DOMINION DIAMOND

SECTION 2

PROJECT ALTERNATIVES

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Section 2 Abbreviations

Abbreviation	Definition
Diavik Mine	Diavik Diamond Mine
Dominion Diamond	Dominion Diamond Ekati Corporation
e.g.,	for example
Ekati Mine	Ekati Diamond Mine
EL	elevation
et al.	and more than one additional author
GNWT	Government of the Northwest Territories
Golder	Golder Associates Ltd.
IBA	Impact Benefit Agreement
i.e.,	that is
KLOI	Key Line of Inquiry
MVRB	Mackenzie Valley Review Board
n/a	not applicable
NAWMA	North Arm Water Management Area
NWT	Northwest Territories
Project	Jay Project
TDS	total dissolved solids
TOR	Terms of Reference
TSS	total suspended solids
WRSA	waste rock storage area
$\sum$	sum of all values in a range of series

Section 2 Units of Measure

Unit	Definition
%	percent
°C	degrees Celsius
km	kilometre
km^2	square kilometre
m	metre
masl	metres above sea level
m^3	cubic metre
tpd	tonnes per day

2 PROJECT ALTERNATIVES

2.1 Introduction

Dominion Diamond Ekati Corporation (Dominion Diamond) is proposing to develop the Jay kimberlite pipe at its Ekati Diamond Mine (Ekati Mine) in the Northwest Territories (NWT). The Jay kimberlite pipe is located beneath Lac du Sauvage, northeast of the existing Misery Pit operation.

Dominion Diamond previously completed a Stage 1 conceptual engineering study (Golder 2014a) to mine the Jay and Cardinal kimberlite pipe deposits, referred to as the Jay-Cardinal Project. This study was used by Dominion Diamond to support a Project Description for the Jay-Cardinal Project in October 2013 (Dominion Diamond 2013).

The Mackenzie Valley Review Board (MVRB) issued Terms of Reference (TOR) for the environmental assessment process for the Jay-Cardinal Project (MVRB 2014). Included in the TOR was the requirement for an analysis of alternative means for the Jay-Cardinal Project as a Key Line of Inquiry (KLOI).

During Dominion Diamond's community engagement meetings held to discuss the Jay-Cardinal Project, concerns were raised about the size of the project footprint. As a result, the Cardinal kimberlite pipe was further evaluated during the drilling program in winter 2014 and a concept for a Jay-only mining operation was developed. The conceptual design for the Jay Project (Project) (Golder 2014b) was used to support the Project Description Addendum for the Project, which Dominion Diamond submitted to the MVRB in June 2014 (Dominion Diamond 2014). The MVRB issued the TOR for the Project on July 17, 2014 (Appendix 1A). The analysis of alternative means remains a KLOI.

The Project needs to be technically, economically, environmentally, and socially viable to proceed. An alternatives analysis process is a transparent method of evaluating project alternatives. The alternatives analysis process that was developed for the Project takes into account the multiple accounts method as described by Robertson and Shaw (2004), and considers alternative analysis reports recently conducted to support project applications for the Gahcho Kué Project (DeBeers 2012) and the Meliadine Gold Project (AEM 2013).

The alternative assessment for the Project involved a pre-screening assessment for the overall approach to the Project to identify the most viable alternative. Once the approach to the Project was identified, the dike design and alignment alternatives were assessed. Simpler alternative assessments were conducted to evaluate components of the Project including: roads, waste rock management, and energy sources.

Project options and alternatives have been discussed, and feedback has been collected during several community consultations, meetings, and site visits through 2014 with Impact Benefit Agreement (IBA) communities. Feedback and traditional knowledge obtained during these discussions has been considered in developing this alternatives assessment.

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2.2 Project Description

2.2.1 Project Scope

To extend the Ekati Mine life beyond the currently anticipated closure date of 2019, Dominion Diamond proposes to develop the Project. Mining the Jay kimberlite pipe has the potential to represent 10 or more years of additional mine life for the Ekati Mine. As an alternative to the Project, the Jay-Cardinal Project was also evaluated, which consisted of mining the Jay and Cardinal kimberlite pipes and represented the potential for 10 or more years of additional mine life. The pipes are located in the southeastern portion of the Ekati claim block approximately 25 kilometres (km) from the main facilities and approximately 7 km to the northeast-east of Misery Pit, in the Lac de Gras watershed. More specifically, the pipes are located below Lac du Sauvage, with the Jay kimberlite pipe and Cardinal kimberlite pipe being overlain by overburden that is approximately 10 metres thick, and up to 35 m and 18 m of water, respectively.

The following new developments and activities would be required to enable mining of the Jay kimberlite pipe alone or the Jay and Cardinal kimberlite pipes together:

- construction of roads, power lines, pipelines, lay-down areas, and incidental support buildings;
- quarrying of granite rock for construction material;
- gaining access to the kimberlite;
- mining the kimberlite;
- transporting the kimberlite for processing to the Ekati main camp;
- placement of waste rock on surface;
- management of site water during construction;
- management of site water, including open-pit and surface minewater inflows, during operations; and,
- reclamation of the constructed facilities.

2.2.2 Project Setting

2.2.2.1 Terrestrial Environment

The Project is a proposed extension project for the Ekati Mine, which is located approximately 200 km south of the Arctic Circle and 300 km northeast of Yellowknife in the NWT. The sub-Arctic region surrounding the mine is known as the Southern Arctic Ecozone; at an area with elevations ranging from approximately 416 to 465 metres above sea level (masl) and above the treeline (Dezé 2007).

The region is characterized by cold long winters with daily temperatures often below -30 degrees Celsius (°C). There is generally five months of spring, summer and fall weather, and four months (June through September) where daytime temperatures are above freezing. The cold Arctic air holds little moisture, resulting in low overall precipitation, with much of the precipitation that does occur in the form of snow.

The air quality within the Project area is good with levels of nitrogen oxides, sulphur dioxides, and carbon monoxides being generally low (i.e., meeting air quality guidelines) (Annex I). This finding is consistent with the air quality reported for Yellowknife.

The Project area lies within the northwestern Canadian Shield physiographic region, which is characterized by rolling hills (terrain elevations rise up to 100 m) and low-relief terrain controlled by the abundant, near-surface, resistant Precambrian rock. Bare bedrock exposures do not have soil development. The terrain has been strongly shaped by glaciation, with glaciers flowing in a variety of directions during the Quaternary period. In general, deglaciation involved an east-northeasterly retreat and abundant supply of meltwater also influenced the terrain through the processes of deposition and erosion. Overall overburden and weathered bedrock are limited to the surface, while relatively competent bedrock comprises the majority of the rock domain.

Esker and kame terrain features are common in the region, and were formed by glaciofluvial processes associated with the transport and deposition of coarse material by glacial meltwater. As such, these landforms are composed of well-sorted sand and gravel. Areas of rolling terrain with ridges and hills that compose much of the region are associated with glacial till or morainal deposition. Glacial till deposits are typically shallow, and consist of heterogeneous, sandy-textured material that have been deposited directly by the glacier by mechanical processes or melt-out. Lacustrine plains are gently sloping areas associated with lakes and comprise a small portion of the region. Lacustrine terrain features are composed of silty and gravelly sands.

Esker habitat comprises a relatively small portion of the Project area. Bedrock, boulder, riparian, riparian shoreline shrub, and sedge wetland also comprise relatively small portions of the Project area. Plant communities along the crests and upper slopes of eskers are sparsely vegetated and contain discrete low-growing mats of heath vegetation on sand and gravel substrate. Plant communities on the mid to lower slopes of eskers are different from those on the crests and upper slopes, particularly on the lee side, which is exposed to wind. These areas tend to be more densely vegetated with a greater diversity of plant species. Heath Tundra, however, is the predominant habitat type within the Project area. This habitat is characterized by an abundance of low-growing heath plants. Heath-boulder and tussock/hummock habitat is also present. Heath-boulder habitat is characterized by discontinuous heath shrubs and lichen communities being broken up by boulder fields. Tussock/hummock habitat occurs in slighter higher areas that are infrequently flooded and supports cotton grasses and sedges.

The Project area is within the zone of continuous permafrost, where permafrost may occupy approximately 90 percent (%) to 100% in the land surface of the area (Natural Resources Canada 1995). In general, permafrost in this area is characterized by having low ice content, indicating the ground ice content in the upper 10 to 20 m of the ground has less than 10% ice content by volume of visible ice (i.e., dry permafrost). Ice lenses (small bodies of ice in frozen soils) and ice wedges are likely locally present, as indicated by ground conductivity and by permafrost features such as palsas (mounds of alternating layers of ice and or mineral soils). At the Project site, the depth of the permafrost beneath the land mass is estimated to be approximately 320 to 485 m, and the depth of the active layer is approximately 1.0 to 2.7 m.

Continuous permafrost is not expected under waterbodies too deep to freeze to the bottom during the winter. Taliks (areas of unfrozen ground) are to be expected where lake depths are greater than ice thicknesses. Based on a site-specific open-talik formation calculation, an open talik is expected beneath Lac du Sauvage.

Valued components that are to be considered during Project planning include air quality, permafrost, the physical terrestrial environment (soils, eskers, and vegetation), caribou, carnivores, breeding birds, and species at risk.

Despite the harsh climate, the area supports many species of mammals and birds. Most of these animals are migratory, moving onto the barrenlands in spring and summer, and migrating south as winter approaches (e.g., caribou, wolf, spotted sandpiper, pectoral sandpiper, yellow warbler, and peregrine falcon), while others are non-migratory (e.g., grizzly bear, wolverine, Arctic fox, red fox, Arctic hare, raven, and gyrfalcon) and utilize the area year-round. Although uncommon, muskoxen have also been observed.

The main focal species considered during planning based on potential Project impacts (footprint development resulting in physical disturbance of habitat) were: breeding birds (particularly, waterbirds and migratory species), and migrating caribou.

The Bathurst, Ahiak, and Beverly barren-ground caribou herds have ranges that potentially overlap with the Project area. These populations typically winter south of the treeline and calve in the barrenland tundra. Thus, encounter rates with the Project area are anticipated to be highest from August through October. At a regional scale, heath tundra, heath tundra/boulder-bedrock, and riparian shrub appear to be the most preferred habitat types during the northern and post-calving migration periods. Based on Traditional Knowledge, the outlet of Lac du Sauvage into Lac de Gras and along the esker on the west side of Lac du Sauvage are known to be important caribou movement sites.

The grass, sedge wetland, and riparian areas within the Project area provide breeding habitat for migrating shorebirds, waterfowl, and some songbird species.

2.2.2.2 Geochemistry

The results of geochemical characterization are used to evaluate acid rock drainage and metal leaching potential that may result from chemical weathering of minerals present in rock that is exposed during construction and mining (Geochemistry Baseline Report, Annex VIII). Oxidation of sulphide minerals, such as pyrite, can produce acidity, sulphate, and metals. The acidity produced by oxidation of sulphide minerals can be neutralized by the dissolution of carbonate minerals and, to a lesser degree, certain silicate minerals present in the rock.

Geochemical characterization of the main rock types at the Ekati Mine has been ongoing since 1995 (refer to the Ekati Mine's *Waste Rock and Ore Storage Management Plan* Version 4.1 [Dominion Diamond 2014] for additional information). A regional geochemical dataset was compiled using existing data from the Ekati Mine, which were collected between 1995 and 2014. The regional dataset was supplemented with the results of geochemical testing of samples collected from the Jay pipe in 2014. The regional dataset was used to develop an understanding of the acid rock drainage and metal leaching potential of overburden, granite, diabase, metasedimentary rock, and kimberlite in the Project area. The results of analysis of supplemental samples collected from the Jay pipe were used to confirm the acid rock drainage and metal leaching characteristics of material that will be mined from the Jay pipe, relative to the regional dataset.

Kimberlite and processed kimberlite have a low potential for acid generation, owing to the abundance of carbonate minerals in these materials. However, they are capable of leaching metals in neutral pH conditions including aluminum, arsenic, copper, nickel, and iron (regional dataset) and cadmium, copper, molybdenum, nickel, selenium, sulphate and silver (Jay pipe dataset). These materials will be handled and stored in accordance to existing management practices at site.

The primary waste rock to be encountered (approximately 70%) during mining of the Jay pipe is anticipated to be granite (quartz diorite, granodiorite, two-mica granite, and pegmatite). The remainder is anticipated to be metasediment with minor amounts of diabase and barren or low-grade kimberlite.

Granite (including granodiorite, two-mica granite, and biotite granite) consists of silicate minerals including quartz, potassium feldspar, plagioclase, biotite, and muscovite. Sulphide minerals are rare in two-mica granite, and fine-grained pyrite has been occasionally observed in granodiorite. The granitic rock at the Ekati Mine has been characterized as non-acid generating. Overburden also has a low acid generating potential. The regional dataset indicated that granite may have the potential for leaching metals (aluminum, copper, arsenic, cobalt, and nickel), but samples collected from the Jay pipe had a low metal leaching potential. Granite will be handled, used, and stored in accordance with existing management practices at site.

Metasedimentary rock is known to contain trace concentrations of sulphide minerals, with occasional concentrations up to 2% to 5%. Diabase dykes are classified as magnetic or non-magnetic. Diabase dykes contain trace concentrations of sulphide minerals, including pyrite, chalcopyrite, and pyrrhotite, and magnetic diabase dykes contain the iron mineral magnetite. Thus, the metasedimentary rock is classified as potentially acid generating (Annex VIII). Further, this material is capable of leaching metals (aluminum, arsenic, copper, cadmium, iron, nickel, silver and zinc) in neutral and acidic conditions. This material will be handled and stored in accordance with the Jay Project Description, which is consistent with existing management practices at site.

2.2.2.3 Aquatic Environment

Surface hydrology, surface water quality, fish and aquatic life, and groundwater have been identified as valued components to be considered during Project planning.

The Ekati Mine, as well as the proposed Project, is located within the headwaters of the Coppermine River drainage basin in the Canadian Shield. More specifically, the Project is located in the Lac du Sauvage basin, which forms the upstream portion of the Lac de Gras basin.

Lac de Gras has a surface area of 572 square kilometres (km^2), a drainage basin of 4,132 km^2, a nominal volume of 6,156 million cubic metres (m^3), a maximum depth of 50 m, and a mean depth of 10.8 m. Lac de Gras contains the headwaters of the Coppermine River, and provides storage and attenuation to inflows and moderates outflows. Runoff from the lake discharges to the Coppermine River, the mouth of which is on the Arctic Ocean at Coronation Gulf, 400 km northwest of Lac de Gras. The maze of small lakes, wetlands, and creeks in the Lac de Gras basin indicate poorly drained conditions.

Lac du Sauvage has a surface area of 86.5 km^2, a drainage basin of 1,461 km^2, a nominal volume of 630 million m^3, a maximum depth of 40.4 m, a mean depth 7.4 m, and is the largest tributary of Lac de Gras. Lac du Sauvage drains via the Lac du Sauvage - Lac de Gras Narrows (Narrows). Because the bottom of the Narrows lies below the normal water surface elevation at Lac de Gras, the discharges from Lac du Sauvage are governed, in part, by the water surface elevation at Lac de Gras. It is expected that flow is maintained between Lac du Sauvage and Lac de Gras year-round.

Lac du Sauvage and Lac de Gras have similar ice regimes, with the ice-cover season typically spanning from mid-October to late June, and featuring a mean peak ice thickness of 1.7 m. These large lakes are also affected by wind, with extreme 100-year winds causing a wind set-up of approximately 0.2 m on each lake, and with the potential to cause 2.1 m waves on Lac du Sauvage and 3.2 m waves on Lac de Gras.

Traditional knowledge has identified that the Narrows is particularly important based on its value as a camping, fishing, and hunting location. The channel has been noted as deep enough to provide for winter movement of fish, and swift currents may keep waters open in the winter, facilitating fishing and easy access to fresh water.

In the Project area, lakes and streams are characterized by clear, soft, slightly acidic, low-alkalinity, low-nutrient waters, which are typical of northern aquatic environments. Most soil nutrients in permafrost areas are not accessible to flowing water. Low temperatures in the active layer result in extremely low rates of organic matter decomposition and nutrient release. Hence, typically surface waters are very low in nutrients and in aquatic plant production. The biological productivity and biomass of plants and animals in the streams and lakes are low as compared to that in southern Canada. These waterbodies are cold, nutrient poor, and covered with up to 2 m of ice for nine months of the year (Pienitz et al. 1997).

Nine species of fish have been recorded in Lac du Sauvage: Lake Trout, Lake Whitefish, Round Whitefish, Slimy Sculpin, Cisco, Burbot, Arctic Grayling, Northern Pike, and Ninespine Stickleback. Overall, within Lac du Sauvage, the littoral habitat (0 to 5 m depths) was described as a steep drop off with substrate consisting of 70% fines and 23% boulder/cobble. Beyond the littoral zone (6 to 10 m), the substrate was also predominately fines with some coarse substrate, while at depths greater than 10 m, the typical substrate was 100% fines. Coarse substrate was the primary cover for fish within Lac du Sauvage.

At the Project site, the deep groundwater flow regime will be connected to the surface through the open talik underlying Lac du Sauvage. The elevations of these lakes are expected to control groundwater flow direction in the deep groundwater flow regime, along with density gradients. The elevation of lakes indicates that Lac du Sauvage is primarily a groundwater discharge zone with the exception of the southern extent of the lake where groundwater flow likely is directed towards Lac de Gras. The shallow ground water (in the active zone and in Lac du Sauvage) are low in total dissolved solids (TDS); with depth, the TDS concentrations are expected to increase. The increased density with depth will result in fluid density gradients that counteract the upward gradient to Lac du Sauvage to some extent because the less dense fresher water will have greater buoyancy than deeper saline groundwater.

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2.2.2.4 Archaeology/Traditional Land Use

Archaeological and heritage sites, and land use (traditional and non-traditional) are valued components identified for consideration during Project planning. Archaeological resources are very important for understanding the cultural history of the NWT and are valued by community members. Furthermore, in the NWT, archaeological resources are protected by the *Mackenzie Valley Resource Management Ac*t (Statutes of Canada 1998, Chapter 25) and the *Northwest Territories Archaeological Site Regulations* (SOR/2001-219).

As a result of Archaeological Impact Assessments from 1994 to 2013, 449 archaeology sites have been recorded in the region around the Ekati claim block and 190 of these are located in the Ekati claim block. The majority of the sites are associated with an undetermined cultural affiliation. Site types typically identified in the region include isolated finds, lithic scatters, and quarries. There are 37 recorded sites in or within the vicinity of the Project area. Three of these sites have been assigned a high cultural or scientific significance: the first contains a possible grave, the second is associated with evidence of Arctic Small Tool Tradition and might have in situ buried remains, and the third contains intact features and might have in situ buried remains.

