10 KEY LINE OF INQUIRY: LONG-TERM BIOPHYSICAL EFFECTS, CLOSURE, AND RECLAMATION

10.1 SUMMARY OF SECTION 10 BEFORE UPDATES

The Key Line of Inquiry: Long-term Biophysical Effects, Closure and Reclamation includes the long-term effects of the proposed Gahcho Kué Project (Project) on wildlife and the aquatic ecosystems of Kennady Lake and downstream waterbodies. The summary within Section 10.1 is based on information provided in the 2011 EIS Update (De Beers 2011), but is limited to information included in the 2011 EIS Update that provides a background for this supplement. The Closure and Reclamation Plan remains unchanged as a result of the supplemental mitigation with one minor exception that will be addressed in Section 10.2.3 of this supplement. Information on the Closure and Reclamation Plan is available in the 2011 EIS Update (Section 10.4).

Long-Term Effects to Kennady Lake Watershed

After closure, the water balance for the Kennady Lake watershed was predicted to change, resulting in the increase of the mean annual water yield. The expected reduction in the surface area of Kennady Lake was anticipated to result in flood peak discharges that would increase slightly during post-closure due to less storage in the lake.

Concentrations of phosphorus were predicted to increase during post-closure due to seepage from materials located in the mine rock piles, Coarse PK Pile, and the Fine PKC Facility. The Fine PKC Facility was identified as the largest contributing source of phosphorus. Using a combination of strategies, De Beers has been committed to incorporating additional mitigation to achieve a long-term maximum steady state total phosphorus concentration of 0.018 mg/L in Kennady Lake (Section 10.2; De Beers 2011). As a result of the increase in phosphorus levels, a change in lake trophic status from oligotrophic (low productivity) to mesotrophic (moderate productivity) was expected in the refilled Kennady Lake, including Area 8.

An aquatic ecosystem was projected to develop within Kennady Lake after refilling and reconnection of its basins, although the re-established communities might differ from pre-development communities. The increased nutrient levels in the refilled Kennady Lake would result in a more productive plankton community. The benthic invertebrate community was expected to be different from the community that currently exists in Kennady Lake and in surrounding lakes; the community would likely be of higher abundance and biomass, reflecting the more productive nature of the lake, and would likely be dominated by midges and aquatic worms.

A fish community was expected to become re-established in Kennady Lake. The final fish community would likely continue to be characterized by low species richness (less than 10 species), consisting of a small-bodied forage fish community (e.g., lake chub, slimy sculpin, ninespine stickleback) and large-bodied species, such as Arctic grayling, northern pike, burbot, round whitefish, lake trout, and possibly longnose sucker. Total lake standing stock and annual production might increase over what currently exists in the lake as a result of the increased phosphorus concentrations and corresponding increase in lake productivity. It was expected that the fish species present within Kennady Lake would be similar to pre-Project conditions, but the community structure (i.e., relative abundances of the species) might differ. Mesotrophic conditions were likely to be more favourable to northern pike, burbot, and Arctic grayling, than cold-water species, such as lake trout and round whitefish.

An increase in productivity (e.g., growth of phytoplankton and algae) would result in increased organic carbon remaining in the lake after senescence in the fall. An increased under-ice oxygen demand in Kennady Lake was anticipated as a result of the increased productivity. The winter oxygen depletion rate for surface (under ice to 6 m), middle (7 to 12 m) and deeper (>12 m) depth zones in Kennady Lake and a dissolved oxygen balance for Kennady Lake at the end of winter were estimated. The results indicated that the surface zone of the water column was expected to remain oxygenated over the winter, but the mid-depth and bottom depth zones would likely be subject to lower dissolved oxygen levels. The deeper epilimnetic zones of the open Tuzo and Hearne Pits were not expected to be subject to the same winter oxygen demand as other shallower areas of Kennady Lake and were expected to remain well oxygenated. Under open-water conditions, Kennady Lake was expected to remain well mixed and near, or at, saturation with respect to dissolved oxygen (similar to existing conditions).

Of the 23 trace metals that were modelled for the assessment, four metals in Kennady Lake were predicted to be higher than Canadian Council of Ministers of the Environment (CCME) water quality guidelines at post closure: chromium, iron, cadmium, and copper. Concentrations of trace metals in Area 8 of Kennady Lake were predicted to peak when Dyke A is removed and Kennady Lake is reconnected. Cadmium, chromium, and copper were projected to be higher than water quality guidelines after closure in Area 8. However, changes in the chemical constituents of water quality were expected to have low or negligible residual effects to aquatic communities in Kennady Lake in post-closure under the assessed conditions.

Boron was not projected to be higher than CCME water quality guidelines at post-closure; however, the ecological risk assessment indicated that effects to aquatic-dependant birds (i.e., waterfowl and shorebirds) could occur as a result of boron levels in Kennady Lake after refilling. The ecological risk assessment was completed with conservative assumptions, which corresponded to an extreme condition that had a low likelihood of occurring. De Beers has been committed to further study of this potential issue, and would incorporate mitigative strategies into the Project design to the extent required to maintain boron levels in Kennady Lake below those that may be of environmental concern.

Long-term Effects to Downstream Watershed

Watersheds downstream of Kennady Lake were expected to return to near baseline conditions, but would be affected by the post-closure hydrological regime of the Kennady Lake watershed, which included a small increase in mean annual water yield and a slight increase in flood peak discharges. The hydrological effects of these changes to downstream watersheds would be progressively reduced with increased distance downstream from Kennady Lake as more watershed areas contributed to runoff, which would act to attenuate the magnitude of change.

Streams in the L and M watersheds would experience nutrient enrichment, with corresponding changes in lower trophic communities and fish production, reflecting the gradient in nutrient concentrations. Although changes in the resident benthic invertebrate communities were expected, a negative effect was unlikely due to the increased food supply. Although there might be reduced suitability and availability of spawning habitat immediately downstream of Kennady Lake due to increased benthic algal growth on streambed substrates, it was expected that streams downstream would continue to provide Arctic grayling spawning and rearing habitat.

Phosphorus concentrations were projected to increase in the Interlakes downstream of Area 8, but decline with distance as inflows from the L and M watersheds diluted the concentrations. Lakes along the main flow path in the L and M watersheds were predicted to be mesotrophic. Increases in primary productivity might have some implications regarding water column oxygen dynamics. For the lakes with depths greater than 6 m with overwintering habitat for fish (i.e., Lakes M3 and M4), dissolved oxygen concentrations were expected to remain sufficient to support aquatic life. As the small lakes in the Interlakes, upstream of Lake M3, are currently subject to low under-ice dissolved oxygen levels with none or limited baseline overwintering habitat for fish, potential increases in winter oxygen depletion due to nutrient enrichment would not be expected to change the overwintering capability or suitability of these small lakes.

Increased primary and secondary productivity were expected in downstream lakes. An increase in benthic invertebrate abundance and biomass, as well as a shift in benthic invertebrate community composition, was also anticipated to occur. Because of the increased food base, there might also be increased growth and production in large-bodied fish species.

Concentrations of phosphorus were predicted to slightly increase in Lake 410. Increases during operations and several years into closure were associated with pumped discharge from the WMP to Lake N11; increases several years into post-closure would follow the removal of Dyke A and the reconnection of Kennady Lake to the downstream lakes. A slight increase in primary productivity would be expected in Lake 410; however, the trophic status would remain oligotrophic. Effects in Lake 410 were expected to be lower in magnitude, with corresponding smaller changes in productivity, lower trophic communities, and fish production.

Most trace metals in Lake 410 were predicted to return to near-background conditions in the long-term. However, antimony, arsenic, boron, molybdenum, silver, strontium, uranium, and vanadium were predicted to increase and reach long-term steady state concentrations more than double their respective baseline concentrations. As geochemical sources were the primary contributors of these metals, the majority of total concentrations would be in the dissolved form. None of these metals were predicted to be higher than CCME water quality guidelines at any time. Changes to water quality were predicted to have negligible effects on aquatic health in the waterbodies downstream of Kennady Lake under the assessed conditions, and therefore it would be expected that there would be negligible long-term residual effects to aquatic communities.

Long-term Effects to Wildlife and Human Use

Progressive reclamation has been integrated into mine planning; however, not all the upland areas would be reclaimed. The mine rock piles, Coarse PK Pile, and Fine PKC Facility would be permanent features on the landscape. For species with large home ranges (e.g., caribou, grizzly bear, wolverine), the change in habitat was likely not detectable (i.e., less than 0.01% change). For species with smaller home ranges (e.g., nesting songbirds and shorebirds), the changes were likely detectable, but expected to have minor influence on reproduction in the populations. Therefore, the long-term residual effects to the persistence of wildlife populations were predicted to be negligible.

The ecological risk assessment predicted no impacts for caribou, carnivores, moose, and muskoxen health associated with exposure to chemicals from the Project.

Residual Impact Classification

The projected long-term impacts of the Project on the suitability of water to support a viable and self-sustaining aquatic ecosystem were considered to be not environmentally significant for the Kennady Lake watershed, and its downstream watershed. Water quality was predicted to change; however, the potential for modelled substances to cause adverse effects to aquatic life was considered to be low or negligible. After reconnection with Kennady Lake, nutrient concentrations were predicted to be higher than during pre-development conditions in Kennady Lake and downstream, which might shift the trophic status up a level to mesotrophic. The projected increases in phosphorus would not pose a health risk to a viable and self-sustaining aquatic ecosystem, though it would likely be different to the pre-development ecosystem (i.e., a more productive ecosystem).

The projected long-term impacts on the abundance and persistence of Arctic grayling, lake trout, and northern pike were considered to be not environmentally significant for the Kennady Lake watershed, as well as its downstream watershed. It was expected that self-sustaining populations of Arctic grayling, lake trout, and northern pike would become established in the refilled lake. During post-closure, flows and lake levels downstream of Kennady Lake would return to near baseline conditions. Nutrient enrichment after closure might also provide for improved productivity. All three fish species were expected to continue to persist in the watershed downstream of Kennady Lake in the long-term.

10.2 UPDATES TO SECTION 10

10.2.1 Overview of Changes

In the Project Description of the 2010 EIS (De Beers 2010, Section 3.7), fine PK was stored in both Area 1 and Area 2 of the Fine PKC Facility. As a result of the supplemental mitigation, the Fine PKC Facility's footprint has been reduced by omitting Area 1, which included Lakes A1 and A2. This reduction in size allowed for a reduction in the long-term phosphorus loadings from the facility. To identify this supplemental mitigation, the term "Fine PKC Facility (mitigated)" is used.

With the footprint of the facility reduced to Area 2, the fine PK that was to be stored in Area 1 has been relocated to the 5034 and Hearne pits. As a result of the supplemental mitigation of the Fine PKC Facility (mitigated), the size of the Project footprint has decreased by about 83 ha compared to the footprint associated with the Project Description in the 2010 EIS.

In the 2010 EIS (De Beers 2010), reclamation of the Fine PKC Facility involved progressively covering both Area 1 and Area 2 with coarse PK and mine rock. As part of the supplemental mitigation, the coarse PK and mine rock that was to be used in reclamation of Area 1 will be transferred to the West Mine Rock Pile; this will result in an increase in the height of the West Mine Rock Pile. Within the 2010 EIS, the height of the West Mine Rock Pile was estimated at 70 m; given the supplemental mitigation, the height of this pile is now estimated at 94 m. Hereafter, the pile will be referred to as “West Mine Rock Pile (mitigated)”.

Supplemental mitigation of the Fine PKC Facility is a minor but necessary change intended to reduce the phosphorus release associated with long-term storage of PK. This mitigation will result in a reduction in the Fine PKC Facility’s footprint and minor changes to mine waste and water management.

