frame building with metal siding and a commercial finish.

2.5.5.8 Warehouse and Cold Storage Building

The warehouse building will provide storage for parts and supplies as well as receiving and shipping services for all materials entering or leaving the Project site. The building will measure approximately 56 m by 45 m. Two loading docks and one drive-in at grade entrance will be located at one end of the building for receiving and shipping. The warehouse building will also include offices, a lunchroom, a meeting room, washrooms, service counter, and a mechanical room. The receiving and shipping portion of the warehouse shall be a secured area measuring 15 m x 15 m. All material leaving site (large equipment rebuilds, motors for repair, etc.) shall pass through this room for final search out prior to removal from site. Material and equipment that is too large for this area will be placed in a fenced area outside of the receiving zone for search out prior to leaving site.

A 1,290 m^2, pre-engineered steel frame cold storage building will be provided for warehousing of operating supplies and bulk items.

2.5.5.9 Vehicle Wash Facility, Fire and Emergency Response Building

The vehicle wash facility will consist of a 19 m by 26 m pre-engineered building equipped with steam cleaners and high pressure washing facilities. This facility will also have a collection sump and oil separator to contain any materials washed from the equipment.

The Fire and Emergency response building will be attached to the wash facility and measures 34 m by 25 m. This building will contain the ambulance, fire truck and emergency response equipment, as well as storage, training and office space.

2.5.5.10 Interpretive Centre

The interpretive center will be 460 m^2 and be a diamond shaped building located east of the Administrative building to provide meeting and presentation space for visitors as well as kitchen and washroom facilities (Figure 2.5-1).

2.5.5.11 Security Gatehouse

A small open concept gatehouse (120 m^2) will be constructed on the northeast portion of the plant site (Figure 2.5-1). An automated rolling security gate will manage traffic in and out of the site.

2.5.5.12 Helicopter Landing Pads

Two landing pads are planned. One will be located on the roof of the main plant building above the recovery area, to accommodate secure shipments from site, and is designed to accommodate the safety aspects of landing under different wind shear characteristics. There is also a landing pad close to the Interpretive Centre for general use and emergency response.

2.5.5.13 Coarse Ore Stockpile

A 24 hr supply of coarse ore will be maintained on site to the west of the plant. The pile will be a 42 m high cone, with a 109 m diameter constructed on bare ground. In this configuration, 45,000 t of live load would be maintained in a total of 165,000 t. Apron feeders will load material onto a conveyor that feeds directly into the AG mill.

2.5.5.14 Recovery Rejects Pile

Recovery rejects will be stored in a secure area to the east of the plant (Figure 2.5-5). This pile will contain the heavy minerals contained in the kimberlite. The recovery rejects will periodically be audited for diamonds, and then moved to the Coarse PK pile, sold, or reprocessed. The geochemistry of this material is described in Section 5.2.3 (Metal Leaching and Acid/Alkaline Rock Drainage). The sulphur bearing minerals in the kimberlite are concentrated in these recovery rejects, and, as such, this pile has the potential to leach metals and produce small amounts of acid. This pile will be constructed on a 1 m till base, covered by a 60 mil high density polyethylene liner, and then capped with 1 m of Coarse PK. The liner will direct runoff to a small retention pond, where the water quality will be analyzed and discharged with the process water if it meets discharge criteria, or treated with basic material and then released. The Coarse PK protects the liner, creates a stable working surface for light machinery, and buffers potential acid generation from the sulphur bearing minerals in the pile since the Coarse PK is basic.

2.5.5.15 Explosives Mixing and Storage Facilities

As with other mining activities in Saskatchewan, the mining will involve the use of explosives, estimated at 70 tonnes per week. To ensure safe transportation of explosives, the components of the explosives, ammonium nitrate and fuel oil (ANFO) consisting of prills and diesel fuel, will be delivered to an on-site facility which will serve as the basis of operations for vehicles that will deliver explosives directly down the boreholes.

There will be three storage facilities for explosives on site: a magazine for electric and non-electric detonators, a magazine for packaged explosives used for primers, boosters, and emulsion products, and storage silos for the ammonium nitrate. Fuel oil will be provided from the site fuel supply facility. A delivery / mixing truck will be used to deliver the components to the pit, and the ANFO will be mixed as it is loaded into the borehole. Emulsion products will be pre-packaged and delivered to site by the explosives supplier on an as needed basis to minimize the amounts requiring storage. Storage magazines shall be located at the minimum distances away from public facilities as required by regulation, and will be bermed, fenced and secure.

The explosives mixing truck will be stored in a separate facility, with spill containment, wash systems, secure lock up and water collection. Waste water from the facility will be delivered to the sewage lagoon for disposal.

ANFO storage is not required as the delivery vehicle will carry the components (prills and diesel fuel) on board and will mix them as they are placed in the boreholes. This eliminates the need for a separate storage facility and increases site security and safety.

The magazines will require licensing from both federal and provincial regulators. As the first several years of pit pre-stripping are in unconsolidated sediments, the magazines will not be required immediately. These facilities will be designed, constructed, located and operated according to the Saskatchewan Mines Regulations 2003 (Government of Saskatchewan 2003), the standards set out in the May 2001 edition of Storage Standards for Industrial Explosives (NRCAN 2001) and any other terms and conditions imposed on the permit by the chief mines inspector. The preliminary location is shown on Figure 2.1-1.

In general terms, it is expected that up to 140 tonnes or two weeks' supply of ammonium nitrate will be stored at any one time. Magazines will be protected by a fire break that will extend at least 8 m in all directions. No flammable material, including fuel oil, will be stored within 8 m of any magazine. The road to the explosives area will be clearly signed and securely gated. The area around the magazines will be fenced.

The explosives area will be located approximately 2 km from any point of public road access and about 3 km from the nearest site boundary (Figure 2.1-1). It will be located approximately 21 km from Highway 6, at its closest point. These distances are in excess of the minimum requirements. The proposed explosives mixing and storage location is 2.4 km from Lars road at the nearest point (at the north edge of the overburden pile where it intersects the existing alignment of Lars Road). As is shown on Figure 2.5-3, the proposed re-alignment follows the perimeter of the Overburden pile to the west, then south and east, to connect with the southern part of Lars Road which leads to the part of the James Smith Cree Nation (JSCN) reserve north of the Saskatchewan River.

2.5.5.16 Solid Waste Incinerator and Sewage Lagoon

Construction of the solid waste incinerator and sewage lagoon are described below.

Incinerator

A natural gas incinerator is planned to dispose of combustible refuse generated in the secure areas (see Section 2.6.13.1, Security). The incinerator capacity is calculated to be at least 179 kg/h in order to combust daily refuse. The building will be 12 by 10 m with a height of 5.4 m, and a preliminary location is shown with the main site infrastructure in Figure 2.5-4.

Sewage Lagoon

Waste water treatment will consist of a gravity sewer main to collect sewage and a two cell sewage lagoon to treat effluent, designed to handle 50 m^3 of waste per day. The lagoon will be designed according to Environmental Protection Branch Report No. 203 Guidelines for Sewage Works Design (SMOE 2008). The primary cell (1.27 ha) will receive a biological oxygen demand 5-day (BOD_5) loading of 30 kg/h per day from a BOD_5 contribution of 0.77 kg/capita-day and the secondary cell will hold 180 days of water (9,000 m^3). Both cells will be lined either with a synthetic liner or suitable low permeability soil. The lagoon will be fenced and posted, and located on the west side of the Duke Ravine (Figure 2.1-1), and continuously discharge into it. Continuous discharge will maximize dilution and minimize any environmental effects.

2.5.6 Temporary Construction Camp

A temporary construction camp composed of modular sleeping and recreation / dining units will be required to accommodate up to 700 people. This camp will be in place only for the duration of construction and will be removed once construction is complete. The camp will be powered by generator sets (600kW) until the completion of the power line, and is to be located at the current exploration camp site (Figure 2.1-1). Potable water will be either trucked in to site or made available from the treatment of existing groundwater sources at site. Sewage will be trucked to the existing sewage lagoon on Lars Road until the planned operations lagoon is constructed on the west side of the Duke Ravine.

2.5.7 Construction Phase Wastes and Emissions

Waste management and emissions during the construction phase are described below.

2.5.7.1 Construction Waste Management

Wastes from construction activities will include brush from land clearing and the usual generation of inert and industrial wastes associated with heavy industrial construction. Inert industrial wastes such as unusable scrap metal, wood and other construction debris will be collected and shipped off site for recycling or to a waste handling facility. Other industrial wastes will be segregated and shipped off site by an appropriate contractor. Recycling practices for scrap metal, wood, paper, tires, electronics and recyclable plastics, started at the exploration phase, will continue through construction. All recyclable material will be removed prior to plant start up, and prior to establishment of security zones (see Section 2.6.13.1, Security).

2.5.7.2 Construction Emissions

Emissions during construction will be limited to exhaust emissions and to dust generated by earth moving operations. Exhaust emissions will consist of nitrogen oxides (NOx), sulphur oxides (SOx), carbon monoxide (CO) and carbon dioxide (CO_2) emitted from mobile and stationary internal combustion engines. Equipment will be maintained to manufacturers' specifications to limit exhaust emissions to the extent practical. All vehicles will use provincially approved low-sulphur fuel. An emissions inventory is presented in Section 6.2.2 (Air Quality).

Dust control will be in effect with water being used where appropriate to suppress dust generation.

2.5.8 Construction Management Policies

Shore's Management Policies for security, health and safety, and environment will be adapted for the construction phase.