Traditional and ongoing use of the Ekati claim block by Aboriginal peoples is indicated by 190 archaeological sites and numerous stories and memories. The Project area is within lands that have traditionally been used by Akaitcho, Métis, Tłı̨chǫ, and Inuit people. Traditionally, these groups supported themselves by harvesting resources from the land through activities such as hunting, fishing, trapping, and the gathering of berries and other plant materials. Travelling on foot, by canoe, kayak, dogsled, or snowshoe, the Inuit, Dene, and Métis shared heavily used trails leading to and from Lac de Gras, and were guided by landscape features such as mountains, hills, eskers, waterbodies, Inuksuit, and the caches and cairns left by previous travellers. The movement of family groups was determined by the availability of food and other resources needed for survival, and changed in response to the natural shifts in animal populations. Small family groups camped near areas where caribou, fish, and water were available such as at the Narrows, on small bays along the shore, on protected islands and areas where channels with swift currents kept the water open in winter.

Though the barrenlands were used by Aboriginal people of the NWT and Nunavut year-round, the lands and waters surrounding the present-day Ekati Mine site were used on a largely seasonal basis that coincided with the spring and fall caribou migrations through places such as the Narrows. The fall caribou hunt was the most important for the Inuit, Dene, and Métis because the caribou at that time of year provide an important source of fat, food, and thick, warm furs needed for winter survival. For potentially affected communities, the vital fall hunt traditionally occurred around Contwoyto Lake, Yamba Lake, Courageous Lake, MacKay Lake, Lac de Gras, Lac du Sauvage, and the Coppermine River.

Fishing was a secondary but important activity traditionally practiced at Lac de Gras and the surrounding area. Lac de Gras itself is known as a good source of large, fat, fish. Fish were the main food staple in summer for people and dogs, and were routinely dried and saved for use during the fall and winter hunts because they were light and easy to pack. Fishing was also carried out under the ice in the winter, using nets made of willow and babiche (rawhide lacing).

Birds such as ptarmigan, grouse, goose, and duck have traditionally provided not only food, including meat and eggs, but also important materials, such as feathers, which were used to make blankets and pillows.

Furbearers such as wolf, fox, wolverine, and hare were trapped regularly for their meat and furs and became a major part of the Inuit, Dene, and Métis economy as fur trading posts moved into the north throughout the late 1700s and early 1800s. The eskers around Lac de Gras are known as ideal habitat for wolves and foxes, and have been traditionally used for hunting and trapping activities that continue to contribute to the traditional economy. With the introduction of the fur trade around Great Slave Lake and the Arctic coast, some land use patterns changed, adapting to the new fur trading economy. Many Inuit, Dene, and Métis hunters began to provide provisions to trading posts and would regularly obtain goods from the posts scattered throughout the north. The Métis were the most sedentary, often establishing small settlements and communities at the site of well-established posts. Their ongoing presence in the barrenlands, though, is recorded in the very names of lakes and prominent features in the Ekati claim block, which suggest a French-Métis influence (Lac de Gras, Lac du Sauvage, and Pointe de Misère).

Natural resources such as water and minerals are also very important to Aboriginal groups. Water is used for transportation, drinking, fishing, cleaning, and preparing hides and other materials. Stones such as quartz, chert, soapstone and natural copper have been used in the construction of traditional tools. Plants, moss, lichens, and berries round out the traditional diet and provide fuel, construction materials, and can help treat many injuries and ailments while on the land.

The traditional and ongoing use and dependence on the lands and resources of the north has built a deep-rooted knowledge and respect for the local Inuit, Dene, and Métis communities. The culturally engrained understanding of the fragile relationship between humans and animals, and the ways in which the land has been traditionally used and managed is often referred to as Traditional Knowledge. If used appropriately, this knowledge communicates important information about local environmental values that should be maintained for future generations, and how modern land use activities should be planned so as to respect and maintain these values.

Since purchasing the Ekati Mine, Dominion Diamond has made several commitments to affected communities to support the ongoing collection and documentation of Traditional Knowledge for communities, and for integration into Project design, planning, operations, and eventual closure and reclamation activities. Dominion Diamond recognizes the significance of traditional land use activities and the connections local communities maintain with the Lac de Gras area, and will work with the communities to balance the traditional and present-day land uses so that the cultural connections can be maintained for future generations.

Seven fishing and/or hunting operators are currently licensed within the vicinity of the Ekati Mine site (GNWT-ENR 2013). These operators, which include Arctic Safaris, Aurora Caribou Camp, Aylmer Lake Lodge, Bathurst Arctic Services, Mackay Lake Lodge/True North Safaris, Warburton Bay Lodge, and Peterson’s Point Lake Lodge, are located between 50 and 150 km from the Ekati claim block. Currently, no outfitting or guiding activities are taking place within the surface lease areas or mineral claim block area held by the Ekati Mine.

In the recent past, a single outfitter camp was operated on Lac de Gras near the Diavik Traditional Knowledge Camp. The Lac de Gras camp is located on the southern shore of Lac de Gras, approximately 3 km southeast of the Lac du Sauvage outflow. It was purchased by John Andre of Shoshone Wilderness Adventures in 1999. Shoshone Wilderness Adventures provided fall barren-ground caribou hunts and fishing from 1999 until 2010. The same company owns an outfitting camp at Courageous Lake. The total number of hunters who used each site annually is unknown. Hunting activity at the Lac de Gras camp was first limited in 2007, when the Government of the Northwest Territories (GNWT) reduced the number of sport hunting tags following concerns about declining numbers of the Bathurst caribou herd (The Hunting Report 2007). The camp closed in 2010 following emergency management measures implemented by the GNWT (The Hunting Report 2010; GNWT-ENR 2013).

2.2.2.5 Socio-Economic Environment

Employment and economic effects are also identified as valued components for consideration during Project planning. Direct employment at the Ekati Mine has totalled 21,070 person-years from 1997 to 2012, or, on average, 1,316 full-time employee positions per year. Between 2008 and 2012, average annual employment has been slightly higher at 1,432 full-time employee positions. Northern Aboriginal and other Northern residents have contributed 11,171 person-years of labour to the Ekati Mine since its development. Over the past five years, the average annual participation of Northern Aboriginal and Northern residents in the Ekati Mine workforce have been 735 person-years, representing 51% of the mine's personnel. In 2012, of the 1,367 full-time employees at the Ekati Mine, 715 (52.3%) of those were filled by Northern residents (Aboriginal and non-Aboriginal).

The Ekati Mine is a key contributor to the diamond mining industry in the NWT. It is the largest of the three active diamond mines in the territory when measured by annual spending, employment, and tonnage of rock moved. Since it began, the Ekati Mine has spent $5.98 billion on construction, operations, additional exploration, and development. On average, 72% ($4.3 billion) of that spending has gone to Northern Aboriginal or other Northern-based businesses. In 2012, the Ekati Mine spent $267.6 million on Northern-based businesses, of which 40% went to Aboriginal businesses and 60% to non-Aboriginal business.

2.2.2.6 Human Environment

Human health is also identified as a valued component for consideration during Project planning. The NWT is sparsely populated by a relatively even number of Aboriginal and non-Aboriginal people. Residents of the NWT live in numerous small and remote hamlets and settlements throughout the territory, and in the larger, more accessible city of Yellowknife. The communities within the North Slave Region currently provide workers to the existing Ekati Mine and have signed IBAs with Dominion Diamond. The hamlet of Kugluktuk has also signed an IBA with Dominion Diamond. The largely seasonal Inuit communities of Umingmaktok and Bathurst Inlet have an interest in the Project in relation to experiencing potential effects from Project activities. The potentially impacted communities, their population size, and the distance from the Project area to the community are listed in Table 2.2-1.

Table 2.2-1 Communities, Populations, and Distances from the Project

Community	Population (2012)	Distance From the Project (km)
Behchokǫ̀	1,915	350
Dettah	210	315
Fort Resolution	470	425
Gamètì	250	345
Łutselk'e	280	250
N'Dilo	n/a	320
Wekweètì	140	195
Whatì	490	385
Yellowknife	18,830	320
Kugluktuk	1,440	425
Bathurst Inlet	n/a	270
Umingmaktok	n/a	365
Northwest Territories	40,800	n/a

Sources: Statistics Canada (2011); Google Earth (2014).
Note: Distances are approximate and rounded to the nearest 5 km.
km = kilometre; n/a = not available.

2.3 Analysis of Alternative Means Methodology

The Project needs to be technically, economically, environmentally, and socially viable to proceed. An analysis of alternative means process is a transparent method of evaluating project alternatives relative to each other to determine the most viable option. Two levels of assessment were completed for the Project. Level 1 involved a detailed alternatives assessment for the overall approach to developing the Project. Level 2 involved a simpler alternatives assessment process to evaluate components of the mining approach selected, such as roads, waste rock management, and energy sources.

2.3.1 Level 1 Methodology

The analysis of alternative means process that was developed for assessing the development approach for the Project takes into account the multiple accounts method. The general steps that were used in this process included the following:

- identification of alternatives;
- pre-screening assessment;
- definition of evaluation criteria (technical feasibility, project economic viability, environmental considerations, and social and economic considerations);
- relative ranking of the alternatives against the evaluation criteria;
- identification of the most viable alternative; and,
- sensitivity assessment.

2.3.2 Level 2 Methodology

The analysis of alternative means process that was developed for assessing the other mine components, which include waste rock management, roads, minewater management, and power supply, is a simplified version of the Level 1 methodology above. The general steps that were used in this process included the following:

- identification of alternatives;
- evaluation of alternatives (considering technical feasibility, project economic viability, environmental considerations, and social and economic considerations);
- relative ranking of alternatives in each category; and,
- identification of the most viable alternative.

2.4 Level 1 – Project Mining Method Alternatives Analysis

The mining method chosen for a project is often largely based on the characteristics of the ore body and host rock. For example, ore bodies close to surface are most often developed using open-pit methods, while ore bodies at larger depths are often developed using underground methods. One of the most significant factors for the Project is that the kimberlite pipe is located beneath Lac du Sauvage.

Different mining methods were considered for developing the Project, including having no project, as follows:

- No Project;
- Underground Mining – Jay Only;
- Diversion and Drawdown – Jay-Cardinal Project;
- Open-Pit Mining within a Single Dike – Jay Only; and,
- Other Alternatives:
  - Wet Mining;
  - Underwater Mining; and,
  - Lake Drawdown and Underground Mining.

Dominion Diamond advanced several conceptual design studies for the Project to support these alternatives. A brief description of each of the above alternatives is provided below. If an alternative was not considered suitable for consideration in the pre-screening assessment, then reasons are provided.

2.4.1 No Project

The reserves of the two largest operating mines in the NWT (the Ekati Mine and Diavik Diamond Mine [Diavik Mine]) are declining. The Ekati Mine is currently scheduled to close in 2019 and the Diavik Mine in 2023. The continued development of new mineral deposits is a means of allowing Northerners to continue to benefit from a viable mining sector and will contribute to a healthy Northern economy.

Mining of the Jay kimberlite pipe represents the potential for 10 or more years of additional mine life at the current kimberlite processing rates. Development of the Jay kimberlite pipe will extend employment at the Ekati Mine site, increasing long-term employment stability for the current mine employees. Consequently, Dominion Diamond has rejected the "No Project" option in favour of gaining the most benefit from the available natural resources at the Ekati Mine for the general benefit of all parties.

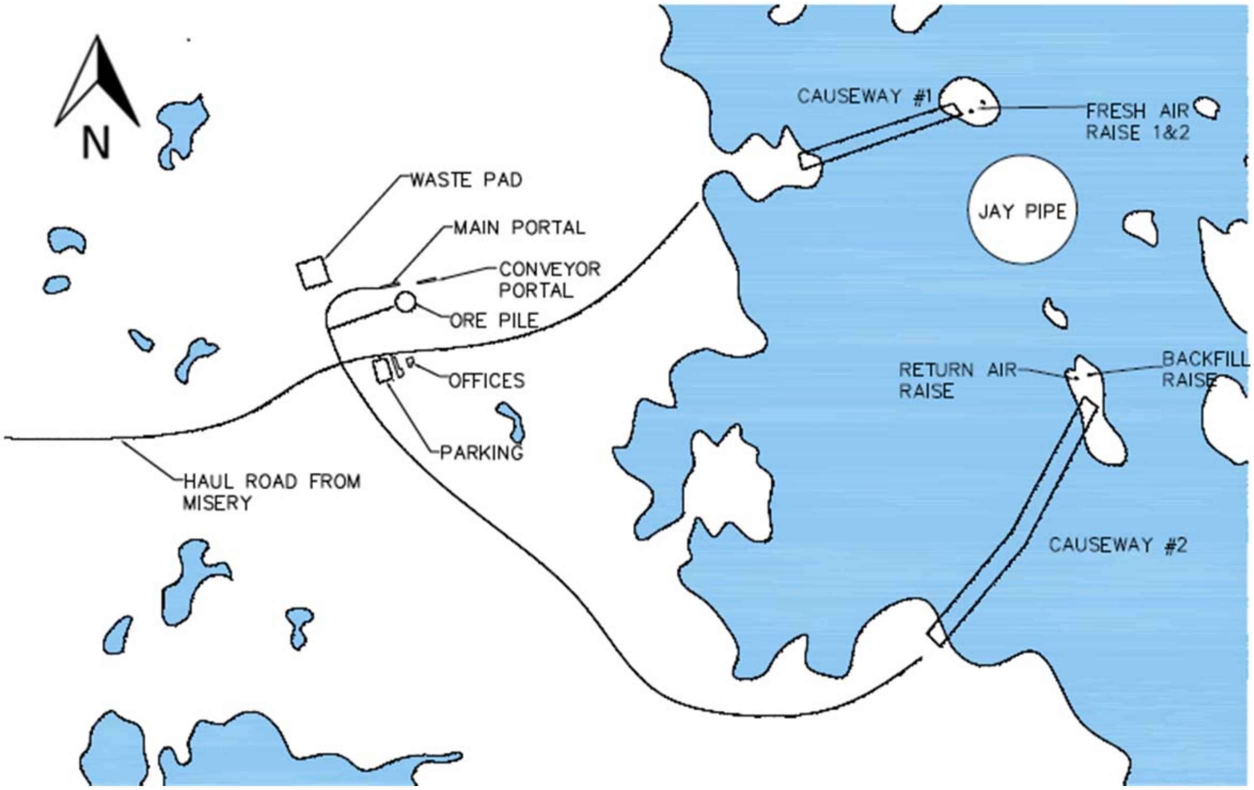
2.4.2 Underground Mining – Jay Only

It would be possible to mine the Jay kimberlite pipe exclusively by underground methods. The kimberlite would be accessed from an adit located on the shore of Lac du Sauvage. Dominion Diamond commissioned Stantec Engineering to develop a conceptual underground mining approach for the Jay kimberlite pipe (Stantec 2013).

The underground mining approach that was assessed by Stantec involves a crown pillar to isolate the underground workings from the lake, and the primary mining method assessed was longhole (blasthole) stoping. This mining approach includes the use of cemented backfill to provide partial support to the crown pillar.

The major advantage of this approach to the Project is that it would have less of an effect on Lac du Sauvage because no dewatering would be required. This approach would also have minimal waste rock requiring storage on surface. A haul road would be required to access the mine from the existing Misery Haul Road, and two causeways would be required to extend from the shoreline of Lac du Sauvage to small islands north and south of the Jay pipe to allow for construction of mine infrastructure. The general conceptual layout for the Underground Mining – Jay Only Alternative is shown in Figure 2.4-1.

Figure 2.4-1 Conceptual Underground Mining – Jay Only Alternative General Layout

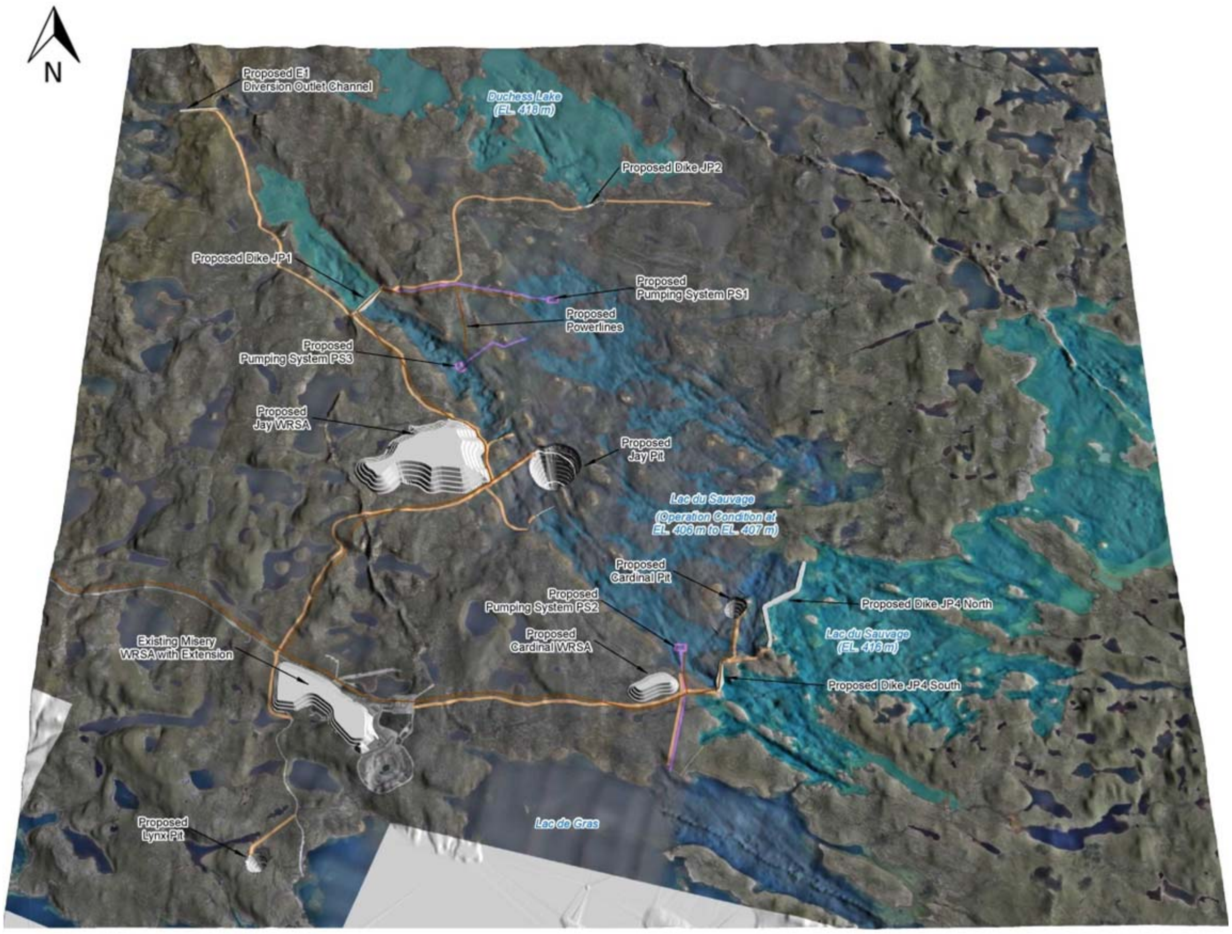


2.4.3 Diversion and Drawdown – Jay-Cardinal

It would be possible to mine the Jay and Cardinal kimberlite pipes by isolating an extensive area of Lac du Sauvage through the construction of several dikes that would divert a majority of the Lac du Sauvage inflows to the north and south of the isolated area, and allow for drawdown of a large area to expose the Jay and Cardinal kimberlite pipes. In this approach, the engineering design of the dikes is less sophisticated than the "Diavik-style" ring dike or "Meadowbank-style" dike discussed in Section 2.4.7, because the increase in available surge capacity within the diked off areas for this alternative reduces operating risks. Dominion Diamond commissioned Golder Associates Ltd. (Golder) to describe several possible variations on carrying out this approach (Golder 2014a).