The purpose of Section 10.2 is to assess the long-term biophysical effects of the supplemental mitigation on aquatic and terrestrial valued components. Table 10.2-1 identifies the subsections from Section 10 of the 2011 EIS Update (De Beers 2011) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to the 2011 EIS Update. If the text in the subsection required updates, the changes are provided in the text that follows.

Table 10.2-1 Updated and Unchanged Subsections from Section 10

Section 10 from the 2011 EIS Update	Updated in 2012	Reason for Update
10.1 Introduction	no	-
10.2 Summary	no	updates are included in the subsections indicated by “yes”
10.3 Existing Environment	no	-
10.4 Closure and Reclamation	yes	reduction in Project footprint
10.5 Effect of Project Activities on the Long-term Recovery of Kennady Lake	yes	reduction in long-term phosphorus concentrations in the refilled Kennady Lake
10.6 Long-Term Effects to Downstream Aquatic Ecosystems	yes	reduction in long-term phosphorus concentrations in the downstream watershed
10.7 Long-Term Effects to Wildlife and Human Use	yes	change in project footprint
10.8 Residual Impact Classification	yes	updates for reasons described above; now included as Section 10.2.6 Conclusions
10.9 Uncertainty	yes	updates to water quality modelling and geochemical testing
10.1 Monitoring and Follow-up	no	-

Notes: Subsection is unchanged and available in the July 2011 EIS Update (De Beers 2011).

10.2.2 Closure and Reclamation

10.2.2.1 Conceptual Closure and Reclamation Plan

The supplemental mitigation results in the following minor changes to this section:

- Progressively reclaim parts of the Area 1 and Area 2 portions of the Fine PKC Facility are now changed to progressively reclaim Area 2 of the Fine PKC Facility (mitigated).
- References to the West Mine Rock Pile are now replaced by West Mine Rock Pile (mitigated).
- In Table 10.14-1, begin progressive reclamation of Fine PKC Facility (Area 1 and 2) is now changed to begin progressive reclamation of Fine PKC Facility (mitigated).
- In Section 10.4.1.3, the amount of mine rock that will be placed in two designated mine rock piles during operations is changed from 143 million tonnes (Mt) to 146 Mt.
- In Section 10.4.1.3, the height of the West Mine Rock Pile is changed from 70 m to 94 m, and the final crest elevation is changed from 474 to 498 masl.
- In Section 10.4.1.4, the description of the reclamation of Area 1 of the Fine PKC Facility in the first paragraph is now omitted.

10.2.2.2 Long-term Viability of the Plan

The discussion of the long-term viability of the Plan in the 2011 EIS Update (Section 10.4.2; De Beers 2011) remains unchanged except for the first paragraph in Section 10.4.2.2, Fine Processed Kimberlite Facility, which describes the facility before mitigation and is now omitted. Details on the closure of the mitigated facility are available in the following paragraph taken from Section 3.12.4 of this 2012 EIS Supplement.

Reclamation of the Fine PKC Facility (mitigated) will be completed during mine operations. As the Fine PKC Facility (mitigated) in Area 2 becomes filled during the initial years of operations, it will possess a cover layer that will be comprised of non-AG mine rock, and coarse PK depending on material availability. The facility will be graded so that any surface runoff will flow towards Area 3.

10.2.2.3 Consideration of Public feedback and Traditional Knowledge in Developing the Plan

The section *Consideration of Public Feedback and Traditional Knowledge in Developing the Plan* in the 2011 EIS Update (Section 10.4.3; De Beers 2011) remains unchanged except for the first paragraph in Section 10.4.3.3.4, Reclaim Processed Kimberlite Facilities Not Attractive to Caribou, which describes the facility before mitigation and, except for the last sentence, is now omitted. Details on the closure of the mitigated facility are available in the paragraph above (Section 10.2.2.2).

10.2.3 Effect of Project Activities on the Long-term Recovery of Kennady Lake

Long-term Effects to Hydrology

The long-term effects to the hydrology of Kennady Lake are provided in Section 8.2.4.4. The area of the Project footprint will be reduced and the water management updated compared to that presented in the 2011 EIS Update (De Beers 2011). After closure, the pipeline to Lake J1b will be removed and surface runoff from the A watershed will be redirected to Kennady Lake. The permanent diversion of Lake A3 to the N watershed will no longer occur. Conclusions on long-term potential effects remain similar to those presented in the 2011 EIS Update, as indicated in Table 10.2-2.

Table 10.2-2 Updates to Concluding Statements of Residual Effects, 2011 EIS Update (De Beers 2011)

2011 EIS Update	2012 EIS Supplement	Reason for Change
....the mean annual water yield will increase by 5.1% at post-closure, from approximately 147 mm to 160 mm. Mean annual discharge from Kennady Lake will increase by only 6.1%, from 4,760 cubic decametres (dam^3) to 5,050 dam^3. Due to the post-closure decrease in water surface area in Kennady Lake by 11.8%, the runoff of a given quantity of water into the lake will result in a proportionally greater increase in lake water level.	....the mean annual water yield will increase by 5.1% at post-closure, from approximately 147 mm to 154 mm. Mean annual discharge from Kennady Lake will increase from 4,760 cubic decametres (dam^3) to 5,000 dam^3. Due to the post-closure decrease in water surface area in Kennady Lake by 12.4%, the runoff of a given quantity of water into the lake will result in a proportionally greater increase in lake water level.	Change in mine footprint. Change in diversion of the A watershed.

Long-Term Effects to Water Quality

The long-term effects to the water quality of Kennady Lake are described in Section 8.2.5.1 under the *Effects to Water Quality in Kennady Lake at Post-closure* subsection. Post-closure concentrations of each of the water quality parameters in Kennady Lake and Area 8 are presented in Table 8.2-12 and Table 8.2-13, respectively. A summary is provided below. The time series plots are provided in Appendix 8.IV.

As a result of the smaller Fine PKC Facility (mitigated) and updated geochemistry testing, the long-term steady state total dissolved solids (TDS) concentration in Kennady Lake is projected to be 37 mg/L TDS, compared to 83 mg/L as presented in the 2011 EIS Update (De Beers 2011). Maximum concentrations and long-term steady state concentrations for the major ions, sodium, potassium, calcium, magnesium, chloride, and sulphate are all lower than projected in the 2011 EIS Update (De Beers 2011). The long-term steady state concentration of fluoride is just above the CCME guideline (0.12 mg/L); the long-term trend is a result of fluoride being sourced primarily from fine PK than other sources (e.g., groundwater).

Following closure, projected nitrate and ammonia concentrations decrease to steady state concentrations that are below CCME water quality guidelines and near background levels.

As a consequence of the smaller Fine PKC Facility, and updated geochemistry testing that identified that phosphorus concentrations in leachate is not as high as reported in the 2011 EIS Update (De Beers 2011), modelled phosphorus concentrations in Kennady Lake during operations and closure phases are lower than presented in the 2011 EIS Update. Concentrations of phosphorus in Kennady Lake continue to decrease during the post-closure phase to a long-term steady state concentration of 0.009 mg/L. As a consequence, the trophic status of Kennady Lake is projected to return to oligotrophic status (CCME 2004; Environment Canada 2004).

As a result of the smaller footprint of the Fine PKC Facility (mitigated) and updated geochemistry testing, the long-term steady state concentrations of 17 of the 23 metals assessed are projected to be lower than presented in the 2011 EIS Update (De Beers 2011). However, long-term steady state concentrations of cadmium, cobalt, lead, manganese, uranium, and zinc are predicted to increase slightly from the previous results presented in 2011 EIS Update.

Water quality trends in Area 8 as a result of the updated modelling are consistent with the assessment in the 2011 EIS Update (De Beers 2011); additional details are provided in Section 8.2.5.1.

The hydrodynamic modelling was updated for Tuzo Pit. In addition, a hydrodynamic model was also developed for the Hearne Pit as part of the current assessment. The modelling indicates that persistent stable meromictic conditions would be expected to occur and that the stability will strengthen over time. More details are available in Section 8.2.5.2.

Long-Term Effects to Aquatic Health

The long-term effects to aquatic health in Kennady Lake are provided in Section 8.2.6. A summary is provided below. Similar to the 2011 aquatic health assessment, changes to water quality are predicted to have negligible residual effects to aquatic communities in the Kennady Lake in post-closure under the assessed conditions.

Maximum concentrations of substances of potential concern (SOPCs) in water are predicted to be lower than the 2011 EIS Update (De Beers 2011) predictions in Kennady Lake and Area 8 during closure and post-closure, with the exception of copper in Kennady Lake. However, the potential for adverse effects to aquatic organisms in Kennady Lake from copper is considered to be low, and residual effects to aquatic communities are still expected to be negligible. Follow-up monitoring will be undertaken to assess this evaluation.

Predicted fish tissue concentrations generally decreased compared to the 2011 EIS Update (De Beers 2011) predictions in Kennady Lake and Area 8, except for aluminum, nickel, and silver. However, based on a review of the toxicological benchmarks, the concentrations predicted, and the potential for bioaccumulation, the potential for adverse effects to aquatic health in Kennady Lake and Area 8 from aluminum, nickel, and silver was considered to be low, and residual effects to aquatic communities were considered to be negligible.

Predicted tissue concentrations for all other substances of interest (SOIs) considered in the assessment were below toxicological benchmarks, and thus predicted increases in the concentrations of the SOIs are expected, as was the case previously, to have negligible effects on fish tissue quality in Kennady Lake and Area 8 under the assessed conditions.

Long-term Effects to Fish and Fish Habitat

The long-term effects to fish and fish habitat in Kennady Lake are described in Section 8.2.7.2. A summary is provided below. As the post-closure trophic status of Kennady Lake is predicted to remain oligotrophic, the effects to lower trophic levels, and fish and fish habitat, will be lower than those predicted in the 2011 EIS Update (De Beers 2011).

Nutrient concentrations in Kennady Lake will increase within the oligotrophic range, with corresponding changes in productivity and lower trophic communities. Increased productivity is expected at all lower trophic levels, reflected in increases in biomass of phytoplankton, zooplankton, and benthic invertebrates. As a result of the increases in the food base for fish, there may also be increased growth and production in the fish species of Kennady Lake.

In the 2011 EIS Update (De Beers 2011), Kennady Lake was predicted to change in trophic status to mesotrophic; habitat conditions potentially were considered to be more suitable for top predatory species like northern pike and burbot, rather than lake trout. However, based on the revised phosphorus levels, the lake will return to oligotrophic conditions and potential limitations on spawning and overwintering habitat are expected to be less than presented in the 2011 EIS Update. Habitat conditions in the refilled lake will be suitable for all species currently within the lake to return and re-establish.

Recovery of Kennady Lake

The recovery of Kennady Lake is described in Section 8.2.8.

10.2.4 Long-term Effects to Downstream Aquatic Ecosystems

Long-Term Effects to Hydrology

The long-term effects to the hydrology downstream of Kennady Lake are provided in Section 9.2.4.4 under the *Effects of the Project to Long-Term Hydrology Downstream of Area 8* pathway and are summarized in Table10.2-3.