2.5.8.1 Construction Security

The main entrance to the mine site will be gated and all traffic into and out of the mine will pass through this area. The security post will be staffed continuously. Visitors and employees will be required to sign in and sign out. All areas will be restricted to personnel with appropriate security clearance and identification. Shore has developed a security program to support diamond exploration activities, and intends to update this program for the construction and operation phases.

2.5.8.2 Construction Health and Safety

Shore is committed to compliance with, and adherence, to its current Occupational Health and Safety (OH&S) program during construction to ensure the safety of individuals and to continuously improve policies and procedures to be implemented during operations. Many of these policies and procedures were in place during Shore's 5 years of exploration activities, and therefore will continue to be refined and optimized through the transition from construction to production.

An onsite health and safety department will be established for the construction phase to expand the existing OH&S program to include hazards related specifically to heavy construction, which include but are not limited to, the following:

- heavy equipment;
- ground disturbance;
- confined spaces;
- electrical hazards;
- chemical hazards;
- falling objects;
- exposure to noise and vibration; and
- working at heights.

These provisions are further described in more detail in Section 6.4.5 (Human Health) and Section 7.0 (Environmental Management System).

A Health and Safety manual will be developed through a team effort, including both management and representatives of the workforce at all levels. The manual will be readily available to all employees throughout the worksite and an Occupational Health and Safety Committee will be established according to applicable regulations at the site. A thorough understanding of, and compliance with, health and safety policies and procedures will be a requirement of continued employment at the site.

The Health and Safety Plan will be continually reviewed, revised and improved to keep up with the changing scope of site activities during construction and operation. Any changes to policies or procedures will be conveyed to employees and contractors by means of planned safety meetings, formal communication and through bulletin board postings. The Health and Safety Plan will also be presented during site orientation to all new staff and contractors.

2.5.8.3 Construction Environmental Management

Environmental personnel employed by Shore have developed an environmental management system, procedures and protocols to support Shore's 5 years of exploration activities. These existing programs will be the basis of Shore's environment component of SHEMS for the construction phase. Shore will use this experience to smoothly transition to the construction phase and to operations. Details are contained in Section 7.0 (Environmental Management System).

At least one environmental specialist will be on site at all times during construction activities, with alternating shifts to ensure continuous coverage. The duties of the environmental personnel will be to develop environmental plans in anticipation of site activities, monitor activities to ensure the environmental plans developed under the EMS are being followed, to collect environmental samples, and to provide reports to government regulatory agencies as required by the applicable permits and licenses.

Data management during construction will be performed using specific environmental management software designed to track environmental activities, employee responsibility, and follow up. This system will be implemented early in the construction phase, and designed to integrate into operations. Early adoption of the EMS increases efficiency and ensures that costly and disruptive system upgrades are not required.

2.5.9 Employment Opportunities

It is estimated that an annual average of 669 workers will be required for the five year construction period, although the number of people working on the project at any one time could vary from 100 to 1,000 workers. Total labour effort over the four years will be 3,345 person-years (see Section 1.5.4, Labour Force Requirements for Construction and Operation; and Section 6.4.1, Socio-Economic).

About 20% of the construction workforce will consist of general labourers. Another 30% will be journeyman trades people including industrial mechanics, electricians, heavy duty mechanics, and welders. Specialty truck and equipment operators will account for 30% of the workforce. About 10% of the workforce will be professionals and technicians such as engineers, geologists, metallurgists, environmental and health and safety specialists. Another 5% of the construction workforce will consist of construction managers and supervisors, and support office staff. The remaining 5% will be engaged in various other support occupations such as janitorial and security.

2.6 OPERATIONS PHASE

The operations phase is described here in terms of concept and schedule, mining method, backfilling, pit design, kimberlite processing and storage, water and waste management and management policies such as security and health and safety.

2.6.1 Concept and Schedule

Mine design and development will follow a phased approach with four phases planned at Star and two at Orion South.

The Feasibility Study (FS) (Shore 2011b) mining sequence is as follows: Star phases 1, 2, 3, and 4, then Orion South phases 1 and 2. Overburden from Star Phase 4 would be backfilled internally to the Star Pit. The FS plan contains designs to accommodate all other overburden in external facilities, without further backfilling of overburden into the Star pit. Shore will continually evaluate the potential for future backfilling of the Star pit; however, in the interests of proposing the worst case, all overburden from Orion South will be placed in the external pile.

There are substantial inferred kimberlite resources and other kimberlitic materials contained within the pit designs that will be mined as part of the waste stripping to expose ore. Shore intends to evaluate this material as mining progresses to determine if processing and diamond extraction is economic. Since this other kimberlitic material cannot be considered in NI 43-101 compliant reporting, but is likely to contain economic diamonds, and therefore be mined, the proposed footprint in the EIS considers this possibility to describe the maximum environmental impact of the Project.

The external PKCF is sized to contain all Fine PK from Star, including ore and other kimberlite, regardless of whether it currently meets reserve or resource definitions. All Fine PK and process water from the processing of Orion South Kimberlite will be placed in the Star Pit. Coarse PK from Star and Orion South will be placed in the Coarse PK pile.

The overall schedule is summarized in Table 2.6-1. Due to logistical limitations, ore will be stockpiled in-pit in years 15 and 16, for processing in years 17 and 18. Any ore mined in excess of processing will either be stockpiled temporarily in-pit or added to the live stockpile.

Table 2.6-1: Star-Orion South Overall Pit Schedule

	Ore Production (Mt)		Waste Stripping (Mt) (Total tonnes of waste from pre-stripping, IPCC stripping, waste rock stripping during mining)							
			Star Pit					Orion South Pit		
Year	Star Pit	Orion South Pit	Phase 1a	Phase 1b	Phase 2	Phase 3	Phase 4	Phase 1a	Phase 1b	Phase 2

Year	Ore Production (Mt)		Waste Stripping (Mt) (Total tonnes of waste from pre-stripping, IPCC stripping, waste rock stripping during mining)							
			Star Pit					Orion South Pit		
	Star Pit	Orion South Pit	Phase 1a	Phase 1b	Phase 2	Phase 3	Phase 4	Phase 1a	Phase 1b	Phase 2
1			12.894							
2			56.786							
3			100.137	6.315						
4			95.695	13.235						
5	0.416		68.363	15.567						
6	14.669		8.488	67.488	33.889					
7	14.967		1.243	50.921	18.552	9.744				
8	14.975			0.926	85.795	6.704		2.793		
9	15.145			0.277	60.280		14.261	19.317		
10	14.918				10.610	63.808	13.675	19.317	20.202	
11	14.897				10.138	44.689	14.155	17.564	30.852	
12	14.896				5.973	9.712	24.964	17.564	19.478	
13	14.745					7.081	8.642	35.188	21.045	
14	14.863					8.830	29.540	87.785	9.019	8.115
15	15.676	0.248				15.544	32.647	8.282	29.765	16.073
16	14.799	14.613				0.008	7.235	8.276	48.996	10.119
17	0.925	10.051					3.858	0.469	45.852	21.220
18		3.237							37.731	30.312
19		15.103							15.791	79.156
20		15.154							2.757	40.134
21		15.171								19.035
22		14.527								8.466
23		15.346								2.118
24		9.640								0.884
Total[1,2]	**165.889**	**113.091**	**343.607**	**154.730**	**225.237**	**166.121**	**148.978**	**216.556**	**281.489**	**235.812**

Note: [1]The tonnages are based on dry bulk densities. The pit equipment selection process and the mine operating cost estimates take additional weight due to moisture into account.
[2]Totals may not sum exactly due to rounding.
[3]Dry tonnes of ore mined.
[4]The processing plant will continue to process 14.3 Mtpa ore in years 17 and 18. Ore reclaimed from a stockpile will be fed to the plant at certain times in years 17 and 18 while the Orion South Pit Phases 1b and 2 are being stripped and readied for ore production.

2.6.2 Mining Method

The proposed Star and Orion South open pits will be conventional open pit mining operations with 15 m high benches.

Shore will operate and maintain a 20,000 tonne per hour (tph) capacity IPCC system for overburden removal (Figure 2.6-1). Removal of most of the surficial sand and clay layers will be conducted by Shore personnel using conventional earthmoving equipment such as excavators and trucks and scrapers to provide firm underfoot conditions for the IPCC system while maintaining a safe working bench height.

The IPCC system equipment includes three electric-powered shovels, three fully mobile sizers, nominally rated at 8,400 tph capacity each, with maximum capacity of 12,000 tph each, in-pit transfer conveyors, an overland waste conveyor and stacking system at the overburden and rock storage pile, and ancillary equipment. The IPCC system will excavate the remainder of the overburden and country rock.

The IPCC system includes controls to help the shovel operator position the bucket over the sizer hopper thus avoiding overshooting the hopper and having to creep back to the dump position and allowing a shovel / sizer combination to automatically creep forward together when advancing parallel to a mining face. The proposed shovels are proven technology with wide tracks and 42 m^3 buckets. The IPCC work will be planned and organized as follows:

- Fully mobile transfer conveyors will transfer material between the sizers and the cross-bench conveyors in order to help reduce the number of cross-bench conveyor moves;
- Inter-bench equipment moves will be made one shovel at a time to facilitate set-ups on new benches; and
- The IPCC shovels and sizers will be relocated to the next phase once they reach a bench where there is sufficient ore available to commence ore production. The ore will then be mined using hydraulic excavators and haul trucks. The haul trucks will dump into mobile sizers located in the pit.