The general site layout for the Diversion and Drawdown – Jay-Cardinal Alternative is shown in Figure 2.4-2.

Figure 2.4-2 Diversion and Drawdown – Jay-Cardinal Alternative General Layout



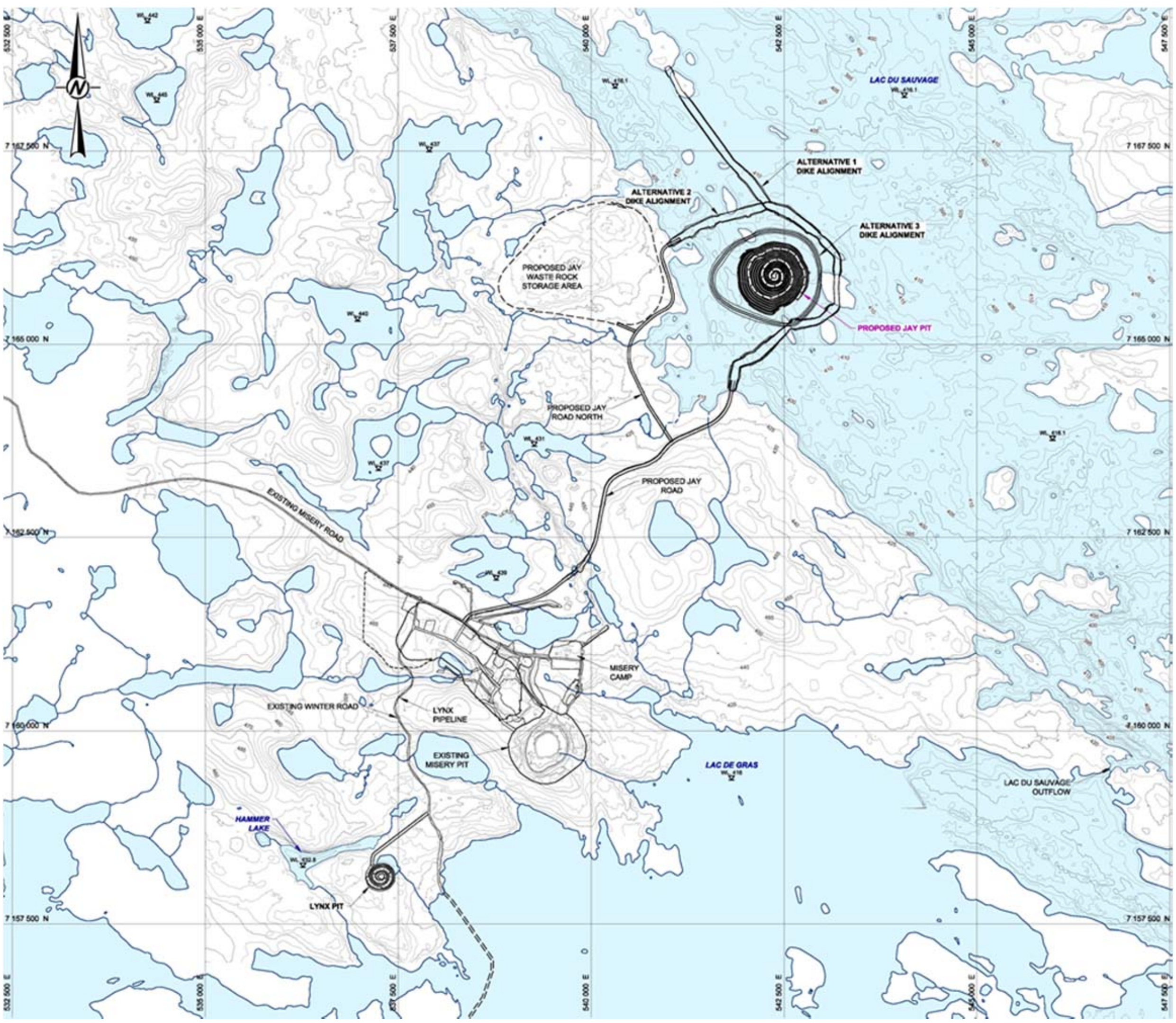
EL = elevation; m = metre; WRSA = waste rock storage area.

2.4.4 Open-Pit Mining With Single Dike – Jay Only

It would be possible to mine the Jay kimberlite pipe by constructing a single dike to isolate a local area of Lac du Sauvage such that the local area could be dewatered. This approach would allow for open-pit mining and the potential to develop an underground mine. The alignment and design of the dike could vary, but the general overall footprint and concept for this approach would be similar.

The general site layout for the Open-Pit Mining with a Single Dike – Jay Only Alternative is shown in Figure 2.4-3. Conceptual single dike alignments are shown in this figure.

Figure 2.4-3 Open-Pit Mining – Jay Only Alternative General Layout



2.4.5 Other Approaches

Several other concepts were considered and quickly identified as impractical for the Project for clear reasons, as described below. These concepts were not considered in the alternatives analysis.

Lake Drawdown and Underground Mining

It would be conceptually possible to drain Lac du Sauvage to the point where underground mining could pursue a caving method similar to the methods used in the Panda and Koala underground workings at the Ekati Mine. The lake draining would be accomplished similar to the “Diversion and Drawdown” concept described above, or by draining Lac du Sauvage entirely. The advantage of this approach would be that the caving methods are generally less expensive relative to other underground mining extraction techniques. However, if Lac du Sauvage was dewatered above the kimberlite pipe(s) it would be more economical to develop an open-pit mine; as such, this approach was not advanced for further assessment.

Wet Mining

The concept of “wet mining” is based on using a dredge, or otherwise floating platform to raise kimberlite to surface after underwater blasting. Water quality in Lac du Sauvage would be protected by silt curtains, rockfill berms or using no turbidity dredges. Wet mining is an unproven technology for use in a northern cold climate. Additionally, the shape and depth of the Jay and Cardinal kimberlite pipes (i.e., vertical ‘carrot’ shapes) are not ideal for this approach. For these reasons, this approach is likely not suitable as a project at the present time.

Underwater Mining

The underwater mining concept would use a remote-operated underwater crawler, equipped with cutting-head and suction pump, to excavate and pump kimberlite to surface. This approach would be modelled after mining techniques used in South Africa and New Zealand in sand deposits as well as harder material in up to 1,500 m depth in Indonesia. While conceptually possible, the basic technology for using this concept in kimberlite containing granite inclusions is not fully developed, although the technology is being tested on projects worldwide. This approach likely is not suitable as a project at this time.

2.4.6 Pre-Screening Assessment

The Project alternatives were evaluated in a pre-screening assessment that was based on a high-level evaluation of technical feasibility, project economic viability, environmental considerations, and social and economic considerations. This assessment eliminated alternatives that had “fatal flaws” and determined which alternatives were the most appropriate for further evaluation. The alternatives that were carried forward from the pre-screening assessment were assessed in more detail using a Multiple Accounts Analysis. The evaluation criteria used for the pre-screening assessment were as follows:

- project alternative can be constructed to consistently produce 12,500 tonnes per day (tpd) by 2020 to enable uninterrupted operation of the Ekati Mine;
- alternative will result in positive project economics;
- alternative respects cultural and environmental values; and,
- alternative allows for mitigation of potential environmental effects.

The pre-screening assessment is summarized in Table 2.4-1. Each alternative was given a score of either 0 or 1 for each of the four categories: Technical Feasibility, Project Economic Viability, Environmental Considerations, and Social and Economic Considerations. A score of 0 meant that the alternative did not meet the pre-screening criteria and a score of 1 meant that it did. Alternatives were required to meet all the pre-screening criteria to be carried forward into the analysis of alternative means.

2.4.6.1 Level 1 Pre-screen Results

The Underground Jay Only Alternative is not a viable project due to the extensive start up schedule requirements and the sub-economic valuation. The Single Dike – Jay Only and Jay-Cardinal Alternatives both met all the pre-screening criteria and would be viable Project alternatives.

The Jay-Cardinal Alternative however would require a much larger footprint than the Single Dike – Jay Only Alternative, which was identified as a concern to local communities through Dominion Diamond’s community engagement program. Based on concern over the larger environmental footprint and the results of the winter 2014 drilling program at the Jay and Cardinal kimberlite pipes, the Jay-Cardinal Alternative was not carried forward for further consideration.

The Single Dike – Jay Only Alternative does not provide for the development of the Cardinal kimberlite pipe, but addresses community concerns of limiting the Project footprint in Lac du Sauvage, around Duchess Lake, and in the esker area west of Lac du Sauvage. For this reason, the Single Dike – Jay Only Alternative was brought forward from the pre-screening assessment for the next stage of the alternatives analysis evaluation.

Table 2.4-1 Mining Method Alternatives Pre-screening

Evaluation Criteria	Alternatives		
	Underground – Jay Only	**Diversion and Drawdown – Jay-Cardinal**	**Single Dike – Jay Only**
Technical Feasibility	• The time required to construct an underground operation that could consistently produce the necessary 12,500 tpd of processing plant feed does not meet the required timeframe.	• The Jay and Cardinal open pit mines could be designed to produce the necessary 12,500 tpd feed to the processing plant. • The projected timeframe, to construct the infrastructure required to commence production, achieves the required timeline. • The Jay-Cardinal alternative is more technically complex than the other alternatives due to the amount of pumping required and upstream diversion requirements.	• The open pit mine could be designed to produce the necessary 12,500 tpd feed to the processing plant. • The time required to construct a dike to allow for mining the Jay kimberlite pipe would depend on the design details of the dike. However, it is considered feasible to construct a dike to allow for production within the required timeframe.
Scores	**0**	**1**	**1**
Project Economic Viability	• The conceptual cash flow projection is clearly and strongly negative, to the point where this alternative is unlikely economically viable in light of current or projected costs and product pricing. • Intensive, up-front capital investment is required to a much greater degree than other approaches, contributing to additional negative economics. • This alternative requires a crown pillar be left in place within the kimberlite, which reduces the minable resource; in addition, the Cardinal pipe cannot be mined with this approach.	• The conceptual cash flow projection is positive; • Mining the Cardinal kimberlite pipe is possible, which could increase the benefits of the Project; and, • Underground mining of either or both kimberlite pipes is possible to further extend mine life.	• The conceptual cash flow for the project is positive. • Underground mining is possible to further extend mine life. • The Cardinal pipe cannot be mined with this approach.
Scores	**0**	**1**	**1**

Table 2.4-1 Mining Method Alternatives Pre-screening

Evaluation Criteria	Alternatives		
	Underground – Jay Only	**Diversion and Drawdown – Jay-Cardinal**	**Single Dike – Jay Only**
Environmental Considerations	• This approach has the smallest terrestrial footprint relative to the other alternatives and does not require dewatering of any portion of Lac du Sauvage. • Two causeways would be required from the shoreline of Lac du Sauvage to islands located north and south of the Jay pipe to allow for construction of underground mine infrastructure. • This approach would produce less waste rock for surface storage. • Fewer roads are required for this alternative compared to the Jay-Cardinal alternative, which results in less potential to affect caribou and traditional land use. • This alternative would likely have less air and noise impacts due to the smaller footprint.	• This approach has the largest terrestrial footprint, including two waste rock storage areas. • More length of road construction is required, including multiple crossings of the esker. • The roads and waste rock storage areas require a larger terrestrial footprint with a higher potential to affect caribou. • This approach requires a substantially larger area of Lac du Sauvage to be dewatered or drawn down, which will also require a very large fish-out. • Flooding of Duchess Lake and the construction of the Lake E1 Outlet Diversion Channel to Paul Lake are required and results in more lakes being affected by the Project compared to the other alternatives.	• The terrestrial footprint of the mine would be substantially less than the Jay-Cardinal alternative, but more than the underground only. • The affected area of Lac du Sauvage is more than the underground only alternative, but substantially less than the Jay-Cardinal alternative. Dewatering or drawdown will require fish-out of this area of Lac du Sauvage. • Fewer roads are required for this alternative compared to the Jay-Cardinal alternative, which results in less potential for effects on caribou and traditional land use.
Scores	**1**	**1**	**1**
Social and Economic Considerations	• An underground mine workforce requires a specific skill set, which is currently less available from Northern and Northern-Aboriginal communities compared to the skill set that is required for an open-pit operation.	• The skill set required for an open-pit mine workforce is generally more available from Northern and Northern-Aboriginal communities as compared to underground mining. • The diversion and drawdown would result in the most change to the flow at the Narrows compared to the other alternatives. The Narrows is an area of importance for traditional land use and the reduced flow at the Narrows could affect fish movement in this area. • The larger footprint and the flooding of land around Duchess Lake were issues raised by local community groups. • Fishing is one of the main traditional land uses of the Project area. Fishing would not be available in a large area of Lac du Sauvage during mining. • Due to the larger footprint of this alternative, there is a higher potential to affect archaeological sites.	• The skill set required for an open-pit mine workforce is generally more available from Northern and Northern-Aboriginal communities as compared to the skill set that is required for underground mining.
Scores	**0**	**1**	**1**

tpd = tonnes per day.

2.4.7 Alternative Means of Carrying Out the Project

Various design concepts were considered for the development of an in-lake dike to isolate the portion of Lac du Sauvage containing the Jay kimberlite pipe. Three concepts were considered in the alternative means analysis and are presented below. These designs were similar to that used at the nearby Diavik Mine in NWT and the Meadowbank Mine in Nunavut.

In 2014, Dominion Diamond commissioned Golder to develop concepts for developing the Jay kimberlite pipe within a water-retaining dike constructed in Lac du Sauvage. Golder investigated and developed two potential dike alignments: Option 1 (“Hockeystick”) and Option 2 (“Horseshoe”). The dike construction approach for these alignments would be similar to that used in the construction of the Bay-Goose Dike at the Meadowbank Mine in Nunavut. These dike alignments are located in shallower water, and are located approximately 200 m from the open-pit rim.

In 2010, BHP Billiton commissioned EBA Engineering Consultants Ltd. to develop a conceptual ring dike approach for the Jay kimberlite pipe. This approach would involve isolating an area for open-pit mining behind a ring dike constructed in Lac du Sauvage. This approach is similar in concept to the approach implemented for the Diavik Mine and would include a causeway to connect the dike to the shore of Lac du Sauvage. This dike alignment would require some sections be constructed in deeper water and would be located approximately 100 m from the open pit rim. In 2013, Dominion Diamond commissioned EBA Engineering Consultants Ltd. to update the ring dike identification study that was developed earlier for BHP Billiton.

2.4.7.1 Alternative One – Meadowbank-Style Dike along Option 1 Alignment (Hockeystick)

Alternative One (ALT-1) considered the construction of a Meadowbank-style dike along the Option 1 dike alignment around the south and east sides of the Jay kimberlite pipe extending northwest to the shore of Lac du Sauvage (Map 2.4-1). The dike design is based on a broad rockfill shell, a central zone of crushed granular fine and coarse filters, and a composite low-permeability element, that would vary based on the depth to bedrock. In deeper areas, the composite low-permeability element would consist of a combination of a cement soil bentonite cut-off wall, jet grout columns extending from the base of the cut-off wall to the bedrock contact, and grouting of the shallow bedrock and bedrock contact. In shallower areas, the composite low-permeability element would consist of a cement soil bentonite cut-off wall and grouting of the shallow bedrock and contact. To make use of shallower water depths and islands, the dike alignment is approximately 200 m from the conceptual open-pit limits. The dike would encompass approximately 10.5 km^2 of Lac du Sauvage, and the estimated total volume to be dewatered would be 64 million m^3. A minewater management area would be developed in the northwest arm of Lac du Sauvage within the area isolated by the dike, designated as the North Arm Water Management Area (NAWMA).

Alternative 1 requires the following key components:

- Option 1 Dike alignment (5.9 km);
- Jay Access Road;
- Jay waste rock storage area (WRSA);

- pipeline for direct release of a portion of the dewatering volume into Lac du Sauvage;
- the NAWMA; and,
- pipeline for release into the NAWMA and from NAWMA to Lac du Sauvage.

Schedule

The construction of the dike along Option 1 alignment is expected to take 3.5 years. Currently, it is anticipated that the earliest construction of land-based access (roads and power line) to Lac du Sauvage and other allowable Project activities will be in 2016 when appropriate approvals are in place. As such, construction of the dike along Option 1 alignment would extend into fall of 2019, followed by dewatering and pre-stripping to expose kimberlite by mid-2020. The following general construction activities are envisioned for the dike construction schedule:

Year 1

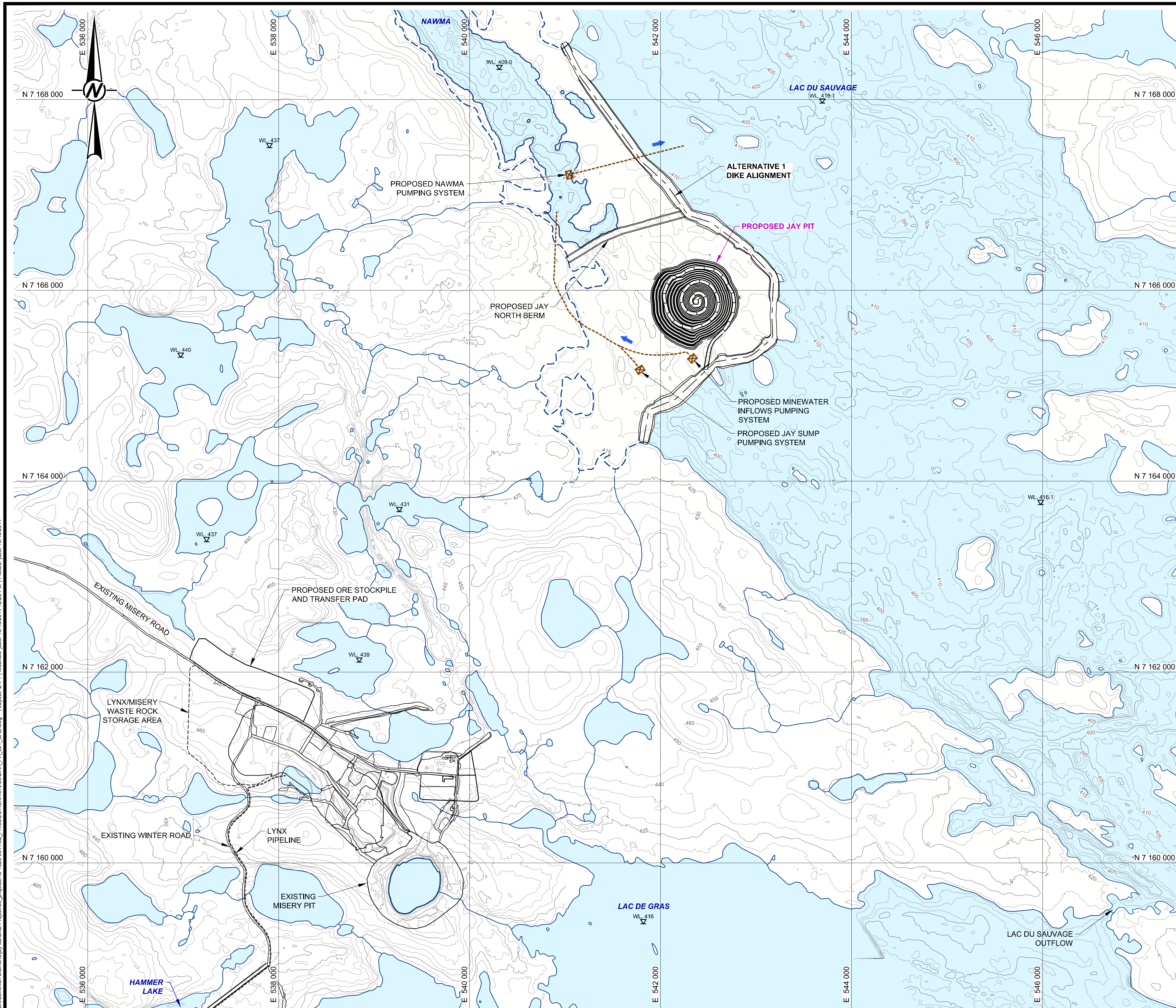
- access road to Jay site;
- Jay site laydown areas;
- blasting and crushing for dike construction material; and,
- initiation of rockfill placement.