Table 10.2-3 Updated Effects to Long-term Hydrology Downstream of Area 8

2011 EIS Update	2012 EIS Supplement	Reason for Change
Expected changes are minor and include a 3.8% increase in mean annual water yield and a slight increase in flood peak discharges. Because the changes are so small, effects to watersheds downstream of Kennady Lake will be proportionately small at Lake L1 and diminish with distance downstream.	Expected changes are minor and include a 5.1% increase in mean annual water yield and a slight increase in flood peak discharges. Because the changes are so small, effects to watersheds downstream of Kennady Lake will be proportionately small at Lake L1 and diminish with distance downstream.	Change in project footprint.
The post-closure regimes of the N2 and upstream watersheds will be as discussed in Section 9.7.4.2 with negligible changes due to the permanent diversion of Lake A3 into Lake N9. Changes to the post-closure regime of the N1 watershed will similarly be negligible.	The post-closure hydrological regimes of the N1 and upstream watersheds will be identical to the baseline regimes.	Change in diversion of the A watershed.

Long-term Effects to Water Quality

The long-term effects to the water quality downstream of Kennady Lake are described in Section 9.2.5.1. Post-closure concentrations of each of the water quality parameters are presented in Table 9.2-17 for Lake N11 and Table 9.2-18 for Lake 410. A summary is provided below. The time series plots are provided in Appendix 9.II.

The long-term steady state concentrations of TDS and major ions are similar to those presented in the 2011 EIS Update (De Beers 2011). Fluoride concentrations are projected to increase following the reconnection of Kennady Lake, with a steady state expected to become established within ten years of the reconnection of Kennady Lake with downstream waters. Projected steady state concentrations of nitrate, ammonia, and total nitrogen are similar to those values presented in 2011 EIS Update. The projected concentrations are expected to remain below CCME guidelines for nitrate and ammonia.

Following the cessation of operational discharge from the WMP, phosphorus concentrations in Lake N11 are projected to return to concentrations consistent with background concentrations. The long-term steady state phosphorus concentration (0.005 mg/L) is the same as that presented in the 2011 EIS Update (De Beers 2011). The trophic status of Lake N11 would remain oligotrophic (CCME 2004; Environment Canada 2004) during operations and closure, with long-term steady state concentrations expected to return to background levels within five years of the cessation of discharge.

The projected long-term steady state concentrations the trace metals are very similar to the values presented in the 2011 EIS Update (De Beers 2011). Of 23 metals assessed, only cadmium is projected to be higher than the CCME guideline; however, observed baseline cadmium concentrations have been measured above CCME water quality guidelines.

In Lake 410, long-term steady state concentrations of TDS and major ions are similar to those presented in the 2011 EIS Update (De Beers 2011). The long-term steady state concentrations of fluoride are below CCME guidelines.

Long-term concentrations of nitrate and ammonia are projected to be similar to those presented in the 2011 EIS Update (De Beers 2011). Concentrations are projected to remain below CCME guidelines for both nitrate and ammonia.

The long-term steady state concentration of total phosphorus in Lake 410 is projected to be similar to those presented in the 2011 EIS Update (De Beers 2011), with Lake 410 anticipated to remain oligotrophic (CCME 2004; Environment Canada 2004).

The long-term steady state metals concentrations are projected to be slightly lower than those presented in the 2011 EIS Update (De Beers 2011) (with the exceptions of the maximum projected concentrations of barium, cobalt, nickel and silver, which are only slightly higher).

Long-term Effects to Aquatic Health

The long-term effects to aquatic health are provided in Section 9.2.6. A summary is provided below. Similar to the 2011 EIS Update (De Beers 2011), changes to water quality are predicted to have negligible effects on aquatic health in Lake N11 and Lake 410 under the assessed conditions.

Maximum concentrations of SOPCs in water are predicted to be lower than the 2011 EIS Update (De Beers 2011) predictions in Lake N11 and Lake 410, with the exception of TDS and constituent ions in Lake N11. However, the new predicted maximum TDS concentrations remain below concentrations associated with potential adverse effects to freshwater aquatic life. Thus, the prediction that increases in SOPC concentrations will have negligible residual effects to aquatic communities has not changed.

Similarly, predicted fish tissue concentrations have decreased compared to the 2011 EIS Update (De Beers 2011) predictions in Lake N11 and Lake 410 and remain below the toxicological benchmarks for all SOIs considered in the assessment. As a result, the predicted increases in the concentrations of the

SOIs compared to background concentrations are still expected to have negligible effects on fish tissue quality in Lake N11 and Lake 410 under the assessed conditions.

Long-term Effects to Fish and Fish Habitat

The long-term effects to fish and fish habitat have not changed from Section 10.6 of the 2011 EIS Update (De Beers 2011). However, as described in Section 9.2.7.2 of this report, the post-closure trophic status of the L and M watersheds is predicted to remain oligotrophic; as a result, the effects to lower trophic levels, and fish and fish habitat, will be lower than those predicted in the 2011 EIS Update.

Nutrient concentrations in downstream lakes and streams will increase within the oligotrophic range, with corresponding small changes in productivity and composition of lower trophic communities. Increased productivity is expected at all lower trophic levels, likely reflected in increases in biomass of phytoplankton, zooplankton, and benthic invertebrates. As a result of the increases in the food base for fish, there may also be increased growth and production in the fish species downstream of Kennady Lake.

In the downstream lakes, there may be a small reduction in under-ice dissolved oxygen levels compared to baseline conditions. However, it is expected that suitable overwintering habitat would continue be available for species remaining in these lakes through the winter; any changes to overwintering habitat would not be expected to affect fish populations or fish community structure in these lakes.

Due to the reduction in nutrient levels compared to the 2011 EIS Update (De Beers 2011), changes to Arctic grayling spawning habitat would be less than presented in the 2011 EIS Update. Although the streams would likely be more productive compared to existing conditions, any changes to Arctic grayling spawning habitat would be expected to be negligible.

10.2.5 Long-term Effects to Wildlife and Human Use

In Section 10.7.2.1.2 of the 2011 EIS Update (De Beers 2011), it is indicated that there will be a permanent diversion from Lake A3 to Lake N9 with the surface water elevation in Lake A3 remain above baseline conditions. This diversion is no longer planned, as the A watershed will be reconnected to Area 3 of Kennady Lake at closure. The post-closure decrease in water surface area in Kennady Lake is now predicted to be 12.4%, compared to 11.8% in the 2011 EIS Update. As this change is small, the conclusions of the section remain unchanged. The discussion relating to the change in open-water areas for water birds is provided in Section 8.2.9. All other aspects of the pathway remain unchanged.

10.2.6 Conclusions

To mitigate phosphorus loadings to Kennady Lake, De Beers updated the mine plan to reduce the footprint of the Fine PKC Facility (mitigated) by approximately one half and use the 5034 and Hearne pits for the deposit of additional fine PK. As a result of the change in footprint and redesign of the A watershed diversion, the water balance and water quality model for the Project were updated.

An evaluation of the water quality for this supplemental mitigation, incorporating the most recent results from ongoing and supplemental geochemical testing, indicates that total phosphorus concentrations for Kennady Lake and the downstream watershed for the long term will be less than presented in the 2011 EIS Update (De Beers 2011). Similar to the 2011 aquatic health assessment, changes to water quality are predicted to result in negligible residual effects to aquatic communities in the Kennady Lake and downstream waterbodies in post-closure under the assessed conditions.

The classification of projected long-term impacts is provided in Table 10.2-4. More details regarding the classification can be found in Section 8.2.12 for the Kennady Lake watershed, and Section 9.2.8 for the downstream watershed, under the second time period (i.e., >100 years).

There are no changes to the evaluation of environmental significance. Similar to the 2011 EIS Update (De Beers), the projected impacts on the suitability of water downstream of Kennady Lake to support a viable and self-sustaining aquatic ecosystem, and on the abundance and persistence of Arctic grayling, lake trout, and northern pike are considered to be not environmentally significant for both the Kennady Lake watershed as well as its downstream watershed.

Table 10.2-4 Residual Impact Classification of Projected Long-Term Effects

Assessment Endpoint	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood
Suitability of water downstream of Kennady Lake to support a viable and self-sustaining aquatic ecosystem							
Kennady Lake watershed	negative	negligible	-	-	-	-	-
Downstream Systems	negative	negligible	-	-	-	-	-
Abundance and persistence of Arctic grayling within the Kennady Lake watershed							
Kennady Lake watershed	neutral - positive	negligible	-	-	-	-	-
Downstream Systems	neutral - positive	negligible	-	-	-	-	-
Abundance and persistence of lake trout within the Kennady Lake watershed							
Kennady Lake watershed	negative	negligible	-	-	-	-	-
Downstream Systems	neutral - positive	negligible	-	-	-	-	-
Abundance and persistence of northern pike within the Kennady Lake watershed							
Kennady Lake watershed	neutral - positive	negligible	-	-	-	-	-
Downstream Systems	neutral - positive	negligible	-	-	-	-	-

"-" = not applicable.

10.2.7 Uncertainty

See Section 8.2.10 for a description of the updates to the uncertainty regarding the water quality modelling and geochemical testing.

11 BIOPHYSICAL SUBJECTS OF NOTE

11.1 OVERVIEW

The organization of the 2010 environmental impact statement (EIS; De Beers 2010) for the Gahcho Kué Project (Project) evolved from the issue scoping process conducted by the Mackenzie Valley Environmental Impact Review Board (MVEIRB). The issues were organized into three categories (MVEIRB 2006):

- **Key lines of inquiry** are topics of greatest concern that require the most rigorous analysis and detail in the EIS.
- **Subjects of note** have less priority than key lines of inquiry, but require serious consideration and a substantive analysis.
- **Remaining issues** require a sufficient analysis to demonstrate whether the issues are likely to be the cause of significant impacts. All issues are important and no issue can be excluded.

The Gahcho Kué Panel (2007) clearly identified a hierarchy of effort in preparing the EIS. Subjects of note do not have the same priority as key lines of inquiry, but are nonetheless issues that require serious consideration and a substantive analysis. The 2010 EIS (De Beers 2010) contains 18 subjects of note, of which 12 are biophysical (Gahcho Kué Panel 2007). Section 11 of the EIS contains the biophysical subjects of note, while socio-economic subjects of note are discussed in Section 12.

The subsection headings in Section 11 of the 2010 EIS (De Beers 2010) are based on the biophysical subjects of note (Table 11.1-1). Therefore, they differ from the headings usually found in environmental assessments, where headings are related to the components of the environment that are assessed (e.g., aquatic environment organized as hydrogeology, hydrology, water quality, and fish). In the 2010 EIS, two subjects of note (e.g., Vegetation and Air Quality) represent environmental components; however, other subjects of note are related to the Project description (e.g., Mine Rock and Processed Kimberlite Storage), interactions with the Project (e.g., Waste Management and Wildlife), locations (e.g., Impacts on Great Slave Lake), and species (Other Ungulates).

Table 11.1-1 Revised Biophysical Subjects of Note

Biophysical Subjects of Note in Section 11 of the 2010 EIS		Revised in 2012
Section 11.2	Impacts on Great Slave Lake	No
Section 11.3	Alternative Energy Sources	No
Section 11.4	Air Quality	No
Section 11.5	Mine Rock and Processed Kimberlite Storage	Yes
Section 11.6	Permafrost, Groundwater, and Hydrogeology	Yes
Section 11.7	Vegetation	Yes
Section 11.8	Traffic and Road Issues	No
Section 11.9	Waste Management and Wildlife	No
Section 11.10	Carnivore Mortality	Yes
Section 11.11	Other Ungulates	Yes
Section 11.12	Species at Risk and Birds	Yes
Section 11.13	Climate Change Impacts	No

Notes: EIS = Environmental Impact Statement.