In the Star Phase 1a pit, the IPCC system is scheduled to excavate between 7 Mwt/a (million wet tonnes per annum) and 104 Mwt/a. The proposed IPCC system includes excess shovel and sizing capacity (117 Mwt/a) and a monitoring and control system to assist in maintaining a high level of throughput. A total of 545 million m^3 of overburden and waste rock will be excavated from the Star Pit, and 398 Mbcm will be excavated from the Orion South Pit.

Shore will mine ore from Star and Orion South, at 45,000 tpd, maintaining and operating its own equipment and labour force. The ore and other kimberlitic material will be excavated using conventional hydraulic excavators (i.e., Komatsu PC 4000 or equivalent, 1,350 kW, 1,809 hp) and haul trucks (i.e., Komatsu 1500 or equivalent, 1,048 kW, 1,406 hp). The ore will be hauled to an in-pit ore sizer, and then sized and conveyed to the processing plant live stockpile. Other kimberlitic material will be hauled to an in-pit waste sizer and conveyed by the IPCC waste conveying system. The FS assumes that about 40% of the total ore and other kimberlitic material tonnage contained within the pit limits will need to be drilled-off and lightly blasted using ANFO.

Initial pit excavation will be undertaken to confirm assumptions made during pit design, to optimize future excavation, and to expose sufficient kimberlite ore to commence production.

The Star pit will be approximately 3.0 km long by 2.5 km wide to the crest of the pit and approximately 320 m deep. The Orion South pit is planned to be approximately 2.4 km long by 2.2 km wide and 300 m deep.

2.6.2.1 Use of Explosives

The proposed drilling and blasting program takes the following into consideration:

- pit development sequence;
- material characteristics;
- fragmentation requirements;
- regulatory requirements;
- potential environmental effects;
- environmental controls;
- best management practices; and
- occupational health and safety.

The majority of the material to be removed from the Star and Orion South pits will be free digging, with the remainder requiring drilling and blasting. Harder layers in the till sequences will be ripped using Caterpillar type D11 bulldozers or will be drilled and blasted if that proves to be a more efficient method of loosening the material. Current expectations are that the mine will primarily use shovels and rip hard soil layers if encountered.

Boulders found in the till will be set aside for use in constructing road berms, or otherwise drilled and blasted using a conventional packaged emulsion product and a non-electric detonation system.

Proposed Controls

The blast patterns will be designed to make effective use of the explosives and achieve the desired blast fragmentation. Standard operating procedures will be developed for drilling and blasting, the clean-up of spilled explosives, and the disposal of waste explosives in conformance with regulatory and Shore's requirements. Shore's drilling and blasting training program will extend beyond basic drilling and blasting training to include environmental awareness and emergency response training. Blasting performance will be monitored and continuous improvements will be applied throughout the mine's operation.

Proper blast designs that include the use of appropriate stemming heights and materials, coupled with blast monitoring, will be employed to result in the effective use of explosives and blasting agents, reduce air emissions due to incomplete explosive and blasting agent consumption, and help control fly rock and noise.

ANFO will be the primary blasting agent when borehole conditions are suitably dry; in the case of wet borehole conditions, an emulsion /ANFO blend will be used. The pit phases subsequent to Star Phase 1 will likely be drier due to initial dewatering, lowering the requirement for emulsion based explosives in later phases.

Blasting vehicles will be maintained in good mechanical condition and any metal parts that may come into contact with explosives will be covered with a suitable non-sparking material. Each vehicle will be equipped with two 4.5 kg multi-purpose dry chemical extinguishers that are readily available to the driver, appropriate signage, a battery disconnect, and a flashing red light that is placed in a visible location, in accordance with requirements set out in the Mines Regulations (Government of Saskatchewan 2003).

Blasting Consumables

Blast patterns and explosive loadings are largely dependent upon the mass characteristics, geology, blast configuration and fragmentation requirements. As operations progress, improvements will be made to the blast pattern to reduce the use of explosives and the risk of diamond breakage.

The projected blasting requirements are based on the use of a 70% emulsion / 30% ANFO blend when wet or 100% ANFO when conditions are dry. Explosive mix trucks will be employed to minimize the amount of manufactured explosives on site.

The blasts will be conducted using a conventional non-electric blast initiation system with standard delay time detonators, and/or an electronic system (such as the Unitronic electronic detonator timing system or other comparable systems).

The projected blast patterns for kimberlite, when required, are shown in Table 2.6-2.

Table 2.6-2: Blast Patterns in Kimberlite

Material	Bench height	Borehole Parameters	Explosive	Estimated Powder Factor
Ore	15 m	171 mm (6¾ inch) diameter boreholes. 6 m burden. 7.5 m spacing. 3.5 m collar. 1.3 m subdrill.	ANFO	Typical: 0.19 kg/t 0.38 kg/m^3 High value: 0.43 kg/t 0.84 kg/m^3
			70% emulsion / 30% ANFO blend	Typical: 0.24 kg/t 0.47 kg/m^3 High value: 0.53 kg/t 1.0 kg/m^3
Other kimberlite	15 m	171 mm (6¾ inch) diameter boreholes. 6 m burden. 7.5 m spacing. 3.5 m collar. 1.3 m subdrill.	ANFO	Typical: 0.18 kg/t 0.35 kg/m^3 High value: 0.35 kg/t 0.68 kg/m^3
			70% emulsion / 30% ANFO blend	Typical: 0.22 kg/t 0.44 kg/m^3 High value: 0.42 kg/t 0.84 kg/m^3

Notes: Estimated yield is 880 tonnes per borehole, 78 t / metre drilled.
Increased powder factor based on the use of a tighter (4.5 m x 4.5 m) pattern in ore.
Increased powder factor based on the use of a tighter (5 m x 5m) pattern in kimberlite waste.

2.6.2.2 Backfilling

Overburden and country rock from Star Phase 4 will be placed in the deepest parts of the Star pit using conventional equipment while the IPCC system is moved to the Orion South pit. The Overburden and Rock Storage Pile is designed to accept all overburden from Star and Orion South, however Shore will continually evaluate the possibility of backfilling overburden from Orion South into the Star pit.

Fine PK and process water from Orion South will be placed in the Star pit. As a result, the PKCF will not be used past year 16. Figure 2.6-2 indicates final remediation placement, including moisture and nutrient regimes. Figure 2.6-3 indicates backfilling and direct placement progression for Years 1-23. The Star Pit capacity is presented in Table 2.6-1. 504 million m^3 of overburden would be removed, in addition to 170 Mt of kimberlite (approximately 66 million m^3). Orion South is expected to generate 71.8 Mt of Fine PK (or 27.6 million m^3 of solids). Considering storage in pore space in the Fine PK, and all pit dewatering required, approximately 290 million m^3 are needed to store all produced water during operations from Orion South. As such, the Star pit is expected to have sufficient capacity for all material from Orion South plus a contingency for up to 279.6 million m^3 of overburden, from Star phase 4 or from Orion south.

If additional capacity is required for placement of Fine PK from Orion South, the following alternatives would be considered, in addition to options identified during operations, subject to appropriate permitting.

1. Raising the berm height on the PKCF;
2. Construction of an auxiliary PKCF on top of the Overburden Pile;
3. Construction of an auxiliary PKCF on top of the backfilled Star Pit; and
4. Directing less overburden from Orion South to the Star pit so that volume is available in the Star Pit for additional fines.

2.6.2.3 Pit Slopes in the Overburden Soils

Clifton Associates Ltd. (Clifton) carried out field and lab investigations to a Feasibility Study (FS) level in 2008 and 2010 to provide a geotechnical assessment of the overburden which produced a slope stability evaluation for both the Star and Orion South pits. Clifton (2011) indicated that the slope stability of the proposed Star and Orion South pit walls in the glacial overburden is primarily controlled by:

- the low strength of glaciolacustrine clays in the surficial stratified drift; and
- the condition of the shale at the glacial drift – Colorado Group contact.

Clay layers in the surficial stratified drift (sand, silt and clay) control the stability of the upper 20 m to 45 m of the pit wall, while the overall stability of the pit wall throughout the overburden is controlled by the shear strength of the shale at the top of the Colorado Group.

Based on stability analyses, Clifton assessed that the overall slope in the surficial stratified drift should be no steeper than 3.5:1 (H:V) and in the till should be no steeper than 2:1 (H:V) to maintain a Factor of Safety (FOS) greater than 1.10. However, as the condition of the shale at the upper Colorado Group contact was the controlling factor in the overall stability of the final pit wall slopes the focus of the overburden slope stability analysis for the Star and Orion South pits was on the most conservative case (i.e. the perimeter pit wall slope angles for slopes with the lowest residual shear strength). Various scenarios for the internal pit walls were also examined because of the use of various mining phases; however, for the purposes of the Shore FS only the final pit wall configuration case was presented. Optimization using internal pit wall criteria can be further examined during future detailed design and engineering.

Analyses of the pit slopes incorporated a number of the following design provisions:

- flattening of the overall slope geometry by leaving large benches (385 masl and 325 masl levels);
- reductions in pore water pressures and increases in shear strength with the excavation and replacement of *in situ* materials at the drift – bedrock contact (325 masl level) with a free draining granular (shear key) which has higher shear strength and better drainage properties than the *in situ* material;
- reduction in pore water pressures due to unloading during the pit excavation process;
- the surficial sand and drift aquifers would be dewatered; and
- piezometric levels in the bedrock aquifers would be maintained below the pit floor.