Years 2 and 3

- dike earthworks;
- fish-out;
- jet grouting;
- curtain grouting; and,
- construction of dewatering ramps.

Year 4

- jet grouting (completed);
- curtain grouting (completed);
- instrumentation (completed);
- fish-out (completed); and,
- dewatering.



LEGEND

- WATERBODY
- WATERCOURSE
- EXISTING SHORELINE OF DEWATERED AREA
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- PROPOSED PUMPING SYSTEM
- WL WATER LEVEL ELEVATION
- FLOW DIRECTION

NOTES

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE IN METERS ABOVE SEA LEVEL (masl).
3. GROUND SURFACE AND BATHYMETRY CONTOURS ARE SHOWN AT 5 m INTERVALS.
4. COORDINATES ARE SHOWN IN DATUM: NAD 83, PROJECTION: UTM ZONE 12.

REFERENCES

1. CONTOUR AND BATHYMETRIC DATA PROVIDED BY AURORA GEOSCIENCES LTD., FILE: Final 1m Contours - Priority Area.dxf, DATE RECEIVED: OCTOBER 29, 2013.
2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.

0 800 1,600 2,400
SCALE METRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
ALTERNATIVE ONE MEADOWBANK-STYLE DIKE ALONG OPTION 1 ALIGNMENT

PROJECT No.		1407256.4070.60	FILE No.	DAR_PA_001_CAD
DESIGN	AI	2014-08-05	SCALE AS SHOWN	REV. 0
CADD	JK	2014-08-05		
CHECK	AI	2014-10-15	MAP 2.4-1	
REVIEW	JC	2014-10-15		

Golder Associates

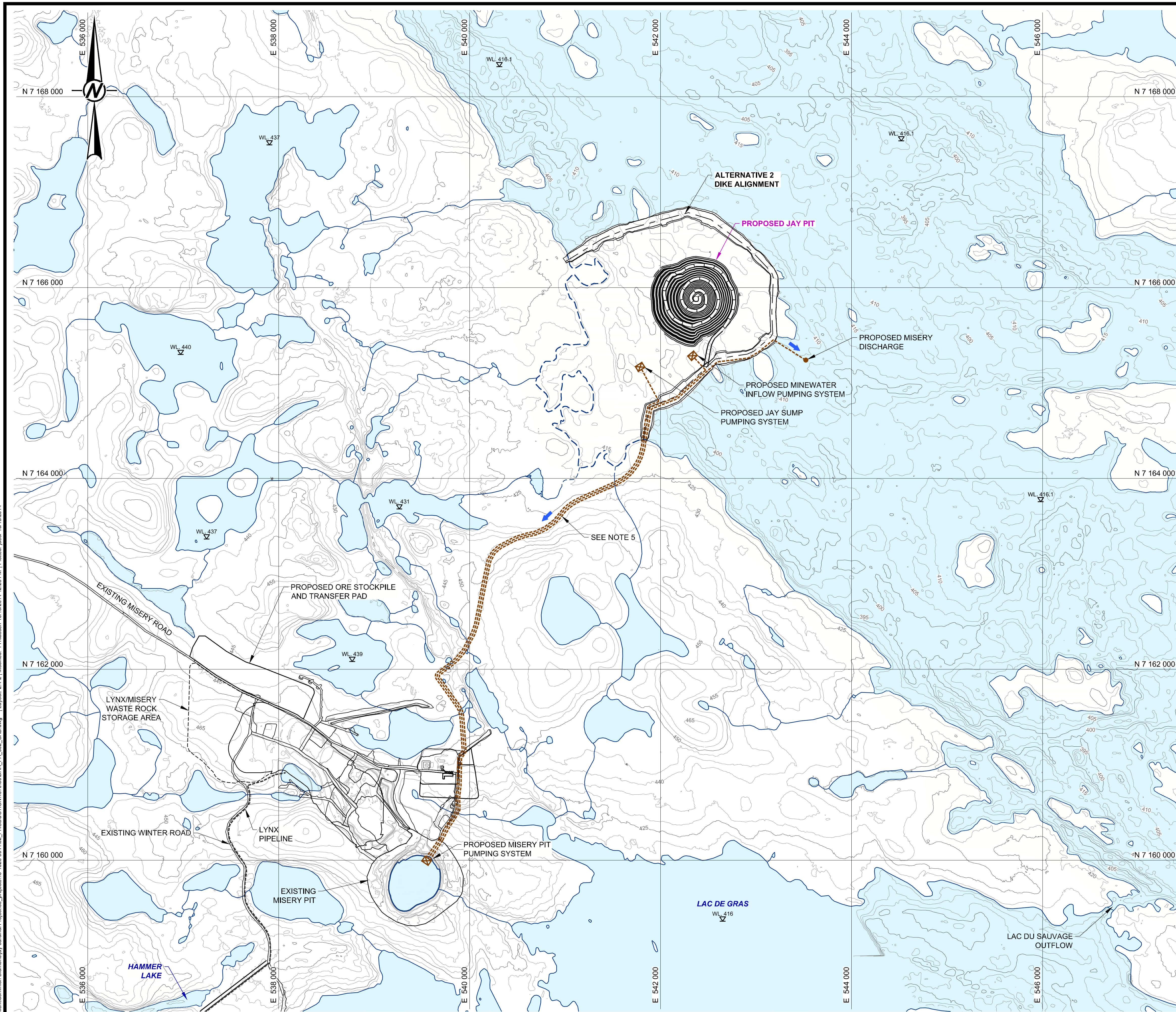
N:\Client\dominion Diamond\jay-cardinal Project\99_projects\13-1328-0041\02_PRODUCTION\4070\60\DAR_PA_001_CAD.dwg | Layout: 2.4-1 | Modified: jdeol 10/15/2014 12:28 PM | Plotted: jdeol 10/15/2014

2.4.7.2 *Alternative Two – Meadowbank-Style Dike along Option 2 Alignment (Horseshoe)*

Alternative Two (ALT 2) considered the construction of a Meadowbank-style dike along the Option 2 dike alignment along the south, east, and north sides of the Jay kimberlite pipe connecting at two locations along the west shore of Lac du Sauvage (Map 2.4-2). The dike would be constructed with a broad rockfill shell, a central zone of crushed granular fine and coarse filters, and a composite low permeability element which would vary based on the depth to bedrock. In the deeper areas, the composite low permeability element would consist of a combination of a cement soil bentonite cut-off wall, jet grout columns extending from the base of the cut-off wall to the bedrock contact, and grouting of the shallow bedrock and bedrock contact. In shallower areas, the composite low permeability element would consist of a combination of a cement soil bentonite cut-off wall, and grouting of the contact and shallow bedrock. To make use of shallower water depths and small islands, the dike alignment is approximately 200 m from the conceptual open-pit limits. The dike would encompass approximately 4.2 km^2 of Lac du Sauvage, and the estimated total volume to be dewatered would be 27 million m^3. The Misery Pit would be used for minewater management for this alternative.

Alternative 2 requires the following key components:

- Option 2 Dike alignment (5.1 km);
- Jay Access Road;
- Jay WRSA;
- pipeline for direct release of a portion of the dewatering volume into Lac du Sauvage;
- pipeline between Jay Pit, Misery Pit, and Lynx Pit;
- pipeline bench and power line along the Jay Access Road; and,
- pipeline from the Jay Pit to the Misery Pit, and from Misery Pit to Lac du Sauvage.



LEGEND

- WATERBODY
- WATERCOURSE
- EXISTING SHORELINE OF DEWATERED AREA
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- PROPOSED PUMPING SYSTEM
- WATER LEVEL ELEVATION
- FLOW DIRECTION

NOTES

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE IN METERS ABOVE SEA LEVEL (masl).
3. GROUND SURFACE AND BATHYMETRY CONTOURS ARE SHOWN AT 5 m INTERVALS.
4. COORDINATES ARE SHOWN IN DATUM: NAD 83, PROJECTION: UTM ZONE 12.
5. ROAD, PIPELINES, AND POWER LINE ARRANGEMENT TO BE DETAILED AS PART OF PRE-FEASIBILITY DESIGN. PIPELINES ARE SCHEMATIC, NOT TO SCALE.

REFERENCES

1. CONTOUR AND BATHYMETRIC DATA PROVIDED BY AURORA GEOSCIENCES LTD., FILE: Final 1m Contours - Priority Area.dxf, DATE RECEIVED: OCTOBER 29, 2013.
2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.

0 800 1,600 2,400
SCALE METRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

ALTERNATIVE TWO MEADOWBANK-STYLE DIKE ALONG OPTION 2 ALIGNMENT

Golder Associates

PROJECT No.		1407256.4070.60	FILE No.	DAR_PA_002_CAD
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CADD	JK	2014-08-05		
CHECK	AI	2014-10-15	MAP 2.4-2	
REVIEW	JC	2014-10-15		

Schedule

The construction of the dike along Option 2 alignment is expected to take three years. Currently, it is anticipated that the earliest construction of land-based access (roads and power line) to Lac du Sauvage and other allowable project activities is 2016 when appropriate approvals are in place. As such, construction of the dike along Option 2 alignment would extend into spring of 2019 followed by dewatering and pre-stripping to expose kimberlite in early 2020. The following general construction activities are envisioned for the horseshoe dike construction schedule:

Year 1

- access road to Jay site;
- Jay site laydown areas;
- blasting and crushing for dike construction material;
- dike earthworks (begins); and,
- curtain grouting (begins).

Year 2

- dike earthworks (continue);
- fish-out (begins);
- jet grouting (begins);
- curtain grouting (continues); and,
- construction of dewatering ramps (begins).

Year 3

- dike earthworks (completed);
- jet grouting (completed);
- curtain grouting (completed);
- construction of dewatering ramps (completed);
- fish-out (completed); and,
- dewatering.

2.4.7.3 Alternative Three – Diavik-Style Dike along Ring Alignment (Ring Dike)

Alternative Three (ALT 3) considered the construction of a Diavik-style dike along a ring alignment around the Jay kimberlite pipe. The dike design is based on crushed and screened rock with an internal vertical plastic concrete seepage cut-off wall which would permit open-pit mining of the Jay kimberlite pipe (EBA 2010, 2013). The dike would encompass approximately 1.33 km^2 of Lac du Sauvage, and the estimated total volume to be dewatered would be 13 million m^3 (Map 2.4-3). To manage capital costs, the dike is aligned as close as reasonably possible to the potential open-pit limits at a setback distance of 100 m. The Misery Pit would be used for minewater management for this alternative.

Alternative 3 requires the following key components:

- Ring Dike (4.1 km);
- Jay Causeway with bridge spanning a fish migration channel to connect the ring dike to the shoreline (0.4 km);
- Jay Access Road to connect to the Misery Haul Road;
- Jay WRSA;
- pipeline for direct release of a portion of the dewatering volume into main basin of Lac du Sauvage;
- pipeline bench, pipeline, and power line along the Jay Access Road; and,
- pipeline bench and pipeline to the Misery Pit.

Schedule

The construction of the ring dike is expected to take five years. Currently, it is anticipated that the earliest construction of land-based access (roads and power line) to Lac du Sauvage and other allowable Project activities will be in 2016 assuming appropriate approvals are in place. As such, construction of the ring dike would extend into mid-2020. This timeframe compromises the fundamental Project requirements for kimberlite production to the processing plant at the start of 2020. However, optimization of the design may be considered to advance the construction schedule. The following general construction activities are envisioned for the ring dike construction schedule:

Year 1

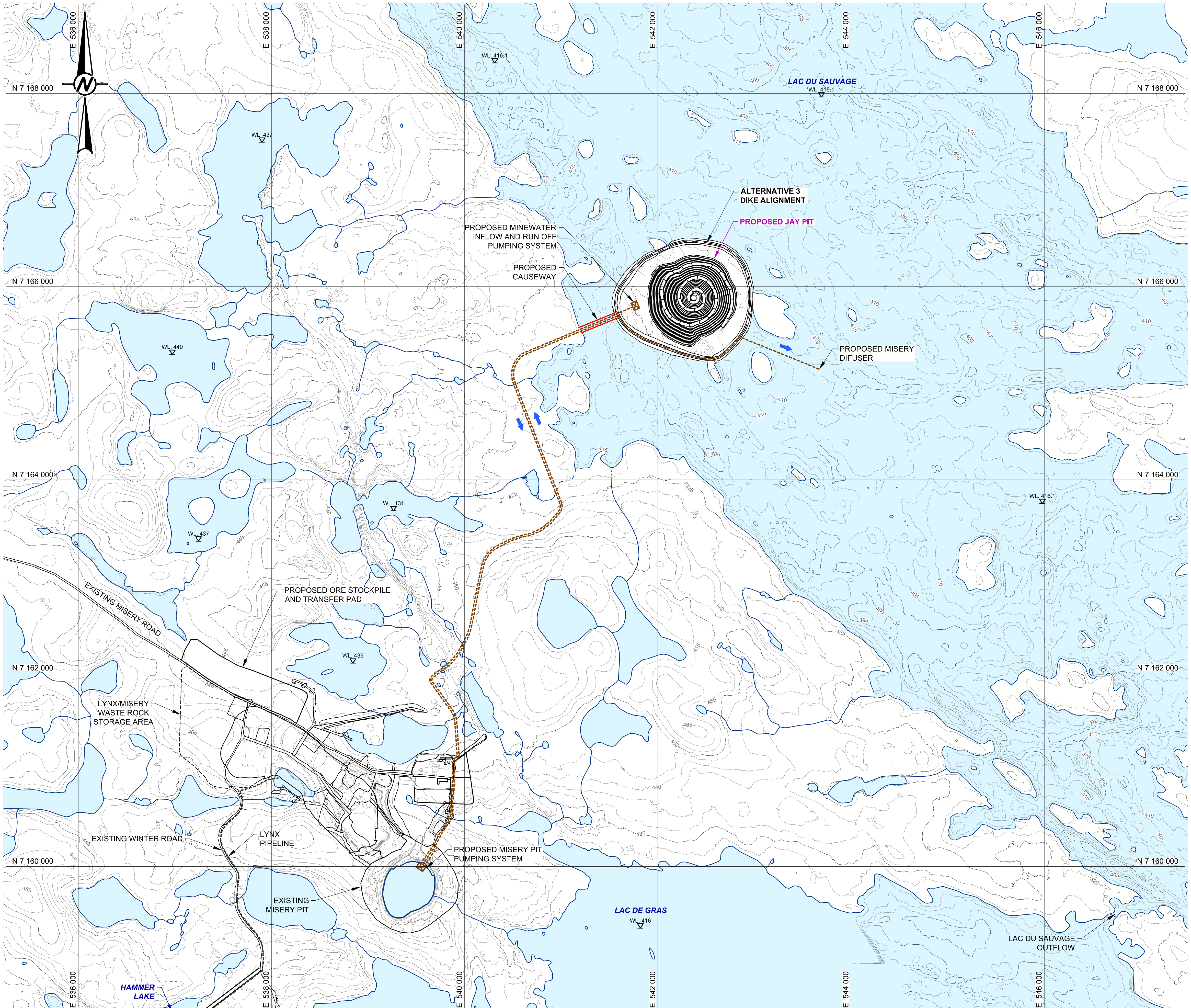
- Access Road to Jay site.
- Jay site laydown areas.
- Blasting and crushing for dike construction materials.
- Causeway with fish channel and bridge.

Year 2

- Lakebed sediment dredging and excavation.
- Filter blanket placement (begins).
- Dike fill placement to 417 m (begins).

Years 3, 4, and 5

- Filter blanket placement.
- Dike fill placement to 417 m.
- Fish-out.
- Vibrodensification.
- Plastic concrete cut-off wall installed.
- Dike fill placement to 418.8 m.
- Jet grouting.
- Curtain grouting.
- Dewatering
- Toe berm construction.



LEGEND

- WATERBODY
- WATERCOURSE
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- PROPOSED PUMPING SYSTEM
- WATER LEVEL ELEVATION
- FLOW DIRECTION

NOTES

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE IN METERS ABOVE SEA LEVEL (masl).
3. GROUND SURFACE AND BATHYMETRY CONTOURS ARE SHOWN AT 5 m INTERVALS.
4. COORDINATES ARE SHOWN IN DATUM: NAD 83, PROJECTION: UTM ZONE 12.
5. PIPELINES ARE SCHEMATIC, NOT TO SCALE.

REFERENCES

1. CONTOUR AND BATHYMETRIC DATA PROVIDED BY AURORA GEOSCIENCES LTD., FILE: Final 1m Contours - Priority Area.dxf, DATE RECEIVED: OCTOBER 29, 2013.
2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.
3. ALTERNATIVE 3 DIKE ALIGNMENT OBTAINED FROM EBA ENGINEERING CONSULTANTS LTD. 2010. JAY PIPE DEVELOPMENT: IDENTIFICATION PHASE STUDY OF CIVIL ENGINEERING COMPONENTS EKATI DIAMOND MINE, NT.

0 800 1,600 2,400

SCALE METRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

ALTERNATIVE THREE DIAVIK-STYLE RING DIKE

Golder Associates

PROJECT No.		1407256.4070.60	FILE No.	DAR_PA_003_CAD
DESIGN	AI	2014-08-25	SCALE AS SHOWN	REV. 0
CADD	JD	2014-08-27		
CHECK	AI	2014-10-15	MAP 2.4-3	
REVIEW	JC	2014-10-15		

2.4.7.4 Evaluation Criteria

A set of evaluation criteria called sub-accounts have been developed within four categories or accounts: technical feasibility; Project economic viability; environmental considerations; and, social and economic considerations. In some cases, the sub-accounts required refinement to allow for measurement and evaluation. These sub-accounts were broken down into measurement criteria called indicators.