Although each subject of note is independent and separate, the order of the biophysical subjects of note within Section 11 of the 2010 EIS (De Beers 2010) was based, to the extent possible, on the bottom-up structure in natural systems (i.e., physical and chemical components → plants → animals), and an attempt to limit the amount of cross-referencing as recommended by the Gahcho Kué Panel (2007). The order of subjects of note in Section 11 is shown in Table 11.1-1.

The purpose of the 2012 EIS Supplement is primarily:

- to describe the supplemental mitigation of the Fine PKC Facility; and
- to assess the effects of the supplemental mitigation on the aquatic and terrestrial environments and any other components potentially affected by these changes.

The supplemental mitigation of the Fine PKC Facility involves several minor changes in the Project design.

- The Fine PKC Facility's footprint was reduced by omitting Area 1, which included Lakes A1 and A2 in the 2010 EIS (De Beers 2010). This reduction in size allowed for a reduction in the long-term phosphorus loadings from the facility (i.e., Fine PKC Facility [mitigated]).
- In the 2010 EIS (De Beers 2010), the Fine PKC Facility involved storage of fine PK in both Area 1 and Area 2, and reclamation involved progressively covering the facility with a cover layer of mine rock, and coarse PK depending on material availability. With the reduced footprint

of the facility, the fine PK that was to be stored in Area 1 was relocated to the 5034 and Hearne pits. The coarse PK and mine rock that was to be used in reclamation of Area 1 was transferred to the West Mine Rock Pile.

- The maximum height of the West Mine Rock Pile was 70 m (De Beers 2010); the estimated height will increase to a maximum of 94 m in the West Mine Rock Pile (mitigated).
- The reduction in the size of the Fine PKC Facility also involves a change in the diversion of water. In the 2010 EIS (De Beers 2010), a permanent saddle dam (Dyke C) was to be constructed between Area 1 and Lake A3 to the north, which would raise the level of Lake A3 to a point where water from the Lake A3 outlet would be diverted to the northeast into the N watershed. Instead of constructing Dyke C, a saddle dam (Dyke A1) will now be constructed to prevent water from flowing from Area 1 to Area 2. Surface runoff flowing into the A watershed will be managed by constructing a discharging pipeline from Area 1 into Lake J1b allowing water to flow to Area 8 of Kennady Lake.

The supplemental mitigation introduced in 2012 has resulted in the update of six of the 12 biophysical subjects of note (Table 11.1-1); these subjects of note will be discussed in more detail within this section of the 2012 EIS Supplement. The supplemental mitigation is not expected to affect Sections 11.2, 11.3, 11.4, 11.8, 11.9, and 11.13 (Table 11.1-1). A brief explanation of why these subjects of note are not expected to change is provided under each of these subsections.

11.2 IMPACTS ON GREAT SLAVE LAKE

The Project site is located in the watershed of Kennady Lake, a small headwater lake within the Lockhart River system. Waters from Kennady Lake eventually discharge to Kirk Lake and then into Aylmer Lake, which is located on the main stem of the Lockhart River about midway along its length. The Lockhart River system drains into the north-eastern arm of Great Slave Lake.

The Hoarfrost watershed is located to the east of the Project site, with the Hoarfrost River draining into the north-eastern arm of Great Slave Lake, west of the Lockhart River system. The Project is located outside of the Hoarfrost watershed.

Potential pathways identified in the EIS (De Beers 2010) by which the Project could affect Great Slave Lake included the deposition of air emissions and alterations to in-stream water flow and water quality. Each pathway was assessed and found to have no linkage for the following reasons:

- The deposition of air emissions is expected to have a negligible effect on water and sediment quality in regional waterbodies located more than two kilometres away from the Project site, as is the case for the Hoarfrost River watershed, the Lockhart River, and Great Slave Lake.
- The Project is located entirely within the Lockhart River watershed; therefore, Project water releases and potential changes in surface water flow and/or quality within and downstream of Kennady Lake will have no effect on surface water flows, water levels, or water quality in the Hoarfrost River watershed.
- Changes to surface water flows immediately downstream of Kennady Lake would not have a measurable effect on flows in the Lockhart River, because
  - the Project is being designed to minimize the disruption of downstream flows; and
  - the watershed area for the Lockhart River upstream of Aylmer Lake (i.e., where outflow from Kennady Lake joins with the Lockhart River) is approximately 400 times larger than the Kennady Lake watershed.

Potential changes to water quality in waterbodies located immediately downstream of Kennady Lake are expected to have a negligible effect on aquatic health. Because the Kennady Lake watershed contributes such a small proportion of the total flow to the Lockhart River where it joins at Aylmer Lake, no effects to water quality or aquatic health would be expected in the Lockhart River or in Great Slave Lake.

In the 2010 EIS (De Beers 2010), it was determined that because Project effects would not be measurable in the Lockhart and Hoarfrost rivers, or in Great Slave Lake, the Project would not have a measurable contribution to cumulative effects. Effects that are so small that they cannot be measured will not be environmentally significant.

The supplemental mitigation of the Fine PKC Facility (mitigated) involves a reduction in the facility’s size to lower phosphorus loadings from the facility, which is anticipated to result in reduced Project effects from those determined in the 2010 EIS (De Beers 2010). Therefore, the determination in the EIS of “no linkage” is unchanged in regard to the pathways from Project effects to the Hoarfrost and Lockhart rivers, and Great Slave Lake. Further details on the assessment of impacts to Great Slave Lake are available in Section 11.2 of the 2010 EIS.

11.3 ALTERNATIVE ENERGY SOURCES

The Project's critical power requirements include steady, non-fluctuating, and reliable power, at a competitive cost, without large environmental or social impacts. At present, diesel-powered electric generators are the only technically and economically feasible alternative for meeting these needs. It is not feasible to implement either wind or solar power as a primary power source, due to their low reliability under the conditions that the Project must operate. It is not yet feasible to rely on hydroelectric power, as the power source and grid have not been approved for development.

Potential sources of energy conservation, which would lower emissions and operating costs associated with combustion of diesel fuel, were investigated, and several opportunities were identified and will be implemented in the Project design. De Beers is committed to continuously evaluate ways to improve energy efficiency that are both technically and economically feasible.

Since the supplemental mitigation introduced in 2012 does not change the Project's critical power requirements, it does not alter the 2010 assessment of alternative energy sources. Further details on the subject of note for alternative energy sources are available in Section 11.3 of the 2010 EIS (De Beers 2010).

11.4 AIR QUALITY

Section 11.4 of the 2010 EIS (De Beers 2010) included the specific effects of changes to air quality within the airshed potentially associated with the Project. This subject of note also included an assessment of cumulative effects resulting from the Project in combination with the Snap Lake Mine. The maximum 24-hour and annual total suspended particulate (TSP) concentrations exceeded guidelines. The high concentrations were due primarily to fugitive road dust emissions from haul roads along the development area boundary. The TSP fugitive emission estimates in the 2010 EIS were expected to be a conservative representation of air quality changes. There was a high degree of confidence that actual concentrations would be less than the modelled results.

A follow-up assessment, which began in 2011 and is continuing in 2012, is designed to refine estimates of road dust emissions by using more precise and relevant emissions data based on measured particulate emissions under winter conditions at operating mines. Current information indicates that the predicted particulate emissions will be substantially lower in winter. These refinements to the air quality modelling are currently underway and are not available at the time of submission of this 2012 EIS Supplement.

The supplemental mitigation of the Fine PKC Facility involves a reduction in the facility's footprint, and potentially less surface area for dust emission. The effect of the supplemental mitigation is expected, however, to be negligible compared to the reduction in particulate emissions determined by the ongoing modelling.

11.5 MINE ROCK AND PROCESSED KIMBERLITE STORAGE

11.5.1 Summary of Section 11.5 Before Updates

For the purposes of the 2010 EIS (De Beers 2010) and this 2012 EIS Supplement, waste rock is referred to as mine rock. Mine rock is the rock around, and interspersed within, the kimberlite ore bodies. It includes the excavated bed rock surrounding the kimberlite deposits and generally consists of granite. Processed kimberlite (PK) is the material that remains after all economically and technically recoverable diamonds have been removed from the kimberlite during processing. The PK from the processing plant is divided into two streams based on particle size: fine PK (generally comprising 25% by weight), and coarse PK (generally 75% by weight, including PK grits).

The EIS Terms of Reference (Gahcho Kué Panel 2007) for the Subject of Note: Mine Rock and Processed Kimberlite Storage included the following environmental effects analysis requirements:

- evaluation of how the materials placed in the backfilled mine pits may interact with surface water and groundwater, including talik and permafrost areas;
- evaluation of the long-term maintenance and physical stability of the mine rock piles, Coarse PK Pile, and the Fine PKC Facility; and
- examination of how the height of the mine rock piles, Coarse PK Pile, and the Fine PKC Facility may affect caribou behaviour.

The primary analysis of interactions between the backfilled mine rock and PK and the surrounding permafrost and groundwater was provided in the Subject of Note: Permafrost, Groundwater, and Hydrogeology of the 2010 EIS (Section 11.6; De Beers 2010). The primary analysis of interactions between the backfilled mine rock and PK and the overlying surface water was completed in

Key Line of Inquiry: Water Quality and Fish in Kennady Lake (Section 8; De Beers 2010, De Beers 2011). The long-term maintenance and stability of the mine rock piles, Coarse PK Pile and the Fine PKC Facility was outlined in the Project Description (Section 3.7; De Beers 2010) and Key Line of Inquiry: Long Term Biophysical Effects, Closure and Reclamation (Section 10; De Beers 2010). Similarly, the Key Line of Inquiry: Caribou (Section 7; De Beers 2010) provided the primary analysis of potential effects of the Project on caribou. A summary of the relevant information from these various sections was provided in Section 11.5 (De Beers 2010). This section of the 2012 EIS Supplement reviews Section 11.5 of the 2010 EIS (De Beers 2010) to identify any changes due to the supplemental mitigation.

11.5.2 Updates to Section 11.5

11.5.2.1 Overview of Updates

In the 2010 EIS (Section 3.7; De Beers 2010), the Fine PKC Facility stored fine PK in both Area 1 and Area 2. The Fine PKC Facility's footprint has been reduced by omitting Area 1, which included Lakes A1 and A2. This reduction in size allowed for a reduction in the long-term phosphorus loadings from the facility. To identify this supplemental mitigation, the term "Fine PKC Facility (mitigated)" is used. With the footprint of the facility reduced to Area 2, the fine PK that was to be stored in Area 1 has been relocated to the 5034 and Hearne pits. As a result of the supplemental mitigation of the Fine PKC Facility (mitigated), the size of the Project footprint has decreased by about 83 ha compared to the footprint associated with the Project Description in the 2010 EIS.

In the 2010 EIS (De Beers 2010), reclamation of the Fine PKC Facility involved progressively covering both Area 1 and Area 2 with coarse PK and mine rock. As part of the supplemental mitigation, the coarse PK and mine rock that was to be used in reclamation of Area 1 will be transferred to the West Mine Rock Pile; this will result in an increase in the height of the West Mine Rock Pile to 510 masl (94 m max height). Hereafter, the pile will be referred to as "West Mine Rock Pile (mitigated)".

Where appropriate, the potential effects of the supplemental mitigation on analyses relating to mine rock and PK storage are described within each applicable section of this supplement (i.e., Sections 3, 7, 8, 10, and 11.6). A summary of the relevant updated information from these sections is provided below.

Table 11.5-1 identifies the subsections from Section 11.5 of the 2010 EIS (De Beers 2010) and specifies whether they are unchanged or updated within this

2012 EIS Supplement. If the text in these subsections is unchanged, the reader is directed to the 2010 EIS. If the text required updates, the changes are provided in the text that follows.