Material properties for the stability analyses were obtained from laboratory testing of samples obtained from the geotechnical investigations. Average shear strength properties and densities from samples taken around the pit perimeters were used to provide representative values. The soil properties used in the stability analyses for the Star and Orion South pits are included in Table 2.6-3.

Table 2.6-3: Shear Strength Parameters Used in Star and Orion South Stability Analyses

Soil Type	Unit Weight (kN/m^3)	Effective Cohesion, c' (kPa)	Effective Friction Angle (°)
Upper Sand (S1)	19.0	0	32
Lower Sand (S2)	19.1	0	32
Upper Clay (C1) Orion South	19.6	11	27
Lower Clay (C2) (or Star Clay)	19.2	0	12
Saskatoon Gp Till	22.6	40	34
Sutherland Gp Till	20.9	60	33
Sutherland Gp Clay (Orion South)	22.5	40	15.9
Colorado Gp Shale (softened)	19.5	0	22.4
Colorado Gp Shale (residual)	19.5	11	8
Shear Key Granular	19.0	0	32
Kimberlite	26.0	0	35

Star Pit Wall Stability

Results of the Star final perimeter pit wall slope stability analysis indicated an overall pit wall angle of 16.1 degrees was required to meet a FOS of 1.10 in the overburden materials. This analysis also accounted for the worst case scenario where the fully softened shale was mobilized to its residual shear strength, and kept at an FOS of 1.0. Thus, a failure of the worst case material results in a lowest overall FOS of 1.10.

The perimeter of the Star pit has been zoned according to the condition of the intertill clay and the Colorado Group shale at the drift – shale contact. The perimeter pit slope angles applied to the Star pit zones are included in Table 2.6-4. The angles have been measured relative to north (or 0°) azimuth using the centre of the proposed pit as a measuring point. For all zones identified along the Star perimeter pit wall, the slope angle was 16.1 degrees.

Table 2.6-4: Star Pit Wall Zonation and Pit Wall Slope Angles

Perimeter Pit Wall Angle from North (°)	Zonation	Perimeter Pit Wall Slope Angle (°)
290 to 35	2	16.1
35 to 150	3	16.1
150 to 255	1	16.1
255 to 290	3	16.1

Orion South Pit Wall Stability

Results of the Orion South final perimeter pit wall slope stability analysis indicated an overall pit wall angle of 16.1 degrees was required to meet a FOS of 1.10 in the overburden materials where the shale is present. As with the Star pit, this analysis also accounted for the worst case scenario where the fully softened shale was mobilized to it's residual shear strength, and kept at an FOS of 1.0. Thus, a failure of the worst case material results in a lowest overall FOS of 1.10.

The perimeter of the Orion South pit has also been zoned according to the same criteria as Star (i.e. condition of the intertill clay and the Colorado Group shale at the drift – shale contact). The perimeter pit slope angles applied to the Orion South pit zones are included in Table 2.6-5. For all zones identified along the Orion South perimeter pit wall, the slope angle varied from 16.1 degrees to 21.9 degrees. Despite this variation a conservative overall slope angle of 16.1 degrees was applied to the Orion South pit as a whole.

Table 2.6-5: Orion South Pit Wall Zonation and Pit Wall Slope Angles

Perimeter Pit Wall Angle from North (°)	Zonation	Perimeter Pit Wall Slope Angle (°)
345 to 45	4	19.5
45 to 75	6	21.9
75 to 130	3	16.1
130 to 165	5	21.9
165 to 205	2	16.1
205 to 275	3	16.1
275 to 315	2	16.1
315 to 345	5	21.9

2.6.2.4 Pit Slopes in the Sub-Overburden Rock

SRK (2010) characterized the sub-overburden stratigraphy as follows (typical thicknesses and depth intervals are shown in brackets):

- Colorado Group shale and mudstone (70 to 80 m thickness; typical depth interval: 110 m to 190 m);
- Mannville Group mudstone and sandstone (100 m to 110 m thickness; typical depth interval: 190 m to 300 m);
- kimberlite (thickness and depth are extremely variable); and
- limestone.

The geotechnical assessment used for slope design at the Orion South and Star kimberlite deposits adopted a methodology to handle the weak country rock stratigraphy. The points listed below summarize the important parameters used in this assessment:

- **Rock mass assessment and generation of geotechnical domains** - A rock mass assessment was undertaken to review the variability of rock mass quality within the kimberlites and sub-overburden country rocks. Kimberlites have been isolated as separate domains to the country rock and have been assessed independently;
- **Structural evaluation** – A limited kinematic assessment has been undertaken on structural features derived from the oriented core evaluation and underground mapping;
- **Analysis of geophysical data for physical rock properties** – work has been done to refine the range of material properties of the major geotechnical domains; particularly intact rock strength, by using downhole geophysical data;

- **Hydrogeology –** The relevant hydrogeological considerations such as permeability and pore pressures were applied to numerical models; and
- **Numerical modeling** – Discrete element modeling (FLAC 2D) has been conducted on vertical sections based on the Orion South and Star geological and geotechnical models.

The results of the geotechnical assessment provide a range of physical and hydrogeological parameters for each identified geotechnical domain (geotechnical stratigraphic unit) used in the geotechnical model. SRK (2011) concluded that slopes of 15° for the lower Colorado, 20° in the upper Mannville, and 25° in the lower Mannville were appropriate for feasibility level design. °

2.6.2.5 Pit Design

The Star and Orion South open pits will be conventional open pit mining operations encompassing a production rate of 14.3 Mtpa ore. The pits will be developed by Shore personnel using in-house equipment. Shore will be responsible for establishment of the pit haulage roads; dewatering; production drilling and blasting; the excavation of ore to the primary crusher; excavation of overburden and waste rock to the overburden pile; boulder breakage; oversize breakage; haul road maintenance; and equipment maintenance. The pit designs incorporate 15 m high benches. The shovels (42 m^3 capacity) will excavate 15 m high benches in overburden and waste rock. Komatsu PC4000 hydraulic excavator (22 m^3 capacity) will develop 15 m high benches in ore and waste rock. The typical pit slope configuration for Star and Orion South is shown in Figure 2.6-4.

Star Pit Design

Geotechnical design parameters based on the feasibility study reports provided by Clifton (Clifton 2011) for the overburden materials and SRK (SRK 2010) for the sub-overburden units were incorporated into the open pit design for Star.

Haulage ramps were designed to accommodate both double and single lane traffic for 136 t capacity haulage trucks (operating width = 6.7 m). Double lanes were designed to be 32 m wide whereas single lanes were designed to be 18 m wide. Ramp gradients were held constant at 10 %.

Figures 2.6-5, 2.6-6 and 2.6-7 show the Star Pit.

Orion South Pit Design

The Orion South pit design is comprised of three phases. Phases 1a and 1b are located in the south end of the deposit and Phase 2 is located to the north of Phase 1 (Figure 16.2). Most of the surficial waste will be stripped using conventional excavators, trucks, loaders, bulldozers and scrapers. Shore will utilize the IPCC system to strip the tills in Phase 1a to expose the ore. The ore and waste rock will be hauled to in-pit ore / waste sizers, sized and conveyed to the Process Plant ore stockpile / overburden pile. Once the IPCC equipment completes its work in Phase 1 it will be moved to Phase 2 for stripping.

Geotechnical design parameters based on the FS reports provided by Clifton (Clifton 2011) for the overburden materials and SRK (SRK 2010) for the sub-overburden units were incorporated into the open pit design for Star. Haulage ramps were designed to accommodate both double and single lane traffic for 136 t capacity haulage trucks (operating width = 6.7 m). Double lanes were designed to be 32 m wide whereas single lanes were designed to be 18 m wide. Ramp gradients were held constant at 10 %.

Figures 2.6-8, 2.6-9, and 2.6-10 show the OS Pit.

2.6.3 Kimberlite Processing

The process plant will have a nameplate capacity of 16.43 Mtpa and operate at 14.3 Mtpa ore (87 % of the nameplate). The process facility includes autogenous grinding, classification, dense media separation (DMS), diamond recovery and reject disposal.

Kimberlite processing produces three general types of material:

- Coarse PK consisting of material greater than or equal to 1 mm;
- Fine PK consisting of material less than 1 mm; and
- dense media concentrate which contains the extracted diamonds.

Once diamonds are recovered from the dense media concentrate, the remaining material will be stored in a separate pile for potential future re-processing or placement in the Coarse PK pile. Inputs into the processing plant will be ferrosilicon (2,314 kg/day), which is used as a dense medium to float off 99% of the kimberlite, grease (consisting of paraffin wax and petroleum jelly; 38 l/day) and water. All other materials released from the process occur naturally in the kimberlite and/or in the water. Figure 2.6-11 shows a the interior of the process plant.

2.6.3.1 Autogenous Grinding, Washing and Classification

Ore delivered from the conveyer system (minus 400 mm ore) will be fed to one of two 10.97 m diameter x 7.16 m long (flange to flange) rubber lined AG mills driven by two 4,000 kW variable speed drives. Two independent lines will allow for maintenance on one line while continuing production on the other. The speed and loading of the mill will vary with the characteristics of the ore, so that diamond liberation is achieved while minimizing diamond breakage. This flexibility is important, as each kimberlite type (e.g., EJF, Cantuar, etc.) will require different amounts of energy to liberate the diamonds.