The purpose of the Multiple Accounts Analysis was to differentiate the Project mining method based on a Jay Dike along one of three dike alignment alternatives that were identified. Therefore, only evaluation criteria that differentiate between the alternatives were included in the assessment. That is, there may be other important factors with respect to technical, economic, environmental, and social and economic considerations; however, unless the factor allowed for differentiation between the alternatives, it was not included in the assessment.

The following sections summarize the sub-accounts and indicators for each of the four accounts.

2.4.7.4.1 Technical Feasibility

The criteria that were identified as differentiating the alternatives based on technical feasibility were the construction schedule, the technical complexity of the infrastructure, and the water management requirements. The Ekati Mine is currently scheduled to close by 2019; thus, the Project needs to be in production by 2020 to maintain continuous operation of the mine at the current production rate of 12,500 tpd. In addition, the complexity of the infrastructure required for the mining method affects technical feasibility and risk to the Project schedule. Water management requirements are a critical component of the Project, particularly due to the location of the Jay kimberlite pipe below Lac du Sauvage. The tabular format for the technical feasibility evaluation criteria is shown in Table 2.4-2.

Table 2.4-2 Technical Feasibility Evaluation Criteria

Sub-Accounts	Indicators
Construction Schedule	n/a
Technical Complexity of Infrastructure	n/a
Water Management Requirements	Construction
	Operations
	Closure

n/a = not applicable.

The Diavik- and Meadowbank-style dike designs that are being considered for the Jay Dike involve use of proven technology for mines operating in northern Canada. Therefore, the dike design is considered to be non-differentiating.

2.4.7.4.2 Project Economic Viability

Economic viability relates to the economic benefits that can be gained from the Project considering capital costs, operation and maintenance costs, and closure and reclamation costs. Alternatives that require less capital, have lower operating costs, and have a more positive cash flow are preferred. The tabular format for the economic viability evaluation criteria is shown in Table 2.4-3.

Table 2.4-3 Economic Viability Evaluation Criteria

Sub-Accounts	Indicators
Capital Costs	n/a
Operating Costs	n/a
Project Viability	n/a
Closure and Reclamation Costs	n/a

n/a = not applicable.

2.4.7.4.3 Environmental Considerations

The focus of the environmental evaluation of the dike alternatives was to consider areas of the environment identified as KLOI (water quality and quantity, fish and fish habitat, and caribou) in the TOR. Some negative effects can be mitigated, while others will have residual effects that cannot be fully mitigated. The latter possibility is to be avoided if possible, especially if the residual effects are significant. The potential for effects on aquatic ecosystems (i.e., loss of aquatic habitat and fish mortality, and effects on connectivity) were considered in the assessment for the dike alternatives. The tabular format for the environmental considerations evaluation criteria is shown in Table 2.4-4.

Table 2.4-4 Environmental Considerations Evaluation Criteria

Sub-Accounts	Indicators
Potential effects on aquatic ecosystems	Loss of aquatic habitat and fish mortality
	Effects on connectivity

The alternatives would be operated such that minewater would meet the same discharge requirements (i.e., water quality would meet discharge criteria) and therefore, the dike alternatives would not be differentiating on the receiving water quality environment. However, some alternatives may have more substantial water management requirements, and consider a different range of water quality management mitigation and adaptive management options, to meet the discharge requirements. It was, therefore, determined that the water management requirements should be evaluated under the Technical Feasibility category (Section 2.4.7.4.1).

Potential effects on caribou, including loss of habitat and loss of connectivity of migration routes, were considered for evaluating the dike alternatives. However, it was determined that the three dike alternatives would have essentially the same potential effects on caribou, because they have the same waste rock storage requirements and the same haul road access requirements, which are the two main components relating to the dike alternatives that could affect caribou habitat and migration. Therefore, as potential effects on caribou were not differentiating for the three dike alternatives, criteria to assess potential effects on caribou were not included in the assessment for the dike alternatives.

2.4.7.5 Social and Economic Considerations

The social and economic considerations of an alternative can be based on both positive and negative effects. Certain alternatives are more likely to have a positive social and economic impact on local communities.

The potential to impact archaeological sites was considered. The alternatives require similar on-land infrastructure (roads and waste rock). One archaeological site was identified as being within 150 m of the Jay Haul Road. The Jay Haul Road is required for all of the alternatives, so this site is not differentiating. A low weighting factor was assigned to the sub-account for evaluation of the alternatives for archaeological sites because there is only one site that differentiates between the alternatives and it is classified as low significance.

Closure and reclamation was identified as a differentiating criterion for the assessment, relating to the time required for the Project area to return to a viable, self-sustaining ecosystem compatible with human activities, such as traditional land use (i.e., ability to hunt and fish in the area), as per the Ekati Interim Closure and Reclamation Plan (BHP Billiton 2011). The tabular format for the social and economic considerations evaluation criteria is shown in Table 2.4-5.

Table 2.4-5 Social and Economic Evaluation Criteria

Sub-Accounts	Indicators
Potential to affect archaeological sites	n/a
Closure and Reclamation – Time to achieve closure	n/a

n/a = not applicable.

The socio-economic benefits of the Project were evaluated in the pre-screening assessment, where it was identified that open-pit mining typically provides more job opportunities for Northern residents. A socio-economic criterion was not identified that would differentiate the three dike alternatives.

2.4.7.6 Multiple Accounts Analysis

Each alternative was evaluated by assigning relative scores and weightings to the sub-accounts and indicators within each of the four accounts described above (i.e., Technical Feasibility, Project Economic Viability, Environmental Considerations, Social and Economic Considerations). Judgement and perception of the individuals conducting the analyses is inevitably part of any decision-making system, both in the assignment of relative scores and of weighting factors. A sensitivity analysis was also conducted, which allows for a range of perceptions. The following sections explain how scores and weightings were assigned, and the calculations used to determine the preferred alternative.

2.4.7.6.1 Score

A three-point scoring scheme was used to assign relative rankings of the alternatives against each sub-account and indicator. The “best” (most preferred) alternative received a score of 3, and the “worst” (least preferred) alternative received a score of 1.

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2.4.7.6.2 Weighting

Accounts, sub-accounts, and indicators were assigned a relative weighting to introduce a value bias among the individual accounts, sub-accounts, and indicators. The weighting factors ranged from 1 to 9, following recommendations from Robertson and Shaw (2004). The value bias is based on the relative subjective importance of one account/sub-account/indicator versus another. A higher weighting factor indicates a perceived greater relative value or importance.

2.4.7.6.3 Calculations

The calculations for the Multiple Accounts Analysis assessment involved taking individual scores and weightings for each indicator and sub-account within the four accounts, and converting them to a single score for each alternative.

Overall scores for each of the alternatives were calculated for each of the accounts by multiplying the scores and weights for each evaluation sub-account and indicator, and adding them together. These overall scores were then normalized by dividing them by the sum of the weightings of the evaluation criteria in that category. This resulted in four normalized account scores for each alternative, which were added together to obtain one final overall score for each alternative. The alternative with the highest overall score is the preferred alternative.

The following steps provide the detailed calculations:

1) Sub-account merit ratings were calculated using the following steps:
    a. Calculate indicator merit scores by multiplying the score (S) by the weighting (W) for each indicator (S x W).
    b. Calculate the sub-account merit scores by summing the indicator merit scores for each sub-account ($\sum\{S \times W\}$).
    c. Calculate the sub-account merit rating (Rs) by normalizing the sub-account merit scores back to a three-point scale. This was achieved by dividing the sub-account merit scores by the sum of the indicator weightings ($\sum W$) to get $Rs = \sum(S \times W)/\sum W$ to produce a value between 1 and 3 for each sub-account. This normalization is necessary so that the number of indicators associated with each sub-account does not influence the results.
2) The same set of calculations was then conducted to obtain account merit ratings:
    a. Calculate account merit scores by summing the sub-account merit ratings multiplied by the sub-account weightings ($\sum\{Rs \times W\}$).
    b. Calculate the account merit ratings (Ra) by normalizing the account merit scores by the sum of the sub-account weightings ($Ra = \sum(Rs \times W)/\sum W$).

3) Alternative merit scores were then calculated as follows:

   a. Calculate alternative merit scores by summing the account merit ratings multiplied by the account weightings ($\sum\{Ra \times W\}$).

   b. Calculate the alternative merit ratings by normalizing the alternative merit scores by the sum of the account weightings ($Ra = \sum(Rs \times W)/\sum W$). The resulting alternative merit rating (alternative score) is a value between 1 and 3, and provides a means to evaluate the relative ranking of the various alternatives considered.

2.4.7.7 Multiple Accounts Analysis Results

The detailed alternatives assessment matrix tables are provided in Tables 2.4-6 to 2.4-9. The results of the alternatives assessment calculations are summarized in the following sections. The analysis was split into two phases: baseline analysis, and sensitivity analysis.

Table 2.4-6 Technical Feasibility Assessment

Reference Number	Description of Sub-Account	Description of Indicator	Rationale	Weighting		Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick)		Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe)		Alternative 3 – Diavik-Style Ring Dike	
				Indicator	Sub-Account	Description	Score	Description	Score	Description	Score
Tech-1	Construction Schedule	n/a	• The Ekati Mine is currently scheduled to close in 2019 and the Project would need to be in production by 2020 to maintain uninterrupted production. Alternatives that can be in production within this time frame are preferred.	n/a	9	• The projected construction schedule for the dike along the Option 1 alignment is expected to take 3.5 years, which is 6 months more than the dike along the Option 2 alignment, but less than the ring dike. The schedule is expected to allow uninterrupted operation of the Ekati Mine.	2	• The projected construction schedule for the dike along the Option 2 alignment is expected to take 3 years, which is the shortest timeline compared to the other alternatives. This alternative provides the best opportunity to maintain production at the Ekati Mine.	3	• The projected construction schedule for the plastic concrete cut-off wall dike along the ring alignment is expected to take approximately 5 years, which is substantially longer than the other alternatives. This option would require additional engineering design effort for the construction schedule to be compressed to allow for uninterrupted operation of the Ekati Mine.	1
Tech-2	Technical Complexity of Mine Infrastructure	n/a	• Complex project infrastructure can lead to challenges during design and construction, which can also lead to schedule delays. Alternatives with simpler infrastructure designs and methods of construction are preferred.	n/a	3	• The engineering design and construction requirements for the Meadowbank-style dikes involve a cement, soil, and bentonite mix cut-off wall. This design is less complex than the Diavik-style dike design. • The Option 1 and 2 alignments results in the dike being located at least 200 m from the rim of the open pit.	3	• The engineering design and construction requirements for the Meadowbank-style dikes involve a cement, soil, and bentonite mix cut-off wall. This design is less complex than the Diavik-style dike design. • The Option 1 and 2 alignments results in the dike being located at least 200 m from the rim of the open pit.	3	• The engineering and construction requirements to fully encircle the Jay pipe area with a Diavik-style dike involves a plastic concrete cut-off wall along the ring alignment, which is more intensive and complex than the Meadowbank-style dike design. • The ring alignment results in additional length of dike which requires deeper sections of the dike cut-off wall construction and results in the dike being located within 100 m of the rim of the open pit, which is much closer than the other alternatives.	1
Tech-3	Water Management Requirements	Construction Water Management	• The most significant water management requirement for the construction phase of the Project is related to dewatering an area of Lac du Sauvage to access the kimberlite pipe(s).The water quality of the lower portion of the dewatered volume from the diked area of Lac du Sauvage is anticipated to have high levels of TSS, which will require management before being discharged back into Lac du Sauvage. • Alternatives that require management of smaller volumes of water overall, smaller volumes of high TSS water, have less potential to require TSS water treatment during dewatering, and require less infrastructure construction, are preferred.	4	6	• This alternative requires a volume of approximately 57 million m^3 to be dewatered to allow for access to the Jay pipe. • It is anticipated that the first half of the dewatering volume can be discharged to Lac du Sauvage and the other half will require management due to high TSS. The high TSS water will be pumped to the NAWMA. Due to the large volume of water that will require settling, it is anticipated that a portion of the water will require active treatment to remove TSS before discharge. • This alternative requires construction of a water management area in the NAWMA. • A diversion channel is proposed for construction during start up to intercept fresh water from Sub-Basin B and divert it to Lac du Sauvage.	1	• This alternative requires a volume of approximately 27 million m^3 to be dewatered to allow for access to the Jay pipe. This volume is larger than the ring dike alternative, but smaller than the Option 1 dike alignment alternative. • It is anticipated that the first half of the dewatering volume can be discharged to Lac du Sauvage and the other half will require management due to high TSS. The high TSS water will be pumped to the Lynx and Misery pits. • This alternative uses an existing facility for water management and will only require transport infrastructure.	2	• Once the ring dike is constructed, water will be pumped out from within the dike to allow for open-pit mining. The dewatering volume would be approximately 13 million m^3, which is less than the dewatering volumes for the other alternatives. • It is anticipated that the first half of the dewatering volume can be discharged to Lac du Sauvage and the other half will require management due to high TSS. This water would be pumped to the Lynx and Misery pits. • This alternative uses an existing facility for water management and will only require transport infrastructure.	3

Table 2.4-6 Technical Feasibility Assessment

Reference Number	Description of Sub-Account	Description of Indicator	Rationale	Weighting: Indicator	Weighting: Sub-Account	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick): Description	Score	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe): Description	Score	Alternative 3 – Diavik-Style Ring Dike: Description	Score
Tech-4	Water Management Requirements	Operational Water Management	• During operations, minewater inflows will report to the open-pit area and will require management. This minewater is anticipated to have elevated levels of TDS, which will require management before discharge to Lac du Sauvage. • Alternatives that require water management of smaller volumes and/or simpler water management, and/or delay release of minewater by several years during operations are preferred.	8	6	• Once the initial dewatering is complete and the mine is operating, water management will include management of seepage through the dikes and minewater inflows reporting to the open pit. Open-pit minewater during operations is anticipated to have high TDS and will require management before discharge. • The NAWMA would be used for water quality management for open-pit minewater, surface minewater, and fresh water draining to the NAWMA. It is expected that this alternative would have the largest total water management effort. • The water to be managed for this alternative is expected to have the lowest TDS due to the highest amount of dilution. The volume available in the NAWMA would allow for storage of only a very small portion of the high TDS water, resulting in operational discharge to Lac du Sauvage commencing during the early years of mine operation. • This alternative is considered to have the least desirable overall water management requirements.	1	• Once the initial dewatering is complete and the mine is operating, water management will include management of seepage through the dikes and minewater inflows reporting to the open pit. Open-pit minewater during operations is anticipated to have high TDS and will require management before discharge. • Open-pit minewater, surface minewater, and fresh water draining to the dewatered area within the Jay Pit area, would be pumped to Misery Pit for management before release to Lac du Sauvage. It is expected that the total water management effort for this alternative would be higher than for the Ring Dike alternative, but less than Alternative 1. • The water to be managed for this alternative is expected to have lower TDS than the Ring Dike due to dilution from runoff water reporting to the dewatered area, but higher TDS than Alternative 1. Misery Pit would provide storage for a portion of the high TDS water; discharge to Lac du Sauvage is expected to be required towards the middle of the mine life. • This alternative is considered to have the most flexibility during operations due to having capacity for storage in both the dewatered area surrounding the Jay Pit and the main storage in the Misery Pit. • This alternative is considered to have the most desirable overall water management requirements compared to the other alternatives.	3	• Once the mine is operating, the water management requirements for this alternative will generally involve management of seepage through the low-permeability ring dike, and open-pit minewater. Open-pit minewater during operations is anticipated to have high TDS and will require management before discharge. • Open-pit minewater and surface minewater would likely be pumped to Misery Pit for management before release to Lac du Sauvage. The WRSA and open-pit seepage would require separate water collection systems. • Misery Pit would provide storage for a significant portion of the high TDS water, although discharge to Lac du Sauvage from Misery Pit is still expected to be required during the later years of mine operations. • Even though this option may minimize the total water management effort, it is likely to result in water with the highest TDS due to the lack of fresh water for dilution. • This alternative is considered to have overall water management requirements that are between those of the other alternatives.	2
Tech-5	Water Management Requirements	Closure	• Alternatives that require less water management infrastructure for closure and reclamation of the Project, are less complex, and require less volume to be transferred for closure, are preferred.	6	6	• The NAWMA is anticipated to have high TDS water at closure. A portion of the high TDS water from the NAWMA would be pumped to the Jay open pit. Freshwater caps would be placed over the Jay open pit and the NAWMA during back-flooding, and once suitable water quality is demonstrated, the dike would be locally breached. • This option would require more discharge points to conduct the back-flooding than the other alternatives, and will require more planning and monitoring to manage the potential to create elevated TSS due to failures of the natural lakeshore slopes during back-flooding. • This option would require the greatest back-flooding effort compared to the other alternatives. • This alternative would also require closure of the Sub-Basin B Diversion Channel.	1	• A portion of the high TDS water from the Misery Pit would be pumped to the Jay open pit using infrastructure from operations. Freshwater caps would be placed over the Misery and Jay pits. The Jay Pit dewatered area will be back-flooded, and once suitable water quality is demonstrated, the dike would be locally breached. • This alternative would also require closure of the Sub-Basin B Diversion Channel. • The technical complexity of the water management requirements for this alternative are considered to be similar to Alternative 3 and quite a bit less than Alternative 1.	3	• A portion of the high TDS water from the Misery Pit would be pumped to the Jay Pit using infrastructure from operations. Freshwater caps would be placed over the Misery Pit and Jay Pit during back-flooding, and once suitable water quality is demonstrated, the dike would be locally breached. • The technical complexity of the water management requirements for this alternative are considered to be similar to Alternative 2 and quite a bit less than Alternative 1.	3

n/a = not applicable; m = metre; million m^3 = million cubic metre; TDS = total dissolved solids; TSS = total suspended solids; NAWMA = North Arm Water Management Area; WRSA = waste rock storage area.

Table 2.4-7 Project Economic Viability Assessment

Reference Number	Description of Sub-Account	Description of Indicator	Rationale	Weighting: Indicator	Weighting: Sub-Account	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick): Description	Score	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe): Description	Score	Alternative 3 – Diavik-Style Ring Dike: Description	Score
Eco-1	Capital Costs	n/a	• Alternatives that require less capital costs are preferred.	n/a	9	• The capital cost for construction of the infrastructure required for Alternative 1 and 2 are similar and less than Alternative 3.	3	• The capital cost for construction of the infrastructure required for Alternative 1 and 2 are similar and less than Alternative 3.	3	• The capital cost for construction of a ring dike around the Jay Pit has the highest capital cost compared to the other alternatives.	1
Eco-2	Operating Costs	n/a	• The most substantial operating costs that will differentiate the alternatives will be water management costs. The mining operating costs will be the same.	n/a	3	• Alternative 1 will involve pumping water a shorter distance than the other alternatives, which will result in the lowest operating costs.	3	• Alternatives 2 and 3 will involve pumping water a similar distance, which is longer than Alternative 1. Therefore, the operating costs for Alternatives 2 and 3 will be higher than Alternative 1.	2	• Alternatives 2 and 3 will involve pumping water a similar distance, which is longer than Alternative 1. Therefore, the operating costs for Alternatives 2 and 3 will be higher than Alternative 1.	2
Eco-3	Project Viability	n/a	• Alternatives that have a more positive cash flow are preferred.	n/a	6	• The conceptual cash flow projection is positive.	3	• The conceptual cash flow projection is positive.	3	• The project cash flow would be poorer than the other alternatives. It is uncertain whether the cash flow could be made positive.	1
Eco-4	Closure and Reclamation Costs	n/a	• The most significant closure and reclamation cost will be related to back-flooding the dewatered sections of Lac du Sauvage. The amount of infrastructure (i.e., roads, dikes, WRSAs) that needs to be reclaimed will also affect the costs, but will be much less significant.	n/a	3	• The dike along alignment Option 1 has the largest volume to back-flood the dewatered area and to back-flood the NAWMA, and is anticipated to have the highest costs.	1	• The dike along alignment Option 2 has a larger dewatered area volume to back-flood than the Ring Dike, but smaller than Alternative 1, and is anticipated to have higher costs than the Ring Dike alternative, but less than Alternative 1.	2	• Because the Ring Dike alternative has the smallest dewatered area volume to back-flood, it is anticipated to have the lowest costs.	3

n/a = not applicable; i.e. = that is; WRSA = waste rock storage area; NAWMA = North Arm Water Management Area.