Table 11.5-1 Updated and Unchanged Subsections from Section 11.5

Section 11.5 from the 2010 EIS	Updated in 2012	Reason for Update
11.5.1 Introduction	no	-
11.5.2 Mine Rock and Processed Kimberlite Storage	yes	reduction in footprint of Fine PKC Facility (mitigated); shift of fine PK to the 5034 and Hearne pits; increased height of West Mine Rock Pile (mitigated)
11.5.3 Pathway Analysis	no	-
11.5.4 Effects Analysis	yes	reduction in footprint of Fine PKC Facility (mitigated); shift of fine PK to the 5034 and Hearne pits; increased height of West Mine Rock Pile (mitigated)
11.5.5 Uncertainty, Monitoring and Follow-up	no	-

Notes: - = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010)

EIS = Environmental Impact Statement; PKC = processed kimberlite containment; PK = processed kimberlite

11.5.2.2 Mine Rock and Processed Kimberlite Storage

The following text represents the updates to the mine rock and PK storage plans originally summarized in Section 11.5.2 of the 2010 EIS (De Beers 2010). This section of the 2012 EIS Supplement focuses on the important changes to Section 11.5.2. The reader is referred to Section 3 Project Description of this 2012 EIS Supplement for a word-by-word update of the changes to mine rock and processed kimberlite.

Small updates are interspersed throughout Sections 11.5.2.1, Design Considerations, and 11.5.2.2, Mine Rock Considerations, as identified in the following bullets:

- In Section 11.5.2.2.1, the Fine PKC Facility is now referred to as the Fine PKC Facility (mitigated) to indicate that the design of this facility has changed.
- In Section 11.5.2.2.2, of the 226 million tonnes (Mt) of mine rock produced to the end of operations, the amount directed to the designed mine rock piles has changed from 143 Mt to 146 Mt.

Because these are the only changes from the 2010 EIS (De Beers 2010), these sections are not shown in full in the text below, which begins with Processed Kimberlite Considerations (originally Section 11.5.2.2.3 in the 2010 EIS).

11.5.2.2.1 Processed Kimberlite Considerations

The processing operations are expected to generate about 31.3 Mt of PK. The PK will be generated in three streams: fine, coarse, and grits. Fine PK is expected to comprise only 25 wt% of the PK waste streams. The PK grits will be dewatered and combined with the coarse PK for a combined weight fraction of 75%.

The fine PK will initially be deposited in Area 2 in the Fine PKC Facility (mitigated) as a slurry with a solids content of about 30 wt%. Fine PK will cease to be deposited in the Fine PKC Facility (mitigated) in Year 5 when the mined-out 5034 Pit becomes available for fine PK storage. From Year 7 to the end of the mine operation, fine PK will be deposited into the mined-out Hearne Pit.

Progressive reclamation of the Fine PKC Facility (mitigated) will be completed during mine operations. More specifically, as the Fine PKC Facility (mitigated) becomes filled during the initial years of operations, reclamation would include a cover layer that will be comprised of mine rock, and coarse PK depending on material availability. The facility will be graded so that any surface runoff will flow towards Area 3.

Coarse PK will be placed in the on-land Coarse PK Pile and placed with mine rock. The design storage capacity of the on-land Coarse PK Pile is approximately 5.2 Mm^3. The results of geochemical testing for the Project indicate that seepage from the PK will not generate acid rock drainage (ARD) and is more likely to produce alkaline drainage. The Coarse PK Pile will be shaped and covered with a layer of mine rock of a minimum of 1 m to limit surface erosion. Runoff will be directed to Area 4.

11.5.2.2.2 Sequencing of Mine Rock and Processed Kimberlite Containment Facilities

The distribution of mine rock is shown in Table 11.5-2. About 65% of the mine rock will be deposited in the mine rock piles and about 35% will be deposited in the mined-out 5034 Pit. Some of the mine rock will be used for construction of roads, dykes, dams, and reclamation. These amounts are included within the quantities of mine rock destined for the mine rock piles (Table 3.7.2).

As shown in Table 11.5-3, the fine PK will be deposited into the Fine PKC Facility (mitigated) for the first five years of mine operations, then into the 5034 Pit for two years, and finally into the Hearne Pit with overlap in Years 5 and 7. There is flexibility in the sequence of placing the coarse PK. Currently, it is planned that coarse PK be placed in the on-land Coarse PK Pile during the first five years of mining operation and used for reclamation of the Fine PKC Facility (mitigated). It will be placed with mine rock in the West Mine Rock Pile (mitigated) thereafter.

Permafrost conditions are anticipated to develop within the mine rock piles by the end of mine life. Permafrost conditions are expected to develop in the Coarse PK Pile over a similar timeframe, but are expected to take longer to develop in the Fine PKC Facility. Although permafrost will form in the mine rock and Fine PKC facility, the effect of permafrost was not included in the long-term water quality modelling.

Table 11.5-2 Distribution of Mine Rock by Year

Year	5034 Mine Rock (Mt)			Hearne Mine Rock (Mt)		Tuzo Mine Rock (Mt)		
	Total Mined	To South Mine Rock Pile	To West Mine Rock Pile (mitigated)	Total Mined	To West Mine Rock Pile (mitigated)	Total Mined	To 5034 Pit	To West Mine Rock Pile (mitigated)
-2	1.6	1.6[(a)]	-	-	-	-	-	-
-1	16.0	16.0[(a)]	-	-	-	-	-	-
1	27.2	27.2	-	-	-	-	-	-
2	24.7	24.7[(a)]	-	-	-	-	-	-
3	17.7	3.6	14.1	-	-	-	-	-
4	10.5	-	10.5[(a)]	1.9	1.9	-	-	-
5	2.9	-	2.9[(a)]	10.0	10.0	11.6	-	11.6
6	-	-	-	11.8	11.8[(a)]	13.3	7.1	6.2
7	-	-	-	3.6	3.6	27.2	27.2	-
8	-	-	-	-	-	31.5	31.5[(a)]	-
9	-	-	-	-	-	9.9	9.9	-
10	-	-	-	-	-	4.0	4.0	-
11	-	-	-	-	-	1.0	0.3	0.7
Total	**100.6**	**73.1**[(a) (b)]	**27.5**[(a) (b)]	**27.3**	**27.3**[(a) (b)]	**98.5**	**80.0**[(a) (b)]	**18.5**

Source: Table 3.7-2 in the Project Description; adapted from Table 11.5-2 of De Beers 2010

(a) Portion of mine rock will be used for dyke, road construction, and closure cover (approximately 3.9 Mt total).

(b) The actual total quantities of mine rock placed in the mine rock piles and mined-out 5034 Pit will be slightly less.

Mt = million tonnes.

Table 11.5-3 Processed Kimberlite Deposition

Year	Fine Processed Kimberlite (Mt)				Coarse and Grits (Mt)			
	Total	Fine PKC Facility (mitigated)	Mined-out 5034 Pit	Mined-out Hearne Pit	Total	Coarse PK Pile	Dyke Construction and Reclamation	Placed with Mine Rock
1	0.63	0.63	-	-	1.89	1.89	-	-
2	0.75	0.75	-	-	2.25	2.25	-	-
3	0.75	0.75	-	-	2.25	2.25	-	-
4	0.75	0.75	-	-	2.25	2.05	0.20	-
5	0.75	0.44	0.31	-	2.25	0.92	0.92	0.41
6	0.75	-	0.75	-	2.25	-	0.72	1.53
7	0.75	-	0.44	0.31	2.25	-	-	2.25
8	0.75	-	-	0.75	2.25	-	-	2.25
9	0.75	-	-	0.75	2.25	-	-	2.25
10	0.75	-	-	0.75	2.25	-	-	2.25
11	0.45	-	-	0.45	1.35	-	-	1.35
Total	**7.83**	**3.32**	**1.5**	**3.01**	**23.49**	**9.36**	**1.84**	**12.29**

Source: Table 3.7-4 in the Project Description; adapted from Table 11.5-3 of De Beers 2010

Mt = million tonnes; PK = processed kimberlite; PKC = processed kimberlite containment; - = no kimberlite to deposit.

11.5.2.2.3 Backfilled Mine Pits

5034 Pit

The 5034 Pit will be backfilled with fine PK and mine rock. The mined-out 5034 Pit serves as the fine PK disposal pit during the period of mid Year 5 to mid Year 7. Backfilling the mined-out 5034 Pit with mine rock will begin sometime during Year 6 and continue until the end of the mine life. The water level in the mined-out 5034 Pit will be limited to 300 m elevation to minimize the effect on the mining in Tuzo Pit. Any additional water accumulated in the mined-out 5034 Pit will be pumped either to the WMP or to the mined-out Hearne Pit.

Hearne Pit

Backfilling of the Hearne Pit begins in Year 7 as soon as kimberlite mining is completed. The fine PK discharge line will be moved from the mined-out 5034 Pit to the Hearne Pit. The mined-out Hearne Pit will serve as the fine PK disposal location until the end of the mine life. The top surface of the settled fine PK in the pit is anticipated to be approximately 100 m below the original lakebed.

Tuzo Pit

The Tuzo Pit, which is the last pit to be mined, will not be backfilled and will be about 305 m deep. The pit will be allowed to flood following the completion of the operations phase, as part of the refilling of Kennady Lake. Natural watershed inflows will be supplemented by pumping water from Lake N11. Flooding of the pits and returning Kennady Lake to its original lake level is expected to take approximately eight years to complete after the end of operations.

11.5.2.3 Effects Analysis

The effects analysis relating to mine rock and PK storage in Section 11.5.4 of the 2010 EIS (De Beers 2010) involved summarizing information on the following:

- effects of backfilled mine rock and PK on groundwater and permafrost (Section 11.5.4.1);
- effects of backfilled mine rock and PK on surface water quality (Section 11.5.4.2);
- effects of the physical presence of the mine rock piles, Coarse PK Pile and the PKC Facility on caribou behaviour (Section 11.5.4.3); and
- long-term stability and maintenance of frozen conditions in mine rock piles, Coarse PK Pile and Fine PKC Facility (Section 11.5.4.4).

The supplemental mitigation presented within this 2012 EIS Supplement has not changed the text associated with Sections 11.5.4.1 and 11.5.4.4, and the reader is directed to these sections of the 2010 EIS (De Beers 2010) for further information. Updates to Sections 11.5.4.2 and 11.5.4.3 of the 2010 EIS are presented below in Sections 11.5.2.3.1 and 11.5.2.3.2, respectively.

11.5.2.3.1 Effects of Backfilled Mine Rock and Processed Kimberlite on Surface Water Quality

De Beers proposes to use the mined-out 5034 and Hearne pits for storage of mine rock and/or fine PK. Approximately 1.5 Mt of fine PK will be placed in the mined-out 5034 Pit following the cessation of mining in this pit. These materials will be overlain by approximately 38.5 Mm^3 of mine rock and influences of the fine PK on Kennady Lake surface water quality are expected to be negligible.

Mining in the Hearne Pit is expected to be complete in Year 7 and the mined-out open pit will be used to store approximately 3.01 Mt of settled fine PK. Following the deposition of this material, this facility will be flooded with natural runoff, groundwater, and water liberated from settling of the fine PK. These flows are anticipated to yield a 100-m deep water cover above the settled fine PK. Hydrodynamic modelling of this facility indicates that meromixis (i.e., permanent stratification) will occur within the pit lake and development of a pycnocline (i.e., the layer of water with the highest density gradient between two waters of varying density) in the Hearne Pit is expected to isolate deeper saline water from the overlying, lower density water. Therefore, influences of the fine PK on the overlying water are expected to be isolated below the pycnocline and are not expected to have an effect on the surface water quality in Kennady Lake.