Material will be discharged through 40 mm and 50 mm grates from the AG mill. Larger material will stay in the mill until it is broken down to less than 50 mm (-50 mm). The material less than 45 mm (-45 mm) will be discharged from the mill through the trommel screen while the material -50 mm +45mm will be recycled back to the AG mill feed. The -45 mm material will report to a double spiral classifier where the +0.25 mm material will be washed, dewatered and conveyed to a double-deck, sizing screen. Minus 0.25 mm material will be floated off the spiral classifier tank with water to a pumpbox, and subsequently pumped in slurry to the PKCF. A spare spiral classifier will be installed in the centre so when the operating unit needs to be replaced a chute will divert the material to the centre spiral classifier while repairs occur.

The sizing screen will separate the +0.25 mm solids into two sizes: -1 mm +0.25 mm and --45 +1 mm. Minus 45 +1 mm will be conveyed to a 5,000 t feed preparation bin prior to DMS. The +0.25 to -1 mm material will be collected and pumped to the PKCF.

Water will be added to the sizing and fines removal screens through spray nozzles.

2.6.3.2 Dense Medium Separation (DMS) Feed Preparation

The -45 +1 mm material will be sorted into two sizes with the aid of wash water: -8 +1 mm and -45 +8 mm prior to DMS. Each size fraction will go to a DMS circuit optimized to recover diamonds from each specific size fraction.

2.6.3.3 DMS Module Operation

The DMS circuit separates heavy minerals, including diamonds, from lighter materials. Ore is combined with ferrosilicon in slurry form at a ratio of 1:7 by volume for the -8 +1 mm size fraction and at a ratio of 1:5 by volume for the -45 +8 mm size fraction. Lighter materials float in ferrosilicon, and are removed from the heavier material with the aid of a cyclone. Light material is conveyed to the Coarse PK pile, and heavy material reports to recovery.

Ferrosilicon will be recovered and recycled wherever possible, thus minimizing the amount reporting to the PKCF.

2.6.3.4 Recovery Circuit

The diamond recovery circuit will utilize magnetic sorting, X-ray recovery, grease and Laser Raman recovery techniques. The expected average recovery circuit concentrate treatment rate will be 14.2 t/h for Star and 4.6 t/h for Orion South. DMS concentrate will be separated into 5 specific size fractions to optimize diamond recovery. Various combinations of grease, X-ray, Laser Raman, and magnetic separation will be used according to each size fraction. For example, the smaller sizes (1 to 2 mm) will use magnetic sorting, grease belts and Laser Raman, while larger sizes will include X-rays but not Laser Raman.

2.6.3.5 Water and Mass Balance

Water and mass balance for the process plant is shown in Figure 2.6-12. Quantities of Coarse PK and Fine PK expected from processing Star and Orion South kimberlites are summarized in Table 2.6-6.

Table 2.6-6: Projected Quantities of Coarse PK and Fine PK Materials

Open Pit	ROM Ore Tonnage (Mt)	Coarse PK Material (Mt)	Fine PK Material (Mt)	Recovery Rejects (Mt)
Star pit	165.9	81.8[1]	83.[1]0	0.9
Orion South pit	113.1	29.2	83.9	0.6
Total	**279.0**	**110.0**	**166.3**	**1.5**

Note: [1] The Coarse PK pile and PKCF design include additional storage for the potential processing of 26.2 Mt of inferred kimberlite and 22.8 Mt of contingency kimberlite that is not included in the FS (Shore 2011a and 2011b). The plant's process water needs will be met by drawing water from the pit dewatering wells and from recycle water from the PKCF. The plant's recovery water and potable water requirements will be met using water obtained from surficial water wells near the process plant. Should these wells not provide adequate quantities of water, the shortfall will be made up by collecting and pumping surficial runoff water in the pit and along the pit access ramps. It is projected that the plant will require up to 57,400 m^3/d of Mannville water/recycle water and up to 11,500 m^3/d of surficial water.

2.6.3.6 Bulk Sampling Plant (BSP)

Shore will construct a Bulk Sample Plant (BSP) (Figure 2.6-13) attached to the main plant for the purposes of:

- auditing future mining benches in the pit to provide information for mine planning;
- auditing the process plant to determine plant efficiency;
- processing recovery rejects; and
- processing exploration bulk samples from other kimberlite bodies.

The BSP will be able to treat 30 t/h. After completing each sample, the BSP will be cleaned to limit any cross contamination of samples. For this reason, each unit operation will be accessible and provide little opportunity for material hang-up.

The BSP will contain an AG circuit incorporating a 4.88 m x 2.13 m AG mill to simulate the milling technology in the process plant. The BSP top size will be 20 mm and the small amount of +20 mm AG mill discharge material will be reduced to -20 mm by a cone crusher then go to the DMS circuit. The +8 -20 mm DMS floats will go through a cone crusher back to the DMS to obtain a final product passing 8 mm. The DMS circuit in the BSP will consist of a 420 mm diameter pump fed cyclone, drain and rinse screens for the cyclone products, a magnetic separator for ferrosilicon reclamation, a densitometer and a demagnetizing coil.

The recovery circuit will contain a wet high intensity magnetic separator (WHIMS), a double pass wet X-ray machine, a grease belt with a grease recycling unit, an Infra Red dryer, a high intensity magnetic separator (HIMS), a Laser Raman sorter and a glove box.

Fine PK waste material will be placed with material from the production plant into the PKCF; the Coarse PK will be transported to the Coarse PK storage area.

Security in the BSP will be equivalent to the security in the recovery section in the process plant.

2.6.4 Overburden and Rock Storage

Overburden, consisting of sands, silts and till, and other rock including shale and other kimberlites, will be placed directly on native sand in a pile to the west of the 101 Ravine to avoid direct impacts to riparian areas and to reduce energy consumption, emissions and transportation costs. The size and shape of the overburden pile is shown on Figure 2.1-1 and will have a footprint of approximately 2008.29 ha. The pile is designed to contain up to 1,770 Mt of material (or 943 Mbcm) from the excavation of the Star and Orion South Pits, and be up to 60 m higher than the existing ground level. The overburden and rock storage pile will have slopes no steeper than 4H:1V, and will be engineered to be geotechnically stable.

Overburden and rock will be placed using a stacker. Suitable materials (i.e., till, sand and clay) will be placed near the surface to assist reclamation. Shale materials are not suitable for reclamation and will be buried or capped with at least 2 m of suitable material. Overburden and rock from Orion South may be placed in the Star pit, so final dimensions will likely be less than designed or potentially permitted.

2.6.5 Processed Kimberlite Containment Facility (PKCF)

The slurry from the processing plants, consisting of 15 to 30% Fine PK and 70 to 85% process water, will be piped to the PKCF in two 0.355 m (14-inch) inner diameter pipes, one containing -0.25 mm fines, and one containing 0.25 to 1 mm material. A redundant line will also be placed adjacent to these two pipelines as a contingency. The pipelines will be above ground with monitoring equipment to detect leaks along the pipeline. No secondary containment is required as flow will be shutdown and no environmental effect is expected as a result of a spill. Consolidation testing of the Fine PK resulting in calculated hydraulic conductivities ranging from a maximum of $1x10^{-8}$ m/s (void ratio of 1.611) to a minimum of $5x10^{-10}$ m/s after consolidation (void ratio 0.536; Klohn 2011).

For Star, the Fine PK will be pumped as a slurry to the PKCF. In warm weather months (about 8 months per year), the 0.25 to 1 mm stream will be dewatered by a hydrocyclone and used to construct the perimeter dyke. The hydrocyclone overflow will be discharged into the PKCF. All Fine PK will be discharged into the PKCF without hydrocycloning during cold weather months. All Orion South Fine PK will be pumped as a slurry into the Star pit in two 0.355 m (14-inch) inner diameter pipes. The pipes will be placed along the access ramp and discharge into the pit, with local erosion protection at the discharge point. As the pit fills, the pipe will be cut to length during unfrozen months, to discharge at the appropriate level. As the fine PK and process water will be continually discharging in the same location throughout the winter, it is unlikely that placement of material will occur on top of frozen ground. The Project is located well away from any locations of discontinuous permafrost and, the development of ice lensing is unlikely. In addition, during exploration, no ice lensing or frost build up occurred in the fines management area during year round operation.

The starter perimeter dyke will be constructed using suitable till or sand material excavated from the within the footprint of the PKCF or the Star pre-stripping operations. Hydrocycloned 0.25 to 1 mm processed kimberlite will be used to progressively raise the dyke. The dyke will be constructed using the centerline method with a downstream 4H:1V slope, and have an ultimate height of 60 m with a 1.5 m freeboard. A pond will be maintained within the PKCF and water will flow from the PKCF to a polishing pond east of the plant site for further polishing. The polishing pond water will be recycled to the processing plant or released to the environment, depending on water quality. Seepage, estimated at 1,000 m^3 per day, will be collected in perimeter ditches, and, depending on water quality, will be treated using natural wetlands (wetland treatment) to reduce metal concentrations, or recycled to the PKCF.

The footprint of the PKCF will be approximately 13.59 ha, and have a storage volume of approximately 135 million m^3 (Figure 2.6-14). Once kimberlite from Orion South is processed, fine PK will be disposed of in the Star pit.

2.6.6 Storage for Coarse Processed Kimberlite (Coarse PK)

Coarse PK will be conveyed from the plant to the Coarse PK pile about 1 km from the plant site (Figure 2.1-1) and will be constructed on native sand in two streams: 1 mm to 8 mm material; and 8 mm to 45 mm material. The Coarse PK may be reprocessed at a future date if warranted.