Table 2.4-8 Environmental Considerations Assessment

Reference Number	Description of Sub-Account	Description of Indicator	Rationale	Weighting: Indicator	Weighting: Sub-Account	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick): Description	Score	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe): Description	Score	Alternative 3 – Diavik-Style Ring Dike: Description	Score
Env-1	Potential effects on aquatic ecosystems	Loss of aquatic habitat and fish mortality	• Due to the location of the Jay kimberlite pipe below Lac du Sauvage, fish-out and dewatering of portions of the lake are required to develop the Project. Alternatives that will result in less aquatic habitat loss and smaller fish-outs are preferred.	9	1	• Approximately 11 km^2 of Lac du Sauvage would be dewatered and fished out, which is more than the other alternatives.	1	• Approximately 4 km^2 of Lac du Sauvage would be dewatered and fished out, which is less than the Alternative 1, but more than the Ring Dike alternative.	2	• Approximately 2 km^2 of Lac du Sauvage would be dewatered and fished out, which is the smallest area compared to the other alternatives.	3
Env-2		Effects on connectivity	• Alternatives that will have less potential to affect the connectivity of existing aquatic habitat are preferred (e.g., change to fish migration patterns, loss of access to important habitat for fish populations).	3		• Connectivity is lost between Lac du Sauvage and Basins B, C, and D on the west shore of Lac du Sauvage. Connection to the NAWMA of Lac du Sauvage is lost.	1	• Connectivity is lost between Lac du Sauvage and Basin B on west shore. Connectivity to Basins C and D, and the northwest arm of Lac du Sauvage is maintained. Some loss of connectivity for fish from Lac du Sauvage, but less than Alternative 1.	2	• The Ring Dike alternative would have limited changes to aquatic connectivity.	3

e.g., = for example; NAWMA = North Arm Water Management Area; km^2 = square kilometre.

Table 2.4-9 Social and Economic Considerations Assessment

Reference Number	Description of Sub-Account	Description of Indicator	Rationale	Weighting: Indicator	Weighting: Sub-Account	Alternative 1 - Meadowbank-Style Dike, Option 1 Alignment (Hockeystick): Description	Alternative 1: Score	Alternative 2 - Meadowbank-Style Dike, Option 2 Alignment (Horseshoe): Description	Alternative 2: Score	Alternative 3 - Diavik-Style Ring Dike: Description	Alternative 3: Score
Soc-1	Potential Effects on Archaeological Sites		• All the alternatives require similar on-land infrastructure (such as the WRSA and Jay Haul Road), so the potential to affect archaeological sites is the same. The difference in on-land infrastructure between the alternatives is the requirement for water management infrastructure.		2	• There are no archaeological sites that are within 150 m of Alternative 1 infrastructure that are also not within the same proximity to the other alternatives.	3	• There is one archaeological site that is within 150 m of the proposed water management pipeline from the Jay Pit to the Misery Pit. The archaeological site is classified as low significance.	2	• One archaeological site is within 150 m of the proposed water management pipeline from the Jay Pit to the Misery Pit. The archaeological site is classified as low significance.	2
Soc-2	Closure and Reclamation: Time required to obtain the closure concept related to traditional land use as described in the Closure Plan		• All Project alternatives would be reclaimed and closed to meet the objectives laid out in the Ekati Interim Closure and Reclamation Plan. However, the time to reach the final closure state will vary between the alternatives. The most significant time requirement for closure and reclamation will be back-flooding the dewatered sections of Lac du Sauvage. The amount of infrastructure (i.e., roads, dikes, WRSAs) that needs to be reclaimed will also affect the time, but will be much less significant.		8	• This alternative would have the largest back-flooding volume. In addition, back-flooding of this alternative has a higher potential for elevated TSS due to failures in the natural slopes of the back-flooded area. This alternative is anticipated to have the longest time to back-flood and obtain water quality suitable for breaching the dikes.	1	• It is expected that this alternative would require more time to back-flood the dewatered area and to obtain water quality suitable for breaching the dikes comparable to the Ring Dike alternative, but less time than Alternative 1.	3	• The Ring Dike alternative has the smallest back-flooding volume and is expected to require the least amount of time to back-flood the dewatered area and to obtain water quality suitable for breaching of the dike.	3

i.e., = that is; WRSA = waste rock storage area; TSS = total suspended solids; m = metre.

2.4.7.7.1 Baseline Results

The baseline assessment did not involve assigning weightings to the four accounts (Technical Feasibility, Project Economic Viability, Environmental Considerations, Social and Economic Considerations). The results of the baseline assessment are presented in Table 2.4-10.

Table 2.4-10 Single Dike Alternatives Baseline Results

Account	Scores		
	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick)	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe)	Alternative 3 – Diavik-Style Ring Dike
Technical Feasibility	1.8	2.9	1.5
Project Economic Viability	2.7	2.7	1.4
Environmental Consideration	1.0	2.0	3.0
Social and Economic Consideration	1.4	2.8	2.8
Overall Alternative Score	1.7	2.6	2.2

The results of the baseline assessment indicate that Alternative 2 (Meadowbank-style dike along Option 2 Alignment) is the most viable option for the Project.

2.4.7.7.2 Sensitivity Assessment

Scoring and weighting values assigned in the alternatives assessment are based on the judgement and perception of the individuals conducting the assessment. As such, a sensitivity assessment was conducted to evaluate the robustness of the baseline results. The sensitivity assessment involved varying the account weightings to put varying emphasis on different accounts (Technical Feasibility, Project Economic Viability, Environmental Considerations, and Social and Economic Considerations) to assess how the emphasis influenced the relative rankings of the alternatives. The account weightings used to identify the sensitivity cases are presented in Table 2.4-11. Higher weighting values within each sensitivity case indicate an emphasis on those accounts.

Table 2.4-11 Sensitivity Assessment Account Weightings

Account	Weightings		
	Case 1 – Baseline	Case 2	Case 3
Technical Feasibility	1	3	6
Project Economic Viability	1	6	9
Environmental Considerations	1	9	6
Social and Economic Considerations	1	6	6

The following points briefly describe where the emphasis has been put for each sensitivity case:

- Case 1 – Baseline: No emphasis assigned;
- Case 2 – Higher emphasis on the Environmental Considerations Account and less emphasis on the Technical Feasibility Account; and,
- Case 3 – Higher emphasis on the Project Economic Account.

The results of the sensitivity assessment are presented in Table 2.4-12 and Table 2.4-13.

Table 2.4-12 Sensitivity Case 2 Results Summary

Account	Weighted Scores		
	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick)	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe)	Alternative 3 – Diavik-Style Ring Dike
Technical Feasibility	5.5	8.8	4.6
Project Economic Viability	16.3	16.3	8.6
Environmental Consideration	9.0	18.0	27.0
Social Economic Consideration	8.4	16.8	16.8
Overall Alternative Score	1.6	2.5	2.4

Table 2.4-13 Sensitivity Case 3 Results Summary

Account	Weighted Scores		
	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick)	Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe)	Alternative 3 – Diavik-Style Ring Dike
Technical Feasibility	11.0	17.6	9.1
Project Economic Viability	24.4	24.4	12.9
Environmental Consideration	6.0	12.0	18.0
Social Economic Consideration	8.4	16.8	16.8
Overall Alternative Score	2.1	2.9	2.4

The results of the sensitivity assessment indicate that when an emphasis is put on Environmental Considerations, Alternatives 2 and 3 rank similar to each other and higher than Alternative 1. When an emphasis is put on Project Economics in Case 3, Alternative 2 ranks higher than the other alternatives. These results further support the results of the baseline assessment, which identified Alternative 2 as the most viable option for the Project.

2.5 Level 2 Assessments

2.5.1 Roads Alternative Assessment

The Project requires one main access road to connect the Jay kimberlite pipe area to the existing Misery Haul Road. The objective of the roads alternatives assessment process was to select an access road alignment that would minimize potential effects on the environment while allowing for efficient access to the Project area. The road alignment will also accommodate water management pipelines required for the development of the Jay kimberlite pipe east of the esker crossing, and will provide a corridor for the power line. Several smaller sections of road are required for accessing the abutments of the dike and the open pit, but these roads are common to all the alternatives.

2.5.1.1 Jay Road Alternatives

Three alternatives were considered for the access road and pipeline as shown in Map 2.5-1 and described below.

Jay Road Alternative 1

The Jay Road Alternative 1 is located at the northernmost alignment shown in Map 2.5-1. The road intersects the Misery Haul Road at the north edge of the Misery WRSA, and then runs northeast for a few kilometres where it turns east to cross the esker. From the esker, it continues east to the shore of Lac du Sauvage where it intersects the common roads that branch to connect to the north and south abutments of the dike. Preliminary estimates for Jay Road Alternative 1 are as follows:

- requires a total of approximately 832,000 m^3 of fill material;
- total length is 11.7 km;
- has a maximum grade of 7.4%;
- haul distance is 7.7 km (to common location);
- requires three watercourse crossings; and,
- length of water management pipeline is 10.0 km.

Jay Road Alternative 2

The Jay Road Alternative 2 intersects the Misery Haul Road at the same location as Alternative 1 at the north edge of the Misery WRSA. It follows the same route as Alternative 1 for approximately the first kilometre, then diverges to follow a route further south to cross the esker. From the esker, it extends east to continue to the shore of Lac du Sauvage where it connects to the common roads that branch to connect to the north and south abutments of the dike. Preliminary estimates for Jay Road Alternative 2 are as follows:

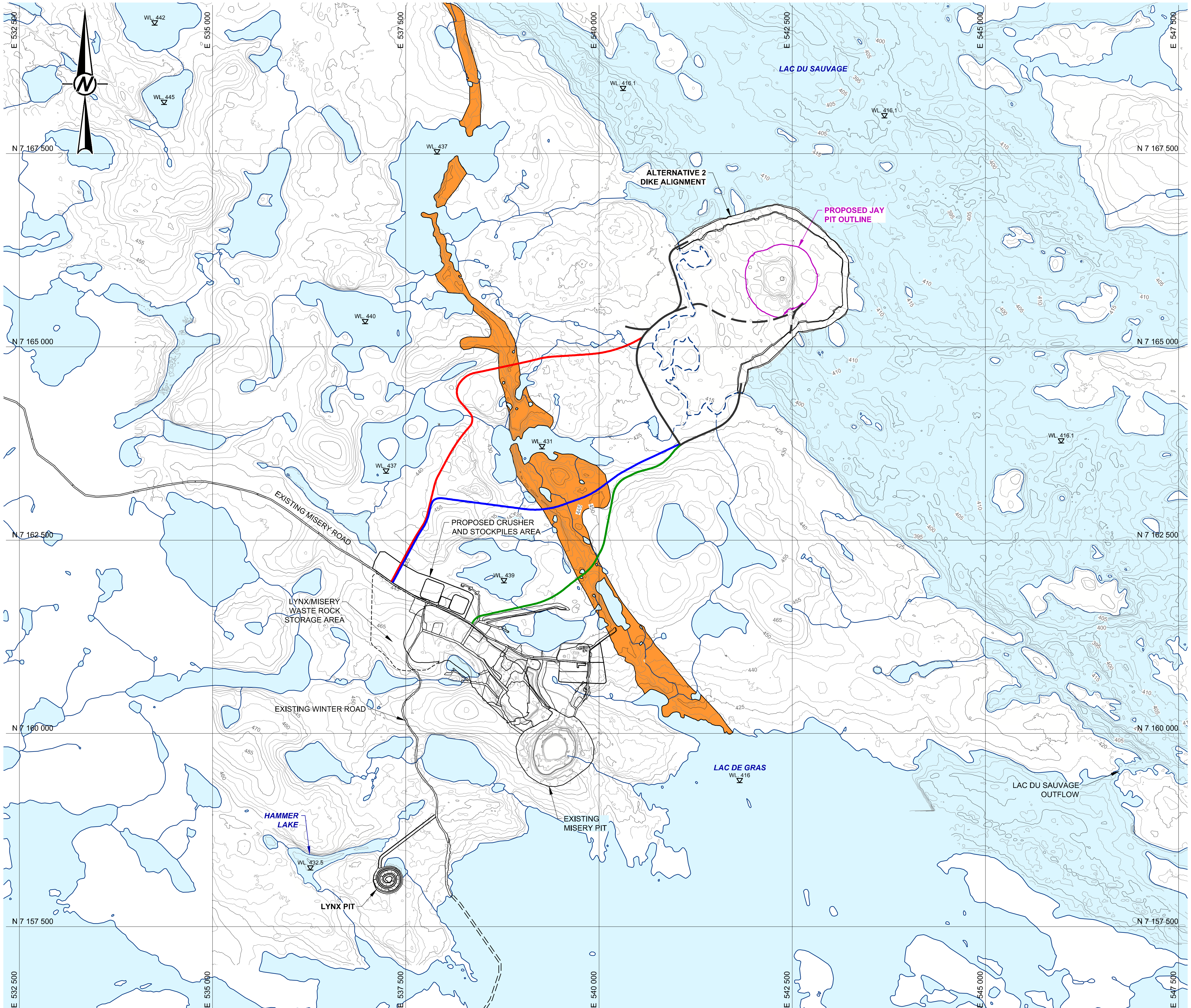
- requires a total of 802,000 m^3 of fill material;
- total length is 10.6 km;
- has a maximum grade of 8.5%;

- haul distance is 7.0 km (to common location);
- requires two watercourse crossings; and,
- length of water management pipeline is 8.8 km.

Jay Road Alternative 3

The Jay Road Alternative 3 intersects the Misery Haul Road at the same location as the King Pond dam access road, closer to the camp than the intersection of Alternative 1 and Alternative 2. The road parallels the King Pond dam, on the downstream side, and then turns north, crosses the esker and continues in a northeast direction to where it connects to the common roads that branch to connect to the north and south abutments of the dike. Preliminary estimates for Alternative 3 are as follows:

- requires a total of 626,000 m^3 of fill material;
- total length is 9.9 km;
- has a maximum grade of 6.6%;
- haul distance is 7.6 km (to common location);
- requires one watercourse crossing; and,
- length of water management pipeline is 5.6 km.



LEGEND

- WATERBODY
- WATERCOURSE
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- ESKER
- PROPOSED ROAD COMMON TO ALL ALIGNMENTS (CONSTRUCTION AND OPERATIONS)
- PROPOSED ROAD COMMON TO ALL ALIGNMENTS (OPERATIONS)
- PROPOSED JAY ROAD ALTERNATIVE 1
- PROPOSED JAY ROAD ALTERNATIVE 2
- PROPOSED JAY ROAD ALTERNATIVE 3
- WL WATER LEVEL ELEVATION

NOTES

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS IN METRES ABOVE SEA LEVEL.
3. GROUND SURFACE AND BATHYMETRY CONTOURS ARE SHOWN AT 5 m INTERVALS.
4. COORDINATES ARE SHOWN IN DATUM: NAD 83, PROJECTION: UTM ZONE 12.

REFERENCES

1. CONTOUR AND BATHYMETRIC DATA PROVIDED BY AURORA GEOSCIENCES LTD., FILE: Final 1m Contours - Priority Area.dxf, DATE RECEIVED: OCTOBER 29, 2013.
2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.
3. ESKER FROM MINERAL SERVICES, DATED: JUNE 14, 2013.

SCALE 0 1,000 2,000 3,000 METRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

JAY ROAD ALTERNATIVES

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PROJECT No.	1407256.4070.60		FILE No.	DAR_PA_004_CAD
DESIGN	AI	2014-08-05	SCALE AS SHOWN	REV. 0
CADD	JK	2014-08-05		
CHECK	AI	2014-10-15	MAP 2.5-1	
REVIEW	JC	2014-10-15		

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2.5.1.2 Evaluation Criteria

The Jay Road alternatives were evaluated based on four categories or accounts: technical feasibility; Project economic viability; environmental considerations; and, social and economic considerations. The following sections summarize the evaluation criteria in each of the four categories.

2.5.1.2.1 Technical Feasibility

Technical Feasibility takes into account the complexity of the design and construction of each alternative. Alternatives with simpler designs and construction techniques are preferred. The Jay Road alternatives have similar designs, which are relatively simple. The approach to crossing the esker (cut or fill) is considered in the technical complexity of the road construction, in addition to the maximum grade of the road. Caribou crossings will be required for the Jay Road, which adds complexity. The number of caribou crossings is assumed to be relative to the length of the road.

2.5.1.2.2 Project Economic Viability

Economic Viability relates to the capital costs, operation and maintenance costs, and reclamation and closure costs associated with each option. The length of new road required for each alternative and the volume of fill material required reflects the capital cost for each alternative. The haul length of the road alternatives represents operation and maintenance costs. The haul distances for each alternative were measured from the Jay Pit to the intersection of Alternatives 1 and 2 with Misery Haul Road, which is the closest common point of all the haul routes.

The road alignment will accommodate additional infrastructure besides the road such as the water management pipeline and power lines. As such, the length of the water management pipeline was also taken into account in this alternatives assessment. The length of the pipeline was measured from the edge of each dike alternative to the Misery Pit.

2.5.1.2.3 Environmental Considerations

Environmental Considerations takes into account the potential environmental effects that each alternative may have on the environment.

The focus of the environmental considerations evaluation is on areas of the environment identified as KLOI (water quality and quantity, fish and fish habitat, and caribou) in the TOR. Some negative effects can be mitigated, while others will have residual effects that cannot be fully mitigated. The latter possibility is to be avoided if possible, especially if the residual effects are significant.

The main caribou migration route in the Project area runs northwest from the Narrows. The three road alternatives must run in an approximately east-west direction to connect the Jay Pit to the Misery Haul Road, and as such, will cross the main caribou migration path and are predicted to have similar effects on caribou movement. Areas requiring wildlife crossings will be identified and designed as part of the pre-feasibility engineering design work. A combination of sources will be used to identify the wildlife crossings, including: collared caribou Global Positioning System tracking data, visible evidence of historical caribou tracks, vegetation and landform information, observations, and site experience of Ekati environmental staff, biologists, Traditional Knowledge (where available), and advice obtained from Elders and IBA community members. Each road alignment must cross the esker; however, the approach to crossing the esker differs and is considered in the evaluation.