11.5.2.3.2 Effects of the Physical Presence of the Mine Rock Piles, Coarse PK Pile and the Processed Kimberlite Containment Facility on Caribou Behaviour

The mine rock piles, Coarse PK Pile and Fine PKC Facility (mitigated) associated with the Project will be permanent features on the landscape. As identified in Section 7 of the 2010 EIS (De Beers 2010), the mine rock and PK storage facilities may attract caribou and present physical hazards that increase the risk of injury or mortality to individual animals, which can affect the caribou population.

The decrease in the area of disturbed terrestrial habitat resulting from the reduction in size of the Fine PKC Facility (mitigated) is minor (60.4 ha) and will not alter the impact classification for the potential effect of this facility on caribou since it is expected to disturb less than 0.1% of the landscape of the seasonal ranges of the Bathurst and Ahiak herds (Section 7). Impacts on the abundance and distribution of caribou from direct changes to habitat from the Project remain unchanged from the 2010 EIS (Section 7.7; De Beers 2010) where they were expected to be negligible to low in magnitude, local to beyond regional in extent, and permanent. No significant effects on the abundance or distribution of caribou, or the continued opportunities for traditional and non-traditional use of caribou were predicted (Section 7.7.2).

Because the maximum height of the West Mine Rock Pile (mitigated) will increase to 510 masl (94 m), the potential risk to caribou survival was reviewed (Section 7 of this supplement). Given the implementation of the proposed mitigation (i.e., construction of ramps at closure) and the absence of any recorded caribou mortality due to mine rock piles, the increase in height of the West Mine Rock Pile (mitigated) is not expected to change the determination in the 2010 EIS (De Beers 2010) of a negligible residual effect on the abundance and distribution of caribou populations.

11.5.2.4 Conclusions

The supplemental mitigation has resulted in updates to the mine rock and PK storage plans originally summarized in the 2010 EIS (De Beers 2010). As a result of the smaller capacity of the Fine PKC Facility (mitigated), fine PK slurry will now be deposited into the mined-out 5034 Pit starting in Year 5 and continuing until mid Year 7. From then on, mine rock will be placed in 5034 Pit and fine PK slurry will be deposited in Hearne Pit. Before the mitigation, the 5034 Pit would have contained only mine rock; however, the fine PK deposited at the bottom of the 5034 Pit will be overlain by approximately 38.5 Mm^3 of mine rock and influences of the fine PK on Kennady Lake surface water quality are expected to be negligible.

The impact classification for the potential effect of the Fine PKC Facility (mitigated) on caribou has not changed from that in the 2010 EIS (De Beers 2010) given the decrease in the size of the facility and the increase in height of the West Mine Rock Pile (mitigated). The supplemental mitigation does not change the determination in the 2010 EIS of a negligible residual effect on the abundance and distribution of caribou populations.

11.6 PERMAFROST, GROUNDWATER, AND HYDROGEOLOGY

Section 11.6 of the 2010 EIS (De Beers 2010) was the subject of note related to permafrost, groundwater, and hydrogeology. This section of the 2010 EIS contained information pertaining to the following topics:

- the potential of the Project to disrupt or change permafrost distribution and groundwater flow; and
- effects related to accumulation of permafrost into on-site infrastructure and proposed mitigative strategies.

In Sections 11.6.3 and 11.6.4 of the 2010 EIS (De Beers 2010), it was determined that the pathways for permafrost, groundwater, and hydrogeology had either no linkages (i.e., no connection between permafrost and the Project) or minor (secondary) effects from the Project to the environment and, therefore, required no further evaluation. The results of these assessments are unchanged given the supplemental mitigation presented within this document.

The assessments of potential effects in the 2010 EIS (De Beers 2010), 2011 EIS Update (De Beers 2011), and 2012 EIS Supplement were completed assuming no permafrost was present within the Fine PKC Facility. Because predictions assume conservatively that the processed kimberlite does not freeze, predicted effects of the Fine PKC Facility (mitigated) on Kennady Lake will not be dependent on the beneficial effects of freezing to reduce seepage.

Changes to permafrost are not expected to affect the integrity of Project infrastructure, because their integrity is not dependant on and will not be negatively affected by the development of permafrost. Performance of the Fine PKC Facility (mitigated) under frozen ground conditions is being modelled separately from the 2012 EIS Supplement to predict realistic performance.

These predictions will be used for site operational management; future monitoring data will be compared to these predictions as part of adaptive management.

11.7 VEGETATION

11.7.1 Summary of Section 11.7 Before Updates

This section summarizes the Environmental Impact Statement (EIS) for the Gahcho Kué Project (Project) Subject of Note: Vegetation (De Beers 2010). For further information pertaining to methods and peripheral aspects of Section 11.7 of the 2010 EIS, refer to De Beers (2010).

In the 2010 EIS (De Beers 2010), a total of 14 ecological land classification (ELC) classes were identified in the Project local study area (LSA), including

- seven wetland/riparian classes,
- five upland classes,
- one water class, and
- one disturbance class.

Due to the inherent variability in landscape conditions, a number of ecosystem polygons were mapped as complex (i.e., containing two ecosystem types), or very complex (i.e., containing three ecosystem types). Thus, a total of 1,307 ELC polygons were mapped, of which 433 were simple polygons, 270 were complex polygons, and 604 were very complex polygons. During the field surveys, 35.4% of the mapped ELC polygons were visited and a total of 197 plant and lichen species were identified. Both the Project RSA and Winter Access Road study area were classified into 15 broad ecosystem units (BEUs) including seven upland classes, five wetland/riparian classes, two water classes, and one unclassified unit. Approximately 2.0% of the LSA and 0.1% of the RSA vegetation ecosystems were to be disturbed by the Project footprint based on the Project Description within the 2010 EIS (see Section 3 of De Beers 2010). At the local scale, the magnitude of impacts from the Project footprint on plant populations was predicted to be low for most community types, and high for the Water Sedge – Narrow-leaved Cottongrass Fen (CA) unit. The direct effects from the Project footprint on vegetation ecosystems and plants were local in spatial extent. Overall, the magnitude of change at the local scale was predicted to be within the range of baseline conditions.

The dewatering of Kennady Lake was to result in the downstream flooding of 90.8 ha of terrestrial vegetation. The magnitude of the effect was to be within or slightly exceeding the limits of natural variation (baseline conditions). Wetlands and riparian communities were expected to be the most resilient to rising and fluctuating water levels, although vegetated portions of the dewatered lake margin could potentially die back if these areas are sensitive to water level declines resulting from dewatering (e.g., wetlands). Uplands were also expected to be relatively unaffected by a decrease in the water level, although some upland ecosystem types along the margins of the flooded areas may be less resilient to prolonged flooding, and could display a more adverse response to these conditions. The exposure of bare, relatively nutrient-rich lakebed sediments may favour the colonization of plants, some of which could be invasive species. The magnitude of effects to plant communities located along the dewatering and flooding margins was expected to be restricted to a relatively narrow impact zone. Effects to these communities were anticipated to be reversible in the long-term (i.e., within 20 to 75 years after Kennady Lake is refilled).

11.7.2 Updates to Section 11.7

11.7.2.1 Overview of Updates

Table 11.7-1 identifies the subsections from Vegetation (Section 11.7) of the 2010 EIS (De Beers 2010) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to the 2010 EIS. If the text in the subsection required updates, the changes are provided in the text that follows.

Table 11.7-1 Updated and Unchanged Subsections from Section 11.7 of the Environmental Impact Statement

Section 11.7 from the 2010 EIS		Updated in 2012	Reason for Update
11.7.1	Introduction	no	-
11.7.2	Existing Environment	no	-
11.7.3	Pathway Analysis	no	-
11.7.4	Effects to Vegetation Ecosystems and Plants	yes	reduction in Project footprint
11.7.5	Related Effects to Wildlife	yes	reduction in Project footprint
11.7.6	Residual Effects Summary	yes	reduction in Project footprint
11.7.7	Residual Impact Classification	yes	reduction in Project footprint
11.7.8	Environmental Significance	no	-
11.7.9	Uncertainty	no	-
11.7.10	Monitoring and Follow-up	no	-

Note: - = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010).

11.7.2.2 Effects to Vegetation Ecosystems and Plants

Vegetation Ecosystem Types and Communities

Within this 2012 EIS Supplement, the Project footprint area is now estimated to be 1,152.8 ha, including 794.3 ha of mine and infrastructure components that will directly impact terrestrial resources (Table 11.7-2). An additional 358.5 ha occurs within the extent of Project footprint but is represented by waterbodies. Of the mine and infrastructure components, the Coarse PK Pile and Fine PKC Facility (mitigated) cover the largest area at 7.2% of the total footprint, while the South Mine Rock Pile and the West Mine Rock Pile (mitigated) each cover 6.7% of the total footprint area, respectively. It is anticipated that water levels associated with the flooded portions of Area 3 of Kennady Lake (representing 0.3% of the disturbance footprint) and other flooded areas (representing 7.1% of the disturbance footprint) will return to baseline levels at closure.

Several mine and infrastructure components had slight area modifications compared to the original EIS (De Beers 2010). There was the addition of Dyke A1 (0.1 ha, <0.1% of Project footprint) and a water pipeline (1.4 ha, 0.1%), and a reduction in the area of the Raised A3 flooded area (now 0 ha compared to 22.7 ha in the 2010 EIS. In addition, the A3 waterbody component was also completely removed from the Project footprint.

Table 11.7-2 Revised Project Components and Associated Project Footprint during Operations

Project Component	Components Affecting Ecosystems		Components Not Affecting Ecosystems[a]	
	ha[b]	% of Project Footprint[b]	ha[b]	% of Project Footprint[b]
Mine and Infrastructure				
5034 Pit	36.2 (36.2)	3.1 (2.9)	-	-
Airstrip	9.6 (9.6)	0.8 (0.8)	-	-
Area 1 Perimeter Berm	0.7 (0.5)	0.1 (0)	-	-
Area 3 - Kennady Lake (flooded area)	3.0 (3.9)	0.3 (0.3)	-	-
Area 4 (de-watered lake bed)	44.7 (45.2)	3.9 (3.7)	-	-
Area 6 (de-watered lake bed)	78.1 (74.2)	6.8 (6)	-	-
Area 7 (de-watered lake bed)	98.4 (98.4)	8.5 (8)		
Building A	2.4 (2.4)	0.2 (0.2)	-	-
Building B	0.5 (0.5)	0.0 (0)	-	-
Building C	0.7 (0.7)	0.1 (0.1)	-	-
Building D	2.1 (2.1)	0.2 (0.2)	-	-
Conveyer Belt	0.0 (0.0)	0.0 (0.0)	-	-
Dyke A1	0.1 (n/a)	0.0 (n/a)		
Dyke A	1.4 (1.4)	0.1 (0.1)	-	-
Dyke B	18.3 (18.3)	1.6 (1.5)	-	-
Dyke D	0.7 (0.7)	0.1 (0.1)	-	-

Table 11.7-2 Revised Project Components and Associated Project Footprint during Operations (continued)