The Coarse PK is a relatively free-draining material, and will be dewatered to low moisture content in the plant before it is conveyed to the Coarse PK pile. The Coarse PK pile is designed to contain 60.7 million m^3 of material and be a maximum of 50 m above the existing ground surface. Total material volumes conveyed to the Coarse PK pile are presented in Table 2.6-7.

Table 2.6-7: Volumes of Material Stored in the Coarse PK Pile by Year

End of Year			Coarse Recrush (-45+8) Volume (m³)	Coarse Reject (-8+1) Volume (m³)	Total Coarse Volume (m³)
0	2014	Dec	65,054	46,398	111,451
1	2015	Dec	1,700,422	1,212,769	2,913,191
2	2016	Dec	3,254,074	2,320,861	5,574,934
3	2017	Dec	4,914,713	3,505,256	8,419,969
4	2018	Dec	6,513,437	4,645,494	11,158,932
5	2019	Dec	8,122,617	5,793,188	13,915,804
6	2020	Dec	9,694,993	6,914,633	16,609,626
7	2021	Dec	11,298,943	8,058,598	19,357,541
8	2022	Dec	12,937,512	9,227,253	22,164,765
9	2023	Dec	14,558,063	10,383,057	24,941,120
10	2024	Dec	16,187,925	11,545,503	27,733,428
11	2025	Dec	17,795,875	12,692,320	30,488,195
12	2026	Dec	19,437,005	13,862,801	33,299,806
13	2027	Dec	21,053,468	15,015,691	36,069,159
14	2028	Dec	22,669,931	16,168,580	38,838,511
15	2029	Dec	24,286,395	17,321,469	41,607,863
16	2030	Dec	25,269,559	18,022,678	43,292,237
	2031	Jan	25,379,801	18,107,499	43,487,299
17	2031	Dec	26,567,567	19,021,378	45,588,945
18	2032	Dec	27,865,575	20,020,078	47,885,653
19	2033	Dec	29,163,583	21,018,778	50,182,361
20	2034	Dec	30,461,591	22,017,479	52,479,069
21	2035	Dec	31,759,598	23,016,179	54,775,777
22	2036	Dec	33,057,606	24,014,879	57,072,485
23	2037	Dec	34,355,614	25,013,579	59,369,194
24	2038	Dec	35,123,751	25,604,591	60,728,341

The final side slopes would be 4H:1V and the total area would be 169 ha. The pile will be constructed by stacking and spreading of the Coarse PK material. Pile run-off and contact water will be collected in perimeter ditches and either directed to natural wetlands for wetland treatment or recycled to the PKCF, depending on water quality.

It is planned that the Coarse PK pile will be progressively reclaimed using a vegetated cover and that the cover placement will include measures to mitigate erosion.

2.6.7 Unprocessed Kimberlite Stockpile

As previously indicated, the Star Kimberlite consists of five eruptive events, each with variable diamond grade and quality. There is also variation in the diamond grade internally within these units, meaning that there may be areas or eruptive units that will be less economic. As a result, there will be a need for an unprocessed kimberlite (low grade ore) stockpile. The low grade stockpile is proposed within the overburden rock storage pile footprint.

2.6.8 Conveyor System

Conveyors will be used as much as possible to move material, to increase production efficiency and to reduce diesel fuel consumption. Conveyors will be used to move:

- overburden and rock from the pits to the overburden and rock pile;
- kimberlite ore from the pits to the process plant or low grade stockpile;
- low grade ore from the stockpile to the processing plant; and
- Coarse PK from the plant to the Coarse PK pile.

Conveyors require a cleared corridor and a maintenance road for operation.

2.6.9 Water Management

The main objective of the Project water management strategy is to manage the flow of groundwater, surface water and runoff which will then allow for in-pit mining activities, provide sufficient water to the process plant, and reduce the environmental impacts. The strategy accounts for design to alleviate sediment loading and to minimize the potential impacts to the Saskatchewan River from site operations. The use of water from the water management system as process water is also designed to reduce the potential environmental impact.

Therefore, the water management system will therefore need to accomplish the following tasks:

- dewater the overburden soils/tills and the rock mass to maintain pit wall stability;
- drain water and prevent water pressures from building up behind the pit walls;
- control surface water and runoff and prevent it from entering the pit;
- capture precipitation and drain it away from roads and active mining areas;
- remove surface water within the pit to prevent flooding of the working areas; and

- provide water to the process plant.

Achieving these goals requires several different measures working together to form an effective mine water management system.

The main components and the expected water flows from the water management system are shown schematically in Figure 2.6-15. The water management system includes both in-pit and well dewatering activities, the construction of holding and polishing ponds, and a pipeline and diffuser into the Saskatchewan River.

For the dewatering of the Star open pit, two separate groundwater collection systems are required due to the differing natures of the shallow and deep groundwater systems. There will be the in-pit system to collect precipitation and groundwater that seeps into the pit from both the shallow groundwater system and from the confining layer. In addition, there will be deep dewatering wells to depressurize the deeper Mannville aquifer.

The Mannville aquifer is a large regional aquifer that is heterogeneous, has a large areal extent and has been shown to have hydraulic conductivities that are suited to it being dewatered by pumping from wells. The aquifers within the shallow groundwater system and the confined layer are generally either much more local in nature than the Mannville aquifer, are of limited vertical extent and/or have only moderate hydraulic conductivities. As a result, the use of wells to dewater the shallow groundwater flow system or the confining layer is not preferred.

2.6.9.1 Water Input

The Process Plant is estimated to have a water requirement of 68,900 m^3 per day, all of which is expected to be sourced from recycling, pit dewatering wells, surface wells or from surface run-off collection. Up to 64,704 m^3/d of water would be pumped to the PKCF with the Fine PK. This water (minus losses due to seepage and evaporation) would be recycled to the Process Plant from the PKCF polishing pond and supplemented with groundwater supply.

Pit Dewatering

There will be two separate sources of groundwater that need to be controlled through the pit dewatering system:

- higher quality shallow groundwater in the overburden (with TDS <1,000 mg/L); and
- lower quality groundwater from bedrock aquifers (mainly the Mannville aquifer with TDS of approximately 3,950 mg/L).

The overburden containing the better quality groundwater will be dewatered separately from the Mannville aquifer by using an in-pit water collection system (estimated to be approximately 10,000 m^3 per day) to collect seepage and groundwater inflow.

The lower quality groundwater from the deeper aquifer will be sourced from the Mannville Group sediments and from groundwater contained within the kimberlite and will be dewatered using a system of pumping centres located around the perimeter of the pits. The deep aquifer also needs to be depressurized to improve the stability of the pit slopes and to reduce or remove the passive inflow of Mannville water through the kimberlite and into the pits during mining.

In-Pit Dewatering

The in-pit dewatering system will collect and manage any in-pit precipitation, all groundwater seepage from pit walls, and potentially any drainage that may be required for geotechnical stability. Groundwater from the shallow groundwater system and from the confining layer will seep into the pit from its walls. The location of these water discharge points into the pit will vary over time as the flow regime changes with shallower aquifers drying out and other deeper aquifers becoming exposed. There will also be changes in the amount of water handled by this system in response to seasonal precipitation events and during the spring freshet. The in-pit dewatering system will consist of a series of temporary and permanent ditches and sumps which can be easily modified to maintain flexibility as the pit is expanded during mining.

In order to address any water pressure build up behind pit walls or to manage any significant, sustained inflow to the pit from gravel horizons, additional horizontal and/or vertical drains or wells may need to be installed. If required, the length, spacing and angle of inclination of these holes or wells will be determined during operations according to requirements. In general, these drains will be a secondary measure to reduce the groundwater pore pressures and transport the water away from the pit walls as quickly as possible. These drains will pipe the water directly to the nearest sump and/or a ditch network.

The in-pit water will be pumped to a small polishing pond, where sediment will settle out. Depending upon water quality, this settled water would then be used for site activities (e.g., dust suppression, fire control etc), used for supplementing flows into local ravines, or be directly discharged into the Saskatchewan River via the diffuser.

Dewatering Wells

Dewatering wells will depressurize the deep groundwater system to restrict the amount of water that seeps and flows into the pit through the Mannville aquifer. Eighteen pit perimeter pumping centres at Star will be installed for dewatering during the first 14 years of operation (with a pumping rate of 98,100 m^3/d) with an additional five in-pit dewatering wells planned for the years 15 to 17.

For mining of Orion South, an additional 7 perimeter wells are needed for years 19 to 24. It is estimated that a peak of approximately 130,800 m^3/d of water may have to be pumped in order to lower water levels sufficiently for safe mining in year 19 while operations are ongoing in the Orion South pit. Deep aquifer water pumped to the surface would be used as make up water in the Process Plant or placed directly in the Saskatchewan River through the diffuser.

Process Water Management

Water used in the Process Plant to treat the kimberlite will be recycled from decant water obtained from the PKCF and placed back in the Process Plant to be used in the AG milling circuit. Make up water, to account for seepage (1,000 m^3/d), process losses (4,128 m^3/d) and evaporation (variable) within the PKCF, will be taken from the Mannville pit dewatering system. Water used in the recovery section of the Process Plant will be sourced from surficial groundwater wells as better quality water is required for use in the recovery process. Seepage from the PKCF will be treated by using a natural wetland system, or pumped back into either the PKCF or the PKCF polishing pond. The system used will depend upon the water quality at the time.