The number of watercourse crossings required for each road alternative was evaluated to represent the potential effects to fish and fish habitat. The crossing of King Pond dam for Alternative 3 was not included in the count of watercourse crossings, because this infrastructure crossing already exists.

2.5.1.2.4 Social and Economic Considerations

The road alternatives were evaluated to determine the proximity of each road alignment to archaeological sites. In addition, the alternatives were evaluated based on the visual impact of the esker crossing and the complexity for reclamation and closure. Evaluation of these components is based on input gained during community consultations.

The esker has been identified as an important location for caribou hunting, trapping, and as a travel route in both the past and present. As such, it holds particular importance to the local Aboriginal communities and to the archaeological record. The three road alternatives must run in an approximately east-west direction to connect the Jay Pit to the Misery Haul road and will cross the esker, as such the potential to affect the esker does not differentiate between the alternatives. Input for the esker crossing design was obtained during community consultations (Section 2.5.1.2.3).

Because the mine roads will have controlled access as part of the mine, they will not provide access to non-traditional land users.

2.5.1.3 Roads Alternatives Assessment

The roads alternatives were ranked relative to each other in each of the four categories (Technical Feasibility, Economic Viability, Environmental Considerations, and Social and Economic Considerations) to determine the preferred alternative. For the evaluation, relative scores from 1 to 3 were assigned to each alternative for each of the categories. The “best” (most preferred) alternative received a score of 3, and the “worst” (least preferred) alternative received a score of 1. The scores for each category were summed to generate an overall score for each alternative with the highest score being the preferred option.

To conduct a sensitivity assessment, a range of weightings were assigned to the four categories to allow for a value bias. The scores were multiplied by the category weightings to determine weighted scores. The four weighted category scores were added together to derive a weighted overall alternative score. The alternative with the highest overall score is the preferred alternative.

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The results of the evaluation are summarized in Table 2.5-1. The results of the assessment indicate that Alternative 3 for the Haul Road, which is the most southern alignment, is the most viable option for the Project. Input regarding the design of the Jay Road esker crossing was obtained during community consultation and was used to conduct a more detailed assessment of the esker crossing for the Jay Road Alternative 3.

2.5.2 Waste Rock Storage Alternatives Assessment

The volume of waste rock and overburden estimated to be produced from mining operations at the Jay Pit is 110,991,000 m^3. To accommodate contingency, the WRSA will be designed to provide storage for up to 120,000,000 m^3 of waste rock and overburden.

It is estimated that 25% of the WRSA volume will be potentially acid-generating waste rock (metasedimentary rock), 70% will be non-acid-generating waste rock (granite), and 5% will be overburden. Waste rock and overburden generated from the Jay Pit mining operations will be transported to the WRSA by haul truck. The design of the WRSA is anticipated to include components to manage the potentially acid generating waste rock. In addition, the design includes wildlife ramps to provide multiple access and exit areas for wildlife during mining and post closure.

2.5.2.1 Waste Rock Storage Alternatives

Three potential WRSA alternatives have been considered for this assessment as described in the following sections.

In addition to the alternatives discussed below, options for in-lake and in-pit waste rock storage were considered but were not selected. Storage of waste rock in the basin of Lac du Sauvage was not selected due to potential regulatory and permitting issues that may not be resolved within the required Project timeframe, and because other viable waste rock management alternatives exist. Storage of waste rock in mined pits, such as Misery, Lynx, Panda, and Koala was rejected due to uneconomic hauling and placement requirements.

Conceptual layouts for the three alternatives were prepared based on the following fundamental design criteria:

- Achieve a reasonable balance between surface footprint area and height, with a target of 50 m over the average foundation elevation.
- Maintain setbacks from receiving waterbodies as a mitigation measure to allow for attenuation of drainage by tundra soils and to allow for contingency construction of water collection structures downstream of the WRSA toe, if required. The minimum setback from Lac du Sauvage is 100 m and the minimum setback from other waterbodies is 30 m.
- Maintain a setback from the esker.

Each option provides secure, long-term storage. For each option, the existing Ekati Mine WRSA Seepage Monitoring Program would be expanded to incorporate the new WRSA(s).

Table 2.5-1 Jay Road Alternatives Assessment Results

Account	Alternative 1	Alternative 2	Alternative 3
Technical Feasibility	• The grade for Alternative 1 is between the other alternatives. • Requires additional fill thickness for crossing the esker.	• Alternative 2 has the steepest maximum grade. • Requires additional fill thickness for crossing the esker.	• Alternative 3 has the shallowest maximum grade. • Requires a cut through the esker.
Relative Scores	**2**	**1**	**3**
Project Economic Viability	• Alternative 1 requires the longest section of new road and requires the most fill. • Alternatives 1 and 3 have similar haul distances, which are longer than Alternative 2. • Alternative 1 has the longest pipeline alignment.	• Alternative 2 requires less road length and fill than Alternative 1, but more than Alternative 3. • Alternative 2 has the shortest haul distance. • The length of the pipeline for Alternative 2 is between Alternatives 1 and 3.	• Alternative 3 requires the shortest section of new road and the least amount of fill. • Alternatives 1 and 3 have similar haul distances, which are longer than Alternative 2. • Alternative 3 has the shortest pipeline alignment.
Relative Scores	**1**	**2**	**3**
Environmental Considerations	• Alternative 1 is longest and will require the most extensive mitigation to create caribou crossings. • The length of the esker crossing is shorter than Alternative 2, but longer than Alternative 3. • Alternatives 1 and 2 require large fills to cross the esker, which could result in an additional barrier to caribou. • Alternative 1 requires three watercourse crossings.	• Alternative 2 requires more mitigation to create caribou crossings than Alternative 3 and less than Alternative 1. • Alternative 2 has the longest esker crossing. • Alternatives 1 and 2 require large fills to cross the esker, which could result in an additional barrier to caribou. • Alternative 2 requires two watercourse crossings.	• Alternative 3 is the shortest and requires the least mitigation to create caribou crossings. • Alternative 3 has the shortest esker crossing. • Alternative 3 has a cut through the esker, which would result in less of a barrier to caribou movement near the esker than the large fills required to cross the esker for Alternatives 1 and 2. • Alternative 3 requires one watercourse crossing.
Relative Scores	**1**	**2**	**3**
Social and Economic Considerations	• One unmitigated archaeological site of low significance is located within 150 m of Alternative 1.	• No archaeological sites have been identified within 150 m of Alternative 2.	• The design of Alternative 3, involving a cut through the esker, will provide less of a visual impact and allow for easier closure compared to Alternatives 1 and 2. • No archaeological sites have been identified within 150 m of Alternative 3.
Relative Scores	**2**	**3**	**3**
Total Scores	**6**	**8**	**12**

m = metre.

WRSA Alternative 1

Waste rock storage area Alternative 1 is located on the west shore of Lac du Sauvage, west of the Jay kimberlite pipe and east of the esker. Alternative 1 maintains the setbacks listed above, including a minimum 200 m setback from the esker. The footprint of the WRSA is approximately 2.5 km^2.

The distance from the Jay kimberlite pipe to the centroid of the WRSA is approximately 3.7 km. The maximum height of the pile is 79 m and the minimum height is 47 m. Alternative 1 does not require any diversions of natural watercourses, because the layout was designed to avoid the surrounding waterbodies and drainage channels.

A substantial portion of the WRSA Alternative 1 footprint is composed of bedrock outcrops (typically at higher elevations), boulders, and sands and gravels. This location is considered to have relatively low-quality habitat for caribou, because there is limited vegetation.

Alternative 1 is located at the minimum setback distance from Lac du Sauvage.

A general layout of WRSA Alternative 1 is shown in Map 2.5-2.

WRSA Alternative 2

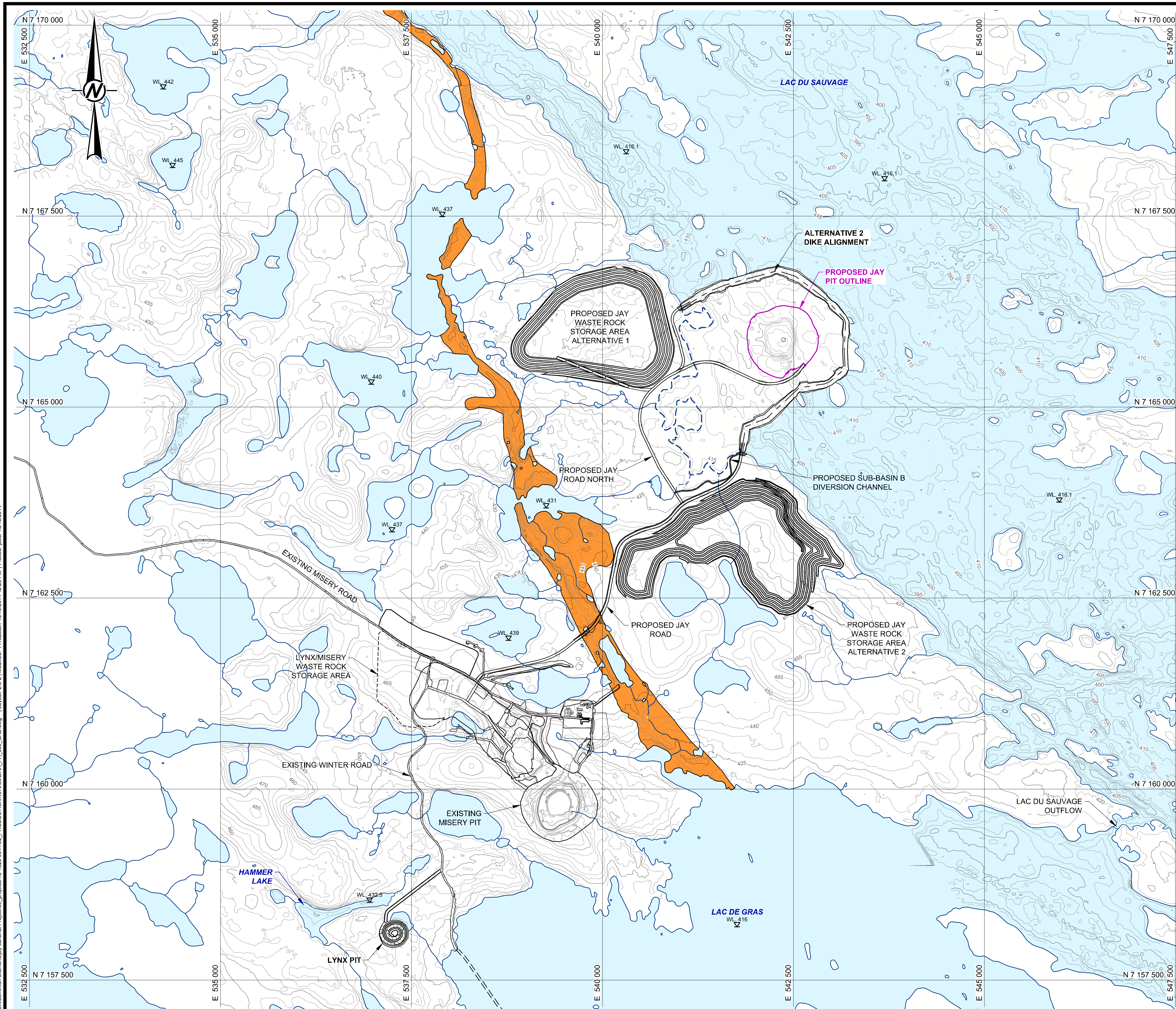
Waste rock storage area Alternative 2 is located south of the Jay kimberlite pipe on the west shore of Lac du Sauvage. Lakes Ac35 and Ac36 are located to the west of WRSA Alternative 2. The footprint of the WRSA is approximately 2.6 km^2.

The distance from the Jay Pit to the centroid of the WRSA ramp is approximately 3.7 km. The maximum height of the pile is 92 m and the minimum height is 49 m.

The footprint area of WRSA Alternative 2 is considered to be higher quality habitat for caribou because it has more vegetation compared to Alternative 1.

Alternative 2 will require the diversion of a natural watercourse running from Lake Ac35 to Lac du Sauvage. Alternative 2 is located at the minimum setback distances from Lac du Sauvage and Lakes Ac35 and Ac36.

A general layout of WRSA Alternative 2 is shown in Map 2.5-2.



LEGEND

- WATERBODY
- WATERCOURSE
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- PROPOSED DIVERSION CHANNEL
- ESKER
- WATER LEVEL ELEVATION

NOTES

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2. ELEVATIONS ARE IN METERS ABOVE SEA LEVEL (masl).
3. GROUND SURFACE AND BATHYMETRY CONTOURS ARE SHOWN AT 5 m INTERVALS.
4. COORDINATES ARE SHOWN IN DATUM: NAD 83, PROJECTION: UTM ZONE 12.

REFERENCES

1. CONTOUR AND BATHYMETRIC DATA PROVIDED BY AURORA GEOSCIENCES LTD., FILE: Final 1m Contours - Priority Area.dxf, DATE RECEIVED: OCTOBER 29, 2013.
2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.
3. ESKER FROM MINERAL SERVICES, DATED: JUNE 14, 2013.

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SCALE METRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

WASTE ROCK STORAGE AREA ALTERNATIVES 1 AND 2

PROJECT No.	1407256.4070.60		FILE No.	DAR_PA_005_CAD
DESIGN	JB	2014-07-24	SCALE AS SHOWN	REV. 0
CADD	JD	2014-07-24		
CHECK	AI	2014-10-15	MAP 2.5-2	
REVIEW	JC	2014-10-15		

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WRSA Alternative 3

Waste rock storage area Alternative 3 involves splitting the waste rock storage between the Alternative 1 and Alternative 2 locations described above. The total combined footprint of the WRSAs is approximately 3.6 km^2.

The distance from the pit exit to the centroid of each of the north and south piles will be 3.5 km. By spreading the waste rock storage out into two locations, the maximum height of the waste rock storage is reduced compared to Alternatives 1 and 2. The maximum height of the north pile is 54 m and the maximum height of the south pile is 62 m. The western edge of the north pile is pulled back for Alternative 3 to increase the offset from the esker to approximately 750 m. The footprint of the south pile for Alternative 3 has been reduced from Alternative 2 to increase the setback from the esker and to avoid covering the natural watercourse running from Lake Ac35 to Lac du Sauvage.

The south pile of Alternative 3 is located at the minimum setback distances from Lac du Sauvage and Lake Ac35.

A general layout of the WRSAs for Alternative 3 are shown in Map 2.5-3

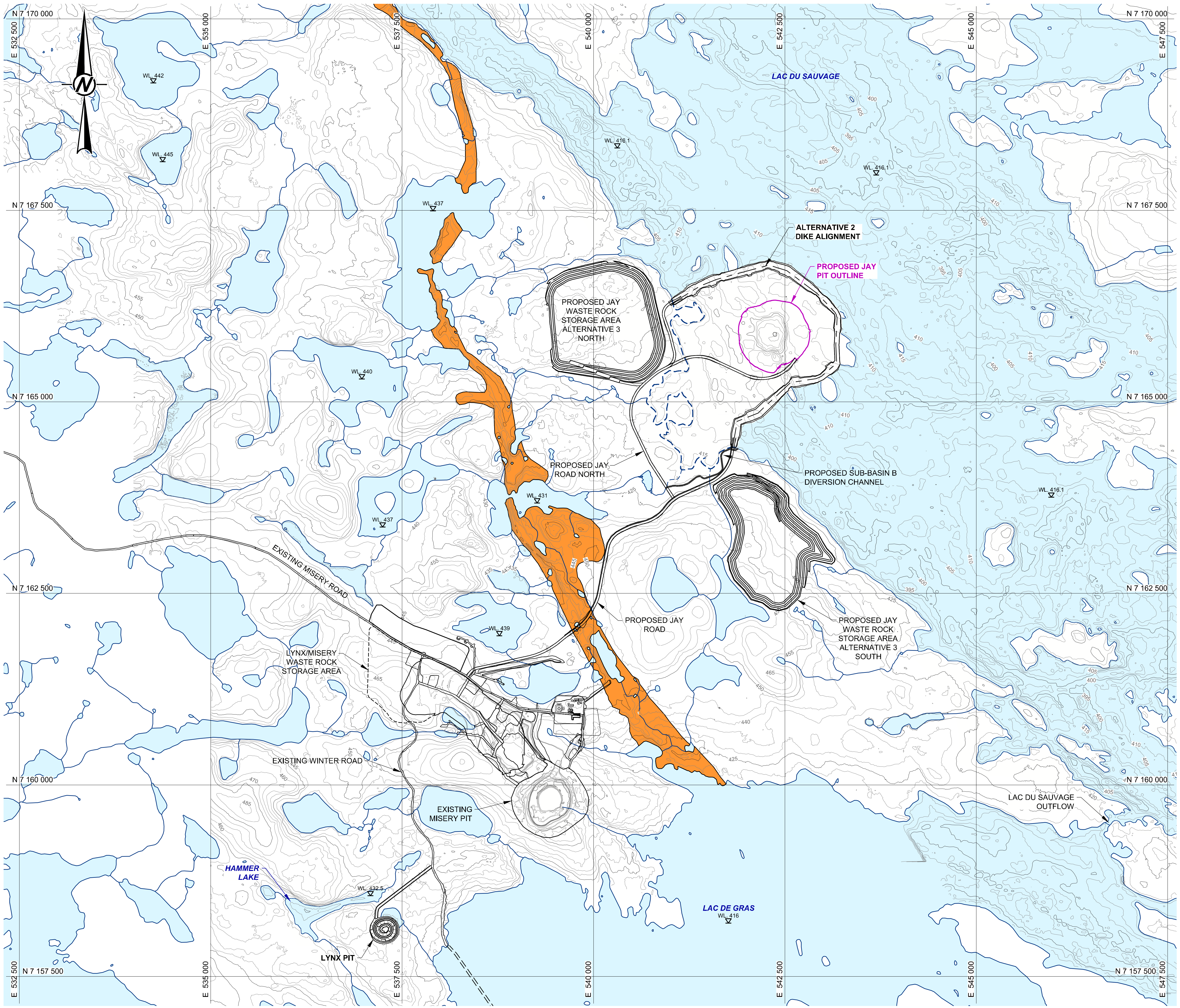
2.5.2.2 Evaluation Criteria

For the WRSA alternatives assessment, the three alternatives were evaluated relative to each other in the four alternatives assessment categories (Technical Feasibility, Project Economic Viability, Environmental Considerations, and Social and Economic Considerations) to determine the preferred alternative. The following sections summarize the criteria that were evaluated for each of the three alternatives.

2.5.2.2.1 Technical Feasibility

Technical feasibility relates to the complexity of the design and necessary construction techniques. Because the design of the WRSA will be the same regardless of the location, it does not differentiate the alternatives. The foundation topography, the pile layout, and height can all factor in to the construction method used to develop the pile. This level of detail was not considered for the WRSA alternatives assessment.

Precipitation over the WRSA may result in some amount of surface minewater runoff (seepage). Collection of seepage water is not anticipated based on geochemical testing and past experience at the Ekati Mine. However, collection of seepage water into the minewater management system remains a possible contingency if poor quality seepage is experienced to the degree that necessitates active management. Therefore, alternatives that would require simpler seepage water management are preferred.