Project Component	Components Affecting Ecosystems		Components Not Affecting Ecosystems[a]	
	ha[b]	% of Project Footprint[b]	ha[b]	% of Project Footprint[b]
Dyke E	1.2 (1.2)	0.1 (0.1)	-	-
Dyke F	1.3 (1.5)	0.1 (0.1)	-	-
Dyke G	1.8 (1.8)	0.2 (0.1)	-	-
Dyke H	1.3 (1.3)	0.1 (0.1)	-	-
Dyke I	3.1	0.3 (0.2)	-	-
Dyke J	0.6	0.1 (0)	-	-
Dyke K	3.1 (3.1)	0.3 (0.2)	-	-
Dyke L	5.4 (5.2)	0.5 (0.4)	-	-
Dyke M	0.8 (0.8)	0.1 (0.1)	-	-
Dyke N	4.2 (4.2)	0.4 (0.3)	-	-
Flooded Area (areas D2, D3 and E1)	82.0 (87)	7.1 (7)	-	-
Hearne Pit	16.7 (16.7)	1.4 (1.3)	-	-
Perimeter Berm	1.7 (4.1)	0.1 (0.3)	-	-
Plant site	25.2 (25.9)	2.2 (2.1)	-	-
Raised A3 (flooded area)	0.1 (22.7)	0.0 (1.8)	-	-
Site Roads	40.9 (39.9)	3.6 (3.2)	-	-
South Mine Rock Pile	77.8 (77.8)	6.7 (6.3)	-	-
Tuzo Pit	34.7 (34.7)	3.0 (2.8)	-	-
Mine Rock Berm 2	0 (0.1)	0.0 (0)	-	-
Mine Rock Covered Coarse PK	32.2 (32.2)	2.8 (2.6)	-	-
Mine Rock Covered Fine PK/Coarse PK	83.2 (115.1)	7.2 (9.3)	-	-
Water Collection Pond Berm 3	0.5 (0.5)	0.0 (0)	-	-
Water Collection Pond Berm 4	0.1 (0.1)	0.0 (0)	-	-
Water Collection Pond Berm 6	0.5 (0.5)	0.0 (0)	-	-
West Mine Rock Pile	77.6 (77.6)	6.7 (6.3)	-	-
Water Pipeline	1.4 (n/a)	0.1 (n/a)	-	-
mine and infrastructure subtotal	*794.3 (853.3)*	*69.0 (69.1)*	-	-
Waterbody				
A3	-	-	0.0 (23.7)	0.0 (1.9)
Area 3 - Kennady Lake	-	-	209.5 (209.5)	18.2 (17)
Area Behind Dyke L - Kennady Lake	-	-	13.2 (13.2)	1.1 (1.1)
CP2	-	-	1.0 (1.0)	0.1 (0.1)
CP3	-	-	2.4 (2.4)	0.2 (0.2)
CP4	-	-	0.2 (0.2)	0.0 (0)
CP6	-	-	1.6 (1.6)	0.1 (0.1)
D10	-	-	4.4 (4.4)	0.4 (0.4)
D2	-	-	12.5 (12.5)	1.1 (1)
D3	-	-	38.4 (38.4)	3.3 (3.1)
E1	-	-	20.2 (20.2)	1.8 (1.6)

Table 11.7-2 Revised Project Components and Associated Project Footprint during Operations (continued)

Project Component	Components Affecting Ecosystems		Components Not Affecting Ecosystems[a]	
	ha[b]	% of Project Footprint[b]	ha[b]	% of Project Footprint[b]
E2	-	-	2.0 (2.0)	0.2 (0.2)
Lake	-	-	5.3 (5.3)	0.5 (0.4)
N14	-	-	21.6 (21.6)	1.9 (1.7)
Submerged Fine PK/Coarse PK	-	-	26.2 (26.2)	2.3 (2.1)
waterbody subtotal	-	-	*358.5 (382.1)*	*31.1 (30.9)*
Grand Total	**794.3 (853.3)**	**69.0 (69.1)**	**358.5 (382.1)**	**31.1 (30.9)**

Source: adapted from Table 11.7-16 of De Beers 2010.

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

(a) Project components will not have an effect on certain waterbodies that occur within the bounds of the Project footprint. These waterbodies will remain unaffected from baseline through closure. For example, the "Submerged Fine PK/Coarse PK" material is placed directly in an existing lake, and therefore is considered a waterbody feature from baseline to closure. Thus, while some of these waterbodies will be used for operational purposes, they are not considered to be affected for the purposes of the terrestrial assessment.

(b) Numbers in brackets are the previous values taken from Table 11.7-16 in the original EIS (De Beers 2010).

ha = hectare; % = percent; < = less than; PK = processed kimberlite; - = not applicable.

Local Study Area

The dominant ELCs in the LSA that experience a change in area disturbed by the Project footprint compared to the 2010 EIS (De Beers 2010) are summarized in Table 11.7-3. The data presented represent an overall reduction in the area being disturbed, and includes a decrease of 39.4 ha for upland classes, a decrease of 20.9 ha for wetland and riparian classes, and a decrease of 22.4 ha for the water class. This represents an overall reduction of disturbance by 82.6 ha within the LSA.

Regional Study Area

The BEU Classes in the RSA that experience a change in area disturbed by the Project footprint during the operations case, compared to the 2010 EIS (De Beers 2010) are summarized in Table 11.7-4. The data presented represent a change in the area of disturbance and include a decrease of 20.1 ha for upland classes, a decrease of 44.7 ha for wetland classes, and a decrease of 17.9 ha for water classes. This represents an overall reduction of disturbance by 82.6 ha within the RSA.

11.7.2.3 Related Effects to Wildlife

Section 11.7.2.2 identifies an overall reduction of disturbances from the Project by 82.6 ha. This decrease in disturbance is not expected to change the outcome of the original EIS with respect to the related effects to wildlife.

11.7.2.4 Residual Effects Summary

As the change in footprint results in a reduction in the amount of area disturbed by the Project when compared to the 2010 EIS (Section 11.7.2.2; De Beers [2010]), no additional residual effects from the Project are predicted.

11.7.2.5 Residual Impact Classification

As the change in footprint results in a reduction in the amount of area disturbed by the Project by 82.6 ha (Section 11.7.2.2), this alteration is not expected to change recommended mitigation or predicted residual effects from the Project compared to the original EIS (DeBeers 2010). Thus, the Project should not result in significant adverse impacts to the persistence of vegetation ecosystems and listed plant species, and the use of traditional plants.

Table 11.7-3 Local Ecosystem Disturbances Within the Project Footprint

Dominant Ecological Landscape Classification (ELC)		Operations		Change in Area of Disturbance from Operations	Closure		Change in Area of Disturbance at Closure
		2010 EIS	2012 EIS Supplement		2010 EIS	2012 EIS Supplement	
Code	Name	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Upland Class							
BF	Boulderfield (sparsely vegetated)	0.0	0.0	0.0	0.0	0.0	0.0
SS	Saxifrage – Moss Campion Xerophytic Tundra	0.0	0.0	0.0	0.0	0.0	0.0
BE	Scrub Birch – Crowberry Tundra	8.6	8.6	0.0	8.6	8.6	0.0
BL	Scrub Birch – Labrador Tea Tundra	176.30	136.87	-39.4	176.3	141.7	-34.6
PE	Spruce – Lichen Woodland	0.0	0.0	0.0	0.0	0.0	0.0
Upland Class subtotal		*184.9*	*145.5*	*-39.4*	*184.9*	*150.3*	*-34.6*
Wetland/Riparian Class							
CE	Round-Fruited Sedge – Chamisso's Cottongrass Fen	16.8	16.8	0.0	16.8	16.8	0.0
BC	Scrub Birch – Bluejoint Shrub Tundra	<0.1	<0.1	0.0	<0.1	<0.1	0.0
BR	Scrub Birch – Cloudberry Low Shrub Tundra	128.1	107.3	-20.8	128.1	106.3	-21.8
RB	Scrub Birch – Riparian Shrub	0.1	0.1	0.0	0.1	0.1	0.0
EA	Sheathed Cottongrass – Bog Rosemary Sedge Fen	53.8	53.8	0.0	53.8	53.8	0.0
CA	Water Sedge – Narrow-leaved Cottongrass Fen	8.7	8.6	-0.08	8.7	8.6	-0.1
SR	Willow – Nagoonberry Shrub	<0.1	<0.1	0.0	0.1	0.1	0.0
Wetland/Riparian Class subtotal		*207.6*	*186.6*	*-20.9*	*207.6*	*185.7*	*-21.9*
Terrestrial subtotal		*392.5*	*332.0*	*-60.4*	*392.5*	*336.0*	*-56.5*
Water Class							
LA	Lake (open water)[(a)]	841.8	819.4	-22.4	173.7	149.44	-24.3
Water Class subtotal		*841.8*	*819.4*	*-22.4*	*173.70*	*149.44*	*-24.3*
ELC Total (terrestrial and water classes)		1,234.3	1,151.4	-82.8	566.20	485.49	-80.7
Existing Camp		1.1	1.3	0.2	28.9	29.1	0.2
Total		**1,235.4**	**1,152.8**	**-82.6**	**595.10**	**514.7**	**-80.5**

Source: adapted from Table 11.7-17 of De Beers 2010.

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

(a) Includes waterbodies not affecting ecosystems.

ha = hectare; % = percent; n/a = not applicable; < = less than.

Table 11.7-4 Regional Ecosystem Disturbances within the Project Footprint

Broad Ecosystem Unit (BEU) Class		Operations		Change in Area of Disturbance from Operations	Closure		Change in Area of Disturbance at Closure
		2010 EIS	2012 EIS Supplement		2010 EIS	2012 EIS Supplement	
Code	Name	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Upland Class							
BEAS	Bedrock Association (>80% Bedrock)	3.8	3.9	0.1	3.8	3.8	0.0
BOAS	Boulder Association (>80% Boulders)	5.0	4.3	-0.7	5.0	4.0	-1.0
ESCO	Esker Complex	0.0	0.0	0.0	0.0	0.0	0.0
HETU	Heath Tundra (<30% Rock)	58.2	50.8	-7.4	58.2	52.2	-6.0
HEBE	Heath/Bedrock (30 to 80% Bedrock)	30.5	26.1	-4.4	30.5	26.4	-4.1
HEBO	Heath/Boulders (30 to 80% Boulders)	15.5	14.1	-1.4	15.5	13.7	-1.8
SPFO	Spruce Forest	35.4	29.1	-6.3	35.4	29.2	-6.2
Upland Class subtotal		*148.3*	*128.3*	*-20.1*	*148.3*	*129.2*	*-19.2*
Wetland Class							
BISE	Birch Seep	24.6	21.1	-3.5	24.6	21.7	-2.9
PEBO	Peat Bog	79.1	64.0	-15.1	79.1	68.2	-10.9
TASH	Riparian Tall Shrub	23.8	22.1	-1.7	23.8	19.0	-4.8
SEWE	Sedge Wetland	73.7	66.7	-7.0	73.7	65.6	-8.1
TUHU	Tussock/Hummock (Sedge Association)	80.1	62.7	-17.4	80.1	63.6	-16.5
Wetland Class subtotal		*281.3*	*236.6*	*-44.7*	*281.3*	*238.0*	*-43.3*
Water Class(a)							
DEWA	Deep Water	660.5	650.6	-9.9	119.7	109.8	-9.9
SHWA	Shallow Water	144.0	136.0	-8.0	44.5	36.3	-8.2
Water Class subtotal		*804.5*	*786.6*	*-17.9*	*164.2*	*146.1*	*-18.1*
Unclassified							
UC	Unclassified	1.3	1.4	0.1	1.3	1.4	0.1
Unclassified subtotal		*1.3*	*1.4*	*0.1*	*1.3*	*1.4*	*0.1*
Ecosystem Class Total		**1,235.4**	**1,152.8**	**-82.6**	**595.1**	**514.7**	**-80.5**

Source: adapted from Table 11.7-18 of De Beers 2010

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

[a] Includes waterbodies not affecting ecosystems.

ha = hectare; % = percent; n/a = not applicable; < = less than.

11.7.2.6 Conclusions

The overall effect of the supplemental mitigation on mine rock and PK storage include a number of small changes to the area of several Project components (Table 11.7-2) and more substantial changes to the following Project components:

- a decrease in the area of Lake A3 (flooded area) from 22.7 ha to 0 ha;
- a decrease in the area of the Fine PK/Coarse PK Facility from 115.1 ha to 83.2 ha;
- the addition of Dyke A1 (0.1 ha);
- the addition of a water pipeline (1.4 ha); and
- a decrease in the area of disturbance to the Lake A3 (waterbody) from 23.7 ha to 0 ha.

Within the LSA, the dominant ELC classes that changed from the original EIS (De Beers 2010) include a decrease of 39.4 ha for upland classes, a decrease of 20.9 ha for wetland and riparian classes, and a decrease of 22.4 ha for the water class. This represents an overall reduction of disturbance by 82.6 ha within the LSA.

Within the RSA, the BEU classes that changed from the 2010 EIS (De Beers 2010), considering the operations case, included a decrease of 20.1 ha for upland classes, a decrease of 44.7 ha for wetland classes, and a decrease of 17.9 ha for water classes. This represents an overall reduction of disturbance by 82.6 ha within the RSA.

Overall, the area of the Project footprint decreased from 1,235.4 ha in 2010 to 1,152.8 ha in 2012. The resulting change in the area of the Project footprint is not expected to result in significant adverse impacts to the persistence of vegetation ecosystems and listed plant species, including the use of traditional plants.

11.7.3 Updates to Appendix for Section 11.7

The single appendix associated with Section 11.7 of the 2010 EIS (De Beers 2010) was titled: Appendix 11.7.I Geology, Terrain, and Soils. Changes to this appendix are summarized in the following text.

11.7.3.1 Effects to Terrain and Soils

11.7.3.1.1 Changes to Terrain

The new Project footprint during operations and closure reduced the disturbance to the terrain unit areas when compared to De Beers (2010). A summary of these changes is presented in Table 11.7-5.

Considering the changes made to the Project footprint, the terrain unit area affected by the Project decreased by a total of 80.1 ha (not including Lake units) during operations and 85.6 ha at closure when compared to the original footprint in the 2010 EIS (De Beers 2010).

Table 11.7-5 Terrain Disturbances Within the Project Footprint

Terrain Unit	Operations		Change in Area of Disturbance from Operations (ha)	Closure		Change in Area of Disturbance at Closure (ha)
	2010 EIS (ha)	2012 EIS Supplement (ha)		2010 EIS (ha)	2012 EIS Supplement (ha)	
Lake	841.7	827.1	-14.6	676.7	650.3	-26.4
Bog	0.03	0.03	0.0	0.0	0.0	0.0
Bog/fen	112.1	98.3	-13.7	42.0	10.2	-31.8
Fen	1.9	1.8	-0.1	0.0	0.5	0.5
Glaciofluvial	0.0	0	0.0	0.0	0.0	0.0
Fluvial	0.0	0	0.0	0.0	0.0	0.0
Low relief till	51.0	51.0	0.0	26.6	17.4	-9.2
High relief till	228.1	176.2	-51.9	51.4	39.5	-11.9
Exposed bedrock	1.1	1.27	0.2	0.03	0.03	0.0
Reclaimed	n/a	n/a	n/a	85.4	79.1	-6.3
Flooded	n/a	n/a	n/a	160.8	68.3	-92.5
Non-Reclaimed	n/a	n/a	n/a	191.3	283.3	92.0
Total	**1,236**	**1,156**	**-80.1**	**1,236**	**1,149**	**-85.6**

Source: adapted from Table 11.7.I-15 of De Beers 2010

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

n/a = not applicable; ha = hectares; % = percent; LSA = Local Study Area.

11.7.3.1.2 Changes to Soil Distribution

The maximum effects from Project footprint disturbance on soil distribution is presented in Table 11.7-6. Disturbance to the soil units were reduced when compared to the 2010 EIS (De Beers 2010) during operations and closure.

Considering the changes made to the Project footprint, the soil unit area given the current Project Description decreased by 86.9 ha (not including Lake unit) during operations and 85.6 ha at closure when compared to the 2010 EIS (De Beers 2010).

Table 11.7-6 Soil Disturbances Within the Project Footprint

Soil Unit	Operations		Change in Area of Disturbance from Operations (ha)	Closure		Change in Area of Disturbance at Closure (ha)
	2010 EIS (ha)	2012 EIS Supplement (ha)		2010 EIS (ha)	2012 EIS Suppleme nt (ha)	
Lake	841.7	827.1	-14.6	676.1	647.2	-28.9
Dragon Lake Association	21.5	21.4	-0.1	19.6	3.2	-16.4
Goodspeed Lake Association	0.0	0.0	0.0	0.03	0.0	-0.03
Hoarfrost Lake Association	0.0	0.0	0.0	0.0	0.0	0.0
Sled Lake Association	23.0	21.9	-1.1	8.0	0.1	-7.9
Sled Lake/Dragon Lake Co-dominant	69.5	48.4	-21.1	14.4	7.3	-7.1
Sled Lake/Goodspeed Lake Co-dominant	0.03	0.03	0.0	0.0	0.1	0.1
Wolverine Lake Association	158.1	137.9	-20.2	37.2	27.8	-9.4
Wolverine Lake/Dragon Lake Co-dominant	0.0	0.0	0.0	0.0	0.0	0.0
Wolverine Lake/Bedrock Co-dominant	0.0	0.0	0.0	0.0	0.0	0.0
Wolverine Lake/Sled Lake Co-dominant	121.1	91.1	-30.0	41.4	33.3	-8.1
Exposed bedrock	1.1	1.3	0.2	0.03	0.0	-0.03
Reclaimed	n/a	n/a	n/a	86.0	79.1	-6.9
Flooded	n/a	n/a	n/a	160.8	68.3	-92.5
Non-reclaimed	n/a	n/a	n/a	191.3	282.8	91.5
Total	**1236**	**1,149**	**-86.9**	**1,235**	**1,149**	**-85.6**

Source: adapted from Table 11.7.I-20 of De Beers 2010.

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
The larger change in Area of Disturbance from Operations (ha) value for total soil unit area in comparison to terrain unit are (Table 11.7-5) is attributed to small, incremental measurement differences in GIS data.

n/a = not applicable; ha = hectares; % = percent; LSA = Local Study Area.

11.7.3.2 Conclusions

The change in Project footprint is not expected to result in a change to the findings for terrain and soil when compared to the 2010 EIS (De Beers 2010).

11.8 TRAFFIC AND ROAD ISSUES

The Project site is about 140 km northeast of the nearest community, Łutselk’e, and 280 km northeast of Yellowknife. Winter road access from Yellowknife to the Project will be along the existing Tibbitt-to-Contwoyto Winter Road and the

Winter Access Road leading to the Project from the Tibbitt-to-Contwoyto Winter Road. Winter road traffic bound for the Project will access the Tibbitt-to-Contwoyto Winter Road via the Ingraham Trail (Highway 4). Access will also be provided by aircraft.

The Project will result in increased winter road traffic. Table 11.8-1 provides a forecast of average and maximum winter road traffic volumes for the Project from the 2010 EIS (De Beers 2010), for each phase of development. Load frequency for the construction phase was based on the experience at similar projects (Ekati and Snap Lake). A typical winter road season has been assumed.

Table 11.8-1 Project-related Winter Road Traffic Forecast by Phase

Project Phase	Number of Years	Loads per Year	
		Average	Maximum
Construction	2	1,500	2,000
Operations	11	1,000	1,200
Closure[(a)]	2	110	200

Source: 2010 Environmental Impact Statement (De Beers 2010).

(a) Closure refers to time required to remove site infrastructure, also referred to as "interim closure".

Winter road traffic to the Project will share the first 271 km of the Tibbitt-to-Contwoyto Winter Road with other users. For 2007, the Tibbitt-to-Contwoyto Winter Road accommodated a record 11,656 loads (GNWT 2007). The increased truck tonnage and volume for 2007 incorporated equipment and materials that were not transported on the 2006 winter road due to early closure. It is anticipated that the load factors for other users of the Tibbitt-to-Contwoyto Winter Road will not exceed the 7,100 range per year over the next 10 years, given that the existing mines will continue to operate at present levels of production without any large infrastructure developments. Duration of winter road operation may be constrained by a change in natural weather patterns and project challenges.

Taking into consideration the projected truck loads for other Tibbitt-to-Contwoyto Winter Road users (7,100) as well as the projected average truck loads for each phase of the Project (as per Table 11.8-1), the total projected truck loads during development phases are shown in Table 11.8-2. During construction, the Project would, therefore, contribute a 17% to 22% increase in truck loads on the Tibbitt-to-Contwoyto Winter Road (Table 11.8-2). During operations and closure, it would result in 12% to 14% and 2% to 3% increases, respectively.

Table 11.8-2 Impact of Project Loads on Total Tibbitt-to-Contwoyto Winter Road Loads

Project Phase	Number of Years	Project Loads per Year (Average)[(a)]	Other User Loads per Year[(b)]	Total Winter Road Loads per year[(c)]	Percentage Change Due to Project (%)
Construction	2	1,500 to 2,000	7,100	8,600 to 9100	17 to 22
Operations	11	1,000 to 1,200	7,100	8,100 to 8300	12 to 14
Closure[(d)]	2	110 to 200	7,100	7,210 to 7,300	2 to 3

Source: 2010 EIS (De Beers 2010).
(a) Forecast winter road traffic for the Project.
(b) Forecast winter road traffic for other operating mines and mineral exploration on the Tibbitt-to-Contwoyto Winter Road in 2011.
(c) Forecast winter road traffic from Project, as well as other operating mines and mineral exploration on the Tibbitt-to-Contwoyto Winter Road.
(d) Closure refers to time required to remove site infrastructure, also referred to as “interim closure”. Only infrastructure required for lake refilling will remain at the Project site beyond two years. Final site demobilization will occur via a winter ice strip once Kennady Lake has been refilled.
% = percent

The supplemental mitigation of the Fine PKC Facility involves several minor changes in the Project design.

- The Fine PKC Facility’s footprint was reduced by omitting Area 1.
- The fine PK that was to be stored in Area 1 was relocated to the 5034 and Hearne pits.
- The coarse PK and mine rock that was to be used in reclamation of Area 1 was transferred to the West Mine Rock Pile.
- In the EIS (De Beers 2010), a permanent saddle dam (Dyke C) was to be constructed between Area 1 and Lake A3 to the north. Instead, a permanent saddle dam (Dyke A1) will now be constructed to prevent water from flowing from Area 1 to Area 2.
- Surface runoff flowing into the A watershed will be managed by constructing a discharging pipeline from Area 1 into Lake J1b allowing water to flow to Area 8 of Kennady Lake.

In general, the supplemental mitigation involves minor changes to the movement of materials within the site. For example, mine rock and coarse PK will be transported to Area 5 instead of Area 1. Materials used to construct earth-filled Dyke C will now be used to construct Dyke A1, both in Area 1. The construction of a pipeline from Area 1 to Lake J1b will require pipe that will be transported to the site on the winter road during the construction phase. The additional transportation requirements would, however, be within the range of loads per year predicted in Table 11.8-2. The peak predicted traffic volume of 8,600 loads during the Project construction phase is well within the road’s capacity as demonstrated by the total load number of 11,656 trucks in 2007 (GNWT 2007).

The impact of the supplemental mitigation to the roads and traffic will be negligible and, therefore