Due to consolidation of the Fine PK in the PKCF, hydraulic conductivity of the Fine PK is low ($5x10^{-10}$ m/s; Klohn 2011). The consolidation prevents downward movement of process water during operations, and seepage is expected only through the PKCF berms (Klohn 2011). During early operations, prior to Fine PK consolidation, seepage is expected to infiltrate into the surficial sands and be collected in the external drainage ditches as the PKCF sits upon a continuous layer of clay silt (hydraulic conductivity of $3.5x10^{-7}$) which restricts vertical water movement. As such, during operations, the external drainage ditches are expected to intercept and collect seepage from the PKCF, and be managed as described above.

Outfall Design

The outfall is located in the Saskatchewan River, approximately 40 km downstream of the confluence of the North and South Saskatchewan Rivers near the FalC Ravine. The diffuser would consist of a 1,200 mm diameter standard wall steel pipe that is buried beneath the low flow width of the Saskatchewan River, with discharge points every 10 m along this pipe. Details of the conceptual design are contained in Appendix 6.3.1-B. For the purposes of dispersion modeling, this outfall was treated as a single pipe although a multi-pipe manifold system could also be used.

Excess Mannville water not used for processing will be transported to the diffuser structure in a 1.37 m diameter high density polyethylene pipe which will come directly from the pit dewatering ring pipeline will connect the pit perimeter pumping centres. In the event of a pipeline failure, Mannville water would be pumped to the PKCF through the redundant third pipeline.

Flow Supplementation

As described in Section 6 of the EIS, small changes in surficial groundwater levels near the Project are expected from pit dewatering activities. These changes have the potential to alter flow volumes in the Project area ravines. Shore will supplement low flows as required by directing water of suitable quality to the ravines. Water resulting from the proposed natural wetland treatment of the PKCF seepage will provide volumes to English Creek and Duke Ravine. The lower reaches of the East Ravine will receive surficial water collected in the upper benches of the Star pit. Water from the runoff pond would be directed to the 101 Ravine or Caution Creek as needed.

2.6.10 Gravel Extraction

A considerable amount of gravel will be required for infrastructure development, including construction of access roads, haul roads, and site foundations. Geotechnical information from both Star and Orion South indicate that the overburden contains significant amounts of gravel, and it is possible that gravel contained within the overburden may be economically recoverable. If so, it is reasonably foreseeable that the gravel operation may use water from pit dewatering for gravel washing and that this gravel will be used for site construction. Additional facilities located within the Project footprint, may be required to wash, extract and store gravel contained in the overburden for commercial sale, if economic.

2.6.11 Products

Products expected from this Project are:

- diamonds;
- sand, clay and gravel from the overburden; and
- other products from the kimberlite and concentrate including garnet and ilmenite.

2.6.12 Wastes and Emissions

Waste management and emissions during the construction phase are described below.

2.6.12.1 Operation Phase Wastes

The principal mining wastes generated from diamond mining will be non-hazardous natural materials: overburden removed from the pit(s), Fine PK and Coarse PK.

All non-hazardous combustible wastes generated within the secure zone (see Section 2.6.13.1, Security) will be incinerated to minimize security risks. The mining process will also produce smaller quantities of inert, non-combustible industrial wastes such as scrap metal and glass which will be stockpiled on site. A certain amount of hazardous waste also will be produced including drained and discarded oil filters, used oil, unserviceable lead acid batteries, contaminated soil from accidental spills, etc. X-ray tubes will be stored on site and periodically returned to the manufacturer for disposal. Other hazardous wastes which are expected to be generated infrequently and in small quantities in the secure zone during operations (e.g., paint and paint remover) will be stored on-site until decommissioning, or, if site security is not jeopardized, removed to an appropriate off-site facility.

As a general principle, wastes generated outside the secure zone will be recycled to the extent practical. Industrial wastes will be collected in a dedicated lined area or a building with adequate secondary containment, and shipped to an approved off-site location by a licensed waste contractor.

2.6.12.2 Operations Phase Emissions

Emissions from operations are expected to result mostly from combustion of diesel fuel in mobile equipment. Other emission sources are the incinerator, light vehicles, and burning of natural gas for heating. These emissions will include carbon dioxide, nitrous oxides (NOx) and particulate matter. Sulfur oxides (SOx) are not expected in significant quantities. These emissions are further detailed in Section 6.2.2 (Air Quality).

Dust will be generated from road traffic, blasting, movement of overburden and from wind erosion on bare ground.

2.6.13 Management Policies

Shore's current Management Policies for security, health and safety, and environment, used during exploration and bulk sampling, will be adapted for the operations phase.

2.6.13.1 Operations Security

The fundamental objective of Shore's security program is to ensure appropriate safeguards are in place to protect employees and Shore assets. Employee safety is ensured by removing the risk of outside influences, including coercion, on employees and their families. Shore will develop a secure work environment and promote an inherent sense of security awareness as a shared responsibility by all employees and contractors. Shore's security program will incorporate professionalism, mutual respect, cooperation and sensitivity.

The security program will conform and operate according to proactive security initiatives and protocols that will be supported by investigative and technical processes to identify security risks that may undermine the mine-to-market value chain.

The security standards and protocols will be carried out by professional security personnel trained in appropriate diamond security methods and techniques. Some of these methods and techniques include physically searching all employees, contractors, parts and equipment exiting from any high risk areas. Security personnel will also utilize the latest technologies within the diamond industry to ensure the highest levels of security to assist in monitoring, securing and protecting the most sensitive and high risk areas. These technologies will include, but are not limited to closed circuit television (CCTV), high resolution cameras, digital video recording, secure access programming, and the latest in security management system software. All areas that may be deemed to be a potential risk will be tightly controlled.

Shore's security program and operations will be subject to regular audit and physical reviews in order to identify and mitigate any potential or identified security risks such as theft and/or other criminal activities.

The security program will also provide training and orientation to employees and contractors regarding site and work specific security protocols. Presentations on security awareness will also be integrated into a site and work orientation program with the ultimate goal of protecting the integrity and physical well being of all Shore employees, their families and contractors and prevent the loss of Shore assets.

Site Security

The main access road is from Highway 55 to the north and will run directly to the mine site security gate entrance facility. The main access road will be monitored by site security using high definition cameras and appropriate sensors to ensure access roadway security and safety for all persons entering the mine site.

Access to the mine site will be by prior authorization only. Once admitted onto the mine site, all persons will be subject to security checking, video monitoring and area access tracking. All vehicles will proceed to a designated parking area. From the parking area all persons will precede directly to the security area located in the entrance foyer of the administration building, and will be required to present themselves to security for further directions.

Access to areas beyond this point will require prior authorizations before access and identity cards will be issued. Once the access and identity cards are issued they must be worn and visible at all times. Authorized visitors and contractors proceeding beyond this point must be accompanied by a supervisor or designated sponsor from the area to be visited.

There will be three zones of security for the mine site (Figure 2.5-1). Each security zone will be determined by potential security risks. The three security zones at the mine site are:

- The Green Zone is an area of low security risk. This area will be secured with natural berm barriers, fencing with security gates and/or doors with access controls. This area may also be monitored by security cameras and/or sensors;
- The Blue Zone is an area of moderate security risk and will be secured with chain link fence, walls or enclosures. All entry to and exit from this Zone will be through authorized secure access control, and will have full time video monitoring and a security presence. Persons and materials will be subject to physical or technical searches on entry and exit; and
- The Red Zone is the area with the highest security risk level. Authorized access to this Zone is limited and strictly controlled through secure barriers, doors and walls, and will include security controlled access at all entry and exit points. All persons and materials will be subject to physical and technical searches by on site security officers.

A helicopter landing pad will be located in the Red Zone on the roof of the recovery building of the process plant, and another in the Green Zone adjacent to the interpretive centre. The helipads and surrounding areas will be continually monitored by site security. Helicopters landing at either of the helipads will require pre-authorization. Security will monitor all flight traffic in and out of the mine site and provide screening accordingly.

All materials slated for operational use will be unloaded at the site warehouse and then checked through security on receipt and before being released for pick-up or delivery to site operational areas. All supplies or materials leaving the mine site will be inspected and checked through a security inspection area in the warehouse.

Generally, all stationary and mobile equipment will remain in a secured zone except when shipped off site for maintenance or service. Everything leaving the mine site will be checked through a security inspection area prior to being released off site.

Site security will also include a mobile security presence in and around the mine site. This will allow rapid response capability to any security and/or safety concerns that may arise.

Plant Security

The process plant will be equipped with a robust access control and monitoring system installed on all entry and exit points including all laboratories, offices, control and electrical rooms. The access control system will be continually monitored by security. Security officers will be present in the process and recovery plants. Only authorized persons will have access to the process plant, recovery plant or the BSP.

All critical and high risk areas of the process plant will be monitored and recorded by a security camera system. The process plant control room will also be equipped with video monitoring of critical process areas.

The recovery plant, BSP, concentrate storage area and concentrate conveyors will be separated from the process pant by suitable walls and barriers constructed from building materials that will not allow common ports or access between the areas.

Access to the recovery plant and BSP areas will be strictly controlled and restricted to authorized persons only. Two authorized people will be required in the recovery area and BSP at all times (two party accountability). All handling or movement of material and any authorized access to any recovery or BSP process equipment must follow ‘two party’ accountability policies and procedures. All recovery and BSP equipment will be equipped with secure access control video monitoring that will be monitored through the security management system.