LEGEND

- WATERBODY
- WATERCOURSE
- ROAD
- WINTER ROAD - YEARLY CONSTRUCTION
- PROPOSED DIVERSION CHANNEL
- ESKER
- WL WATER LEVEL ELEVATION

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REFERENCES

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2. WATER OBTAINED FROM CANVEC NATURAL RESOURCES CANADA, 2012.
3. ESKER FROM MINERAL SERVICES, DATED: JUNE 14, 2013.

0 1,000 2,000 3,000
SCALE METRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
WASTE ROCK STORAGE AREA ATERNATIVE 3

PROJECT No.		1407256.4070.60	FILE No.	DAR_PA_006_CAD
DESIGN	JB	2014-07-24	SCALE AS SHOWN	REV. 0
CADD	JD	2014-07-24		
CHECK	AI	2014-10-15	MAP 2.5-3	
REVIEW	JC	2014-10-15		

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2.5.2.2.2 Project Economic Viability

Economic viability relates to the capital costs, operation and maintenance costs, and reclamation and closure costs associated with each alternative. Alternatives that require less capital and cost less to operate and reclaim are preferred.

Operation and maintenance costs were considered in the economic viability assessment. The haul distance was considered as a direct indicator of the operation and maintenance costs. Haul distance was represented by the distance from the Jay Pit to the centroid of the WRSA.

Capital and reclamation and closure costs were not considered to be differentiating between the alternatives.

2.5.2.2.3 Environmental Considerations

The focus of the Jay WRSA environmental considerations evaluation is on areas of the environment identified as KLOI (water quality and quantity, fish and fish habitat, and caribou) in the TOR. Some negative effects can be mitigated, while others will have residual effects that cannot be fully mitigated. The latter possibility is to be avoided if possible, especially if the residual effects are significant.

The potential effect of each alternative on wildlife habitat, particularly for caribou, was considered in the alternatives assessment. Areas with more vegetation cover are considered to be higher quality wildlife habitat.

Because surface minewater runoff from the WRSA will be monitored and managed as required, effects on water quality and aquatic habitat are considered non-differentiating.

The potential effect of the WRSAs on caribou migration was considered. The main caribou migration route through the area extends from the Narrows north between the west shore of Lac du Sauvage and the esker. Options that create greater barriers to caribou movement were considered less desirable. Caribou access ramps are likely to be required for the WRSAs to facilitate safe ascent and descent routes if caribou find their way onto the WRSA. The number of these ramps and their design are expected to be similar for all three WRSA alternatives; therefore, this factor was considered non-differentiating.

2.5.2.3 Social and Economic Considerations

The height of the WRSA was considered for the social and economic considerations of the WRSA alternatives assessment. During consultation with local community groups, concerns regarding the height of the WRSA(s) were raised. Alternatives with lower heights are understood to be preferred by local communities because they result in less of a visual impact in the area.

The esker has been identified as an important location for caribou hunting in both the past and present. As such, it holds particular importance to the local Aboriginal communities and to the archaeological record. Therefore, the proximity of the WRSA to the esker was evaluated in the WRSA alternatives assessment.

The proximity of the WRSA alternatives to archaeological sites was considered. However, there were no archaeological sites within 150 m of any of the alternatives; therefore, this factor was non-differentiating.

2.5.2.4 Waste Rock Storage Alternatives Assessment Results

The alternatives were ranked relative to each other in each of the four categories (Technical Feasibility, Economic Viability, Environmental Considerations, and Social and Economic Considerations) to determine the preferred alternative. For the evaluation, relative scores from 1 to 3 were assigned to each alternative for each of the categories. The “best” (most preferred) alternative received a score of 3, and the “worst” (least preferred) alternative received a score of 1. The scores for each category were summed to generate an overall score for each alternative with the highest score being the preferred option.

The results of the evaluation are summarized in Table 2.5-2. The results of the assessment indicate that Alternative 1 where the WRSA is located in the northern most location, west of the Jay Pit is the most viable option for the Project.

2.5.3 Energy Sources and Conservation Alternative Assessment

Power will be required at the pump locations for the dewatering stages of the Project and for the life of the mining activities to handle annual runoff collection, pit dewatering, and underground mining (if developed in the future).

2.5.3.1 Power Supply Alternatives Not Considered

Sources of electrical power normally include connection to a local municipal electrical distribution system or production of dedicated power locally, using fuels such as water (hydroelectric power), natural gas, biomass, or wind. At the Project site, there is no local municipal electrical distribution system, nor are there any ready sources of water for hydroelectric power, natural gas, and biomass; therefore, these options were eliminated from consideration.

Wind power was eliminated from further consideration for the following reasons:

- The average wind farm will only produce power a portion of the time due to either too low or too high wind velocity thereby requiring standby capacity from other fuel sources, which doubles the capital cost and significantly increases the operating costs.
- Wind turbines do not operate in extremely low temperatures, which occur at the Project site during several months of the year.

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Table 2.5-2 Jay Waste Rock Storage Area Alternatives Assessment Results

Account	Alternative 1 – North Pile, west of the Jay pipe	Alternative 2 – South Pile, south of Jay pipe	Alternative 3 – Split between North and South Piles
Technical Feasibility	• Alternative 1 would have the simplest seepage water management contingency, if required.	• Alternative 2 would have more complex seepage water management contingency, if required, than Alternative 1.	• Alternative 3 would have more complex seepage water management contingency, if required, than Alternatives 1 and 2.
Relative Scores	**3**	**2**	**1**
Project Economic Viability	• The waste rock haul distance is the same as Alternative 2 and is shorter than Alternative 3.	• The waste rock haul distance is the same as Alternative 1 and is shorter than Alternative 3.	• The haul distance is less than the other alternatives.
Relative Scores	**2**	**2**	**3**
Environmental Considerations	• The footprint area of Alternative 1 is similar, but slightly smaller, than Alternative 2. • The footprint of Alternative 1 has lower quality wildlife habitat than the footprint of Alternative 2. • Alternative 1 does not require water diversions.	• The footprint area of Alternative 2 is similar, but slightly larger, than Alternative 1. • The footprint of Alternative 2 has higher quality wildlife habitat. • Alternative 2 is considered to provide a greater barrier to caribou movement due to its location and orientation. Only a narrow area between the WRSA and the existing Misery development would be available for caribou movement north from the Narrows. • Alternative 2 requires a water diversion.	• Alternative 3 covers a smaller area of higher quality wildlife habitat than Alternative 2, but has a greater overall footprint due to splitting the storage in to two areas. • The south pile for Alternative 3 has a larger setback between the WRSA and the existing Misery development to allow for less impingement on caribou movement compared to Alternative 2. In addition, the west edge of the north pile is pulled back compared to Alternative 1, which provides more space for caribou movement. • Alternative 3 requires a water diversion.
Relative Scores	**3**	**1**	**2**
Social and Economic Considerations	• The maximum height of Alternative 1 is 13 m lower than Alternative 2. • Alternative 1 is closer to the esker than the piles for Alternative 3.	• The maximum height of Alternative 2 is 13 m higher than Alternative 1. • The western edge of Alternative 2 is relatively close to the esker. However, the Jay Road is located downstream of the WRSA toe in this area and was considered to be an existing area of disturbance.	• The maximum heights of the piles for Alternative 3 are 17 to 38 m lower than Alternatives 1 and 2. • The north and south piles of Alternative 3 are pulled back away from the esker.
Relative Scores	**2**	**1**	**3**
Total Scores	**10**	**6**	**9**

WRSA = waste rock storage area; m = metre.

2.5.3.2 Power Supply Alternatives

Alternatives were evaluated for the generation of power to the Project site. The four alternatives for the generation of power are described as follows:

- **Alternative 1** Expand the diesel generation plant (powerhouse) at the Misery Pit.
- **Alternative 2** Purchase or lease capacity at Diavik Diamond mine and purchase electricity from Diavik.
- **Alternative 3** Supply all energy from the powerhouse at Ekati Mine, using the existing Misery power line.
- **Alternative 4** Supply all energy from a new powerhouse at the Project site.

2.5.3.3 Evaluation Criteria

For the Jay power supply alternatives assessment, the alternatives were evaluated relative to each other in the four alternatives assessment categories (Technical Feasibility, Project Economic Viability, Environmental Considerations, and Social and Economic Considerations) to determine the preferred alternative. The following sections summarize the criteria that were evaluated for each of the four alternatives.

2.5.3.3.1 Technical Feasibility

The technical feasibility of the power supply alternatives was evaluated based on the following criteria:

- reliability;
- design of new power generation infrastructure;
- ease of maintenance; and,
- ease of fuel management.

It is preferred for Dominion Diamond to have control of the system from a reliability perspective so that the interests and priorities of the company are in their control in the event of maintenance and unscheduled outages.

2.5.3.3.2 Project Economic Viability

The economic viability of the power supply alternatives was evaluated based on the following criteria:

- construction costs; and,
- operating costs.

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2.5.3.3.3 Environmental Considerations

Location of fuel storage is an environmental consideration for power supply.

The Ekati Mine has an established power smart conservation program to reduce the requirement for power generation. The power smart program would be expanded to include the Project and would be consistent regardless of the alternative chosen. Therefore, it is not included as a differentiation between the alternatives.

2.5.3.3.4 Social and Economic Considerations

Differentiating effects for the power supply alternatives that would influence social and economic considerations are not known.

2.5.3.4 Energy Sources Alternatives Assessment Results

The alternatives were ranked relative to each other in each of the four categories (Technical Feasibility, Project Economic Viability, Environmental Considerations, and Social and Economic Considerations) to determine the preferred alternative. For the evaluation, relative scores from 1 to 4 were assigned to each alternative for each of the categories. The “best” (most preferred) alternative received a score of 4, and the “worst” (least preferred) alternative received a score of 1.The scores for each category were summed to generate an overall score for each alternative with the highest score being the preferred option.

The results of the evaluation are summarized in Table 2.5-3.

Table 2.5-3 Energy Sources Alternatives Assessment Results

Account	Alternative 1 Expand Powerhouse at Misery	Alternative 2 Purchase or Lease from Diavik	Alternative 3 Supply from Ekati Powerhouse (connect to Misery power line)	Alternative 4 Construct new powerhouse at Jay
Technical Feasibility	• Alternatives 1 and 4 involve the design and construction of additional power generating infrastructure.	• Alternatives 2 and 3 are preferred since the capacity already exists. • The Diavik site is currently scheduled to close before completion of mining the Jay pipe. Alternative 2 would require construction of one of the other alternatives at a later date. • Alternative 2 is not preferred for availability.	• Alternatives 2 and 3 are preferred because the capacity already exists. • Maintenance of one powerhouse for the Ekati site where staff are already located is preferred.	• Alternatives 1 and 4 involve the design and construction of additional power generating infrastructure.
Relative Scores	**3**	**1**	**4**	**2**
Project Economic Viability	• Expanding the powerhouse at Misery would cost more than Alternative 3, but less than the other alternatives.	• The operating and capital costs are highest for Alternative 2.	• The most cost-effective option is Alternative 3 to supply power from Ekati powerhouse, because it does not require construction of additional power generation infrastructure, and it is more efficient to operate and maintain a single facility.	• Constructing a new powerhouse at the Jay site would cost less than Alternative 2, but more than the other alternatives.
Relative Scores	**3**	**1**	**4**	**2**
Environmental Considerations	• Requires an expanded fuel storage facility at Misery site.	• Uses existing fuel storage	• Alternative 3 will result in fuel storage in one existing location, which will reduce the surface footprint. • Heat will be recovered from the power generation process and used at the main camp, resulting in power conservation and a lower carbon footprint.	• Requires new fuel storage facility at the Jay site.
Relative Scores	**2**	**3**	**4**	**1**
Social and Economic Considerations	There are no known differentiating effects that would influence social and economic considerations.			
Total Scores	**8**	**5**	**12**	**5**

2.6 Minewater Discharge Alternatives for Future Consideration

The Minewater Management Plan for the Project includes operational discharge of water from the water management pond at Misery Pit into Lac du Sauvage, with water quality being suitable for discharge. However, because Lac de Gras is closer to the Misery Pit where minewater will be stored, discharge into Lac de Gras could be considered as an alternative. Engineering studies would be required during later stages of Project design to determine if this alternative would be a preferred location from a technical feasibility and cost perspective. A preliminary assessment is provided below. Discharge criteria would be met for both alternatives; therefore, discharge criteria is considered non-differentiating.

The preliminary assessment is presented in Table 2.6-1.

Table 2.6-1 Minewater Discharge Alternatives Consideration

Account	Alternative 1 Discharge to Lac du Sauvage	Alternative 2 Discharge to Lac de Gras
Technical Feasibility	• Non-differentiating.	• Non-differentiating.
Economic Viability	• Likely higher cost due to longer pipeline length.	• Requires road construction from Misery site to Lac de Gras. • Lower cost to build and operate due to shorter pipeline length.
Environmental Considerations	• Operational discharge and monitoring in Lac du Sauvage.	• Operational discharge and monitoring in Lac de Gras.
Social and Economic Considerations	• No direct release to Lac de Gras.	• Direct release to Lac de Gras.

The preliminary assessment for the Lac du Sauvage and Lac de Gras minewater discharge indicates the alternatives are similar.

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2.8 Glossary

Term	Definition
Acid Rock Drainage	Acidic pH rock drainage due to the oxidation of sulphide minerals that includes natural acidic drainage from rock not related to mining activity; an acidic pH is defined as a value less than 6.0.
Active Layer	The active layer is the layer of ground subject to annual freezing and thawing in areas underlain by permafrost.
Adit	A horizontal or nearly horizontal entrance to an underground mine by which the mine can be entered, drained of water, ventilated, and minerals extracted at the lowest convenient level. Adits are also used to explore for mineral veins.
Babiche	A type of cord or lacing of rawhide or sinew formed into strips and used to make items such as fastenings, animal snares, and snowshoes.
Barrenlands	The area of the Northwest Territories east of the Mackenzie River valley and north and east of the tree line characterized by a low rolling tundra landscape, continuous permafrost, and low densities of human settlement.
Bedrock	The solid rock (harder than 3 on Moh's scale of hardness) underlying soils and the regolith in depths ranging from zero (where exposed to erosion) to several hundred metres.
Biomass	The weight of living matter in a given area or sample.
Canadian Shield	Large area of exposed Precambrian igneous and high-grade metamorphic rocks (geological shield) that forms the ancient geological core of the North American continent (North American or Laurentia craton), covered by a thin layer of soil. It is an area mostly composed of igneous rock , which relates to its long volcanic history. It has a deep, common, joined bedrock region in Eastern and central Canada and stretches north from the Great Lakes to the Arctic Ocean, covering over half of Canada.
Craton	Part of the Earth's crust that has been stable and little deformed for a prolonged period of time.
Dewatering	Removal of water from a natural waterbody by pumping or draining.
Diabase	A dark coloured, fine- to medium-grained igneous intrusive rock.
Dike	A natural or artificial slope or wall to regulate water levels.
Drawdown	Water withdrawal resultant in an apparent water levels decrease.
Eskers	An esker is a long, winding ridge of stratified sand and gravel believed to form in ice-walled tunnels by streams, which flowed within and under glaciers. After the retaining ice walls melt away, stream deposits remain as long winding ridges.
Fines	Silt and clay particles.
Footprint	The proposed development area that directly affects the soil and vegetation components of the landscape.
Geochemistry	The chemistry of the composition and alterations of solid matter such as sediments or soil.
Granite	A coarsely crystalline igneous intrusive rock composed of quartz, potassium feldspar, mica, and/or hornblende.
Groundwater	Water that is passing through or standing in the soil and the underlying strata in the zone of saturation. It is free to move by gravity.
Kame	A steep-sided mound of stratified material deposited against an ice-front.
Kimberlite	Igneous rocks that originate deep in the mantle, and intrude the earth's crust. These rocks typically form narrow pipe-like deposits that sometimes contain diamonds.
Kimberlite pipe	Vertical structures on which kimberlites occur in the Earth's crust.
Lacustrine	Sediment that have been transported or deposited by water or wave action. Generally consisting of stratified sand, silt or clay deposited on a lake bed or moderately well sorted and stratified sand and coarser material.
Laydown Areas	An area that has been cleared for the temporary storage of equipment and supplies.
Lithics Scatters	A concentration of stone flakes resulting from the production or rejuvenation of stone tools.

Term	**Definition**
Metal Leaching	Removal of metals by dissolution, desorption, or other chemical reaction from a solid matrix by passing liquids through the material.
Metasediments	Sedimentary rocks that have been modified by metamorphic processes.
Nutrients	Environmental substances (elements or compounds) such as nitrogen or phosphorus, which are necessary for the growth and development of plants and animals.
Ore	The naturally occurring material from which a mineral or minerals of economic value can be extracted.
Overburden	Materials of any nature, consolidated or unconsolidated, that overlie a deposit of useful materials. In the present situation, overburden refers to the soil and rock strata that overlie kimberlite deposits.
Permafrost	Ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years. Permafrost is defined on the basis of temperature. It is not necessarily frozen, because the freezing point of the included water may be depressed several degrees below 0°C; moisture in the form of water or ice may or may not be present.
Runoff	The portion of water from rain and snow that flows over land to streams, ponds or other surface waterbodies. It is the portion of water from precipitation that does not infiltrate into the ground, or evaporate.
Saline	Groundwater with a high salt concentration.
Sedges	A grass-like plant with a triangular stem often growing in wet areas. Sedge wetland habitats are typically wet sedge meadows and other sedge associations of non-tussock plant species. Sedge species such as *Carex aquatilis* and *C. bigelowii*, and cotton grass (*Eriophorum angustifolium*) are the dominant vegetation types. Plant species occupy wet, low-lying sites where standing water is present throughout much of the growing season.
Seepage	Slow water movement in subsurface. Flow of water from man-made retaining structures. A spot or zone, where water oozes from the ground, often forming the source of a small spring.
Till	Till is an unsorted glacial sediment. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. Glacial till is that part of glacial drift, which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel, and boulders.
Total Dissolved Solids	The total concentration of all dissolved compounds solids found in a water sample. See filterable residue.
Total Suspended Solids	The amount of suspended substances in a water sample. Solids, found in wastewater or in a stream, which can be removed by filtration. The origin of suspended matter may be artificial or anthropogenic wastes or natural sources such as silt.
Traditional Land Use	Use of the land by Aboriginal groups for harvesting traditional resources such as wildlife, fish or plants, or for cultural purposes such as ceremonies or camping.
Tundra	A vast, mostly flat, treeless Arctic region of Europe, Asia, and North America in which the subsoil is permanently frozen. The dominant vegetation is low-growing stunted shrubs, mosses, lichen.
Vibrodensification	The practices and traditions of land use and resource harvesting by regional, indigenous, and local communities.
Waste Rock	Rock moved and discarded to access the resources being mined.
Waste Rock Storage Area	Engineered landforms in which waste rock from mining activities is stored.
Waterbody	An area of water such as a river, stream, lake, or sea.
Watercourse	Riverine systems such as creeks, brooks, streams and rivers.