2.6.13.2 Operations Health and Safety

Shore is committed to compliance with the Health and Safety plan during operations to ensure the safety of individuals, maintain the integrity of the Health and Safety Program and develop operational policies as needed during operations.

An onsite Health and Safety Department will be established for the operations phase of the Project, and will build upon the Health and Safety program that will be in place during construction. This program will address hazards related to mining and processing including but not limited to:

- safety and fire risk of mobile and stationary equipment;
- exposure to particulates;
- exposure to noise and vibration;
- blasting safety;
- electrical hazards;
- exposure to welding fumes;
- exposure to diesel fuel ;and
- slope failure in the pits.

The program is described in more detail in Section 7.0 (Environmental Management System).

The Health and Safety manual developed during construction will be revised and expanded prior to commencement of operation, and continually updated as development progresses.

The development of this manual will be a team effort, including management and representatives of the workforce at all levels. Comprehensive review and study of the manual will be a requirement of employment at Shore. The manual will be available for all employees throughout the worksite. In addition, an Occupational Health and Safety Committee will be established according to the applicable regulations.

The Health and Safety Plan will be continually reviewed, revised and enhanced. Employees and contractors will be made aware of any changes in policy or procedure by means of planned safety meetings, formal communication and bulletin board postings. The Health and Safety Plan will also be reviewed during site orientation for all staff and contractors.

All employees will be provided Workplace Hazardous Materials Information System (WHMIS) training upon engagement, and Material Safety Data Sheet (MSDS) stations will be set up at key locations. All employees will be required to be familiar with MSDS that pertain to their work. Shore will supply, and require the use of personal protective equipment. Employees will not be permitted to operate any equipment unless trained to do so.

Qualified first aid and medical personnel will be on site 24 hours a day, 7 days a week. A dedicated first-aid equipped vehicle will be available at all times. First-Aid rooms will be kept clean and well stocked with supplies. All employees, contractors and visitors will be informed where these stations are located as part of initial site orientation.

All employees, contractors and visitors will be required to attend safety orientation sessions run by qualified personnel. Visitors will always be accompanied by an employee escort.

2.6.13.3 Environmental Management

For operations, the Environment group is anticipated to consist of 7 employees, who will be responsible for continued development and refinement of the environmental management system (EMS) initiated during construction. In addition, the environmental staff will be responsible for implementation of monitoring programs as required, including regulatory requirements and corporate activities developed under the EMS, to collect environmental samples, and to provide reports to government as required by the applicable permits and licenses.

Data management and reporting will continue to use the dedicated software system initiated during construction. This software facilitates management of environmental activities so that environmental requirements are fulfilled at the right time. Further details of the EMS are described in Section 7.0 (Environmental Management System).

2.6.14 Employment Opportunities

As described in Section 1.5.4 (Labour Force Requirements for Construction and Operation) and Section 6.4.1 (Socio-Economic), on average, the mine will directly employ 730 people annually when in production. Although costs will vary based on the volume of material being moved and processed each year, the workforce is estimated to remain fairly constant. The workforce will have seven components:

- Mining operations would require an average of 200 workers. However, as the volume of material being moved varies considerably, the number of people employed in mining operations could range from a peak of 380 workers in 2026 to less than 100 per year after 2029;
- In-pit crushing and conveying (IPCC) would require 95 workers per year;
- Processing would require 59 workers during each year of operations;
- Maintenance related to mining and processing would employ an daverage of 186 people, although this varies from 270 at peak to 106 at the end of the plan operations;
- The sorthouse would require 31 personnel;
- 21 managers would be required; and
- General and administration would require 128 workers.

Operations will occur year-round. For most staff this will involve 12-hour shifts on a rotational basis. Office staff will work a 40-hour work week.

2.7 DECOMMISSIONING, CLOSURE AND RECLAMATION PHASE

The conceptual Closure, Conservation and Reclamation (CCR) plan is designed to minimize the environmental impacts from the Project (Section 7.5).

The total footprint area of the proposed facilities is 3,945.65 ha with individual sites summarized in Table 2.7-1. Each area will require site specific treatment at closure.

Table 2.7-1: Summary of Project Facilities

Facilities	Project footprint (ha)
Overburden and rock storage pile	2008.29
Orion South pit	427.56
Star pit	588.82
PKCF	513.59
Coarse PK pile	179.91
Site facilities	36.95

Facilities	Project footprint (ha)
Construction camp	0.13
Diffuser	1.15
Conveyor	22.81
Runoff pond	6.2
Polishing pond (North pond)	1.67
South Settling pond	1.67
Multi-use corridors (includes ROW and corridors including those outside the LSA)	140.95
Pipelines	2.95
Explosive area	0.04
Wells	0.1
Sewage lagoon	2.89
Total	3935.65

The objectives of the conceptual closure, conservation and reclamation plan are to:

1. revegetate disturbed areas as soon as they are no longer active;
2. revegetate sites so that the vegetation communities post closure are similar to naturally occurring vegetation communities in the FalC forest post closure;
3. replace a variety of ecosites (combinations of soil, drainage and aspect) such that a diversity of vegetation communities can be supported;
4. incorporate traditional knowledge and traditional land use information (when available) into closure planning so that traditional uses can continue after closure; and
5. include a conceptual strategy for workforce adjustment and consideration of regional community and business sustainability.

The conceptual plan presented in this document is expected to evolve using adaptive management to incorporate the most recent and best information available as mining progresses. Shore anticipates regular updating of this plan at least every five years, throughout operations, to incorporate results from on-going revegetation trials (both research and operational), traditional knowledge and community engagement activities. The conceptual closure, conservation and reclamation plan will involve:

- salvage of all merchantable timber within the Project footprint;
- short term (i.e., less than two years) stockpiling of topsoil materials or direct placement of topsoil materials with acceptable reclamation suitability, where practical;

- revegetation through tree planting on site facilities both during operations (progressive reclamation) where possible and reclamation of all other areas at closure;
- workforce adjustment planning and programming; and
- community and business sustainability planning developed in cooperation with local and provincial governments.

Once all mining and processing is completed (i.e., at closure), all infrastructure and equipment will be removed from the site or buried (inert waste only), sold as used equipment or scrap where possible and the land returned to an acceptable end use as currently conceived in the conceptual closure, conservation and reclamation plan. All industrial wastes will be either returned to suppliers or removed from site for disposal by a licensed waste contractor.

At closure, areas that were not progressively reclaimed during mine life will be made physically and chemically stable. The areas will be revegetated with native vegetation with an aim of restoring the site to vegetation communities found in other parts of the FalC forest at that time. At closure, the site will be contoured to either blend into the surrounding topography (linear corridors, plant site, etc.) or contoured to provide drainage and variations in microsite conditions (i.e., PKCF and the overburden and rock storage pile). This will mean that the processed kimberlite piles and the overburden and rock storage pile will remain as changed features of the landscape.

The Star and Orion South pits will be allowed to naturally fill with groundwater. The Star pit will be partially filled in due to its use to as a processed kimberlite containment facility and backfilling of overburden and rock within the pit.

Closure activity also will generate short-term employment and business opportunities, which will be incorporated in closure plans in a manner consistent with achieving optimum regional benefits and contributing to area sustainability objectives.

During the closure and monitoring period, Shore will continue to engage with the local communities, local First Nations and Métis through regular Diamond Development Advisory Committee meetings, and through other appropriate meetings and incorporate appropriate input into the closure plan.

Further discussion of the reclamation efforts can be found in Section 7.5 (Closure, Conservation and Reclamation).

2.8 ACCIDENTS AND MALFUNCTIONS

Shore completed an initial assessment of hazards for emergency planning requirements of the exploration activities on site. Major types of emergencies identified include:

- medical emergencies, both occupational and non-occupational;
- fire and explosions;
- environmental; and
- mining.

2.8.1 Non-anthropogenic Events

The most likely effect of the environment on the Project is from wildfires. Wildfires may potentially result in long term interruption of operations and potentially affect health and safety. This concern necessitated the development of a specific wildfire management plan (see Section 7.0 (Environmental Management System)).

2.8.2 Catastrophic Events

Catastrophic events are typically those with extremely low probability of occurrence, but whose consequences may be very large on the Project or on the environment. Potential catastrophic events for the Project include:

- slope failure of the Star pit adjacent to the Saskatchewan River that will risk the river being diverted into the pit;
- slope failure in the other areas of the Star pit and in the Orion South pit that could result in an unplanned expansion of the pit footprint, leading to potential loss of dewatering centers and mine infrastructure;
- slope failure of the overburden and rock storage pile could mobilize material and lead to impacts on Caution Creek or the 101 Ravine, or bury additional terrestrial habitat;
- slope failure of the Coarse PK pile could mobilize material and lead to impacts on the upper reaches of the East Ravine, or bury additional terrestrial habitat;
- slope failure of the PKCF berm could mobilize significant quantities of Fine PK and process water into the environment, towards the English Creek drainage, the Duke Ravine drainage, or over terrestrial habitat;
- collapse of underground works during mining. There is the possibility that heavy equipment could inadvertently drive over existing underground workings, and cause a collapse;
- explosives magazine fire that could impact worker safety; and
- pit flooding of either the Star pit or Orion South pit could occur by failure of the dewatering wells leading to an influx of groundwater, or extreme precipitation events.

Prevention and mitigation measures have been developed for each of these potential catastrophic events and include implementing a minimum slope angle; inspections and surveys; mine planning; safe handling procedures for explosives and designing redundancy into the dewatering system. For further information, see Section 7.2 (Environmental Risk Management).

2.9 REFERENCES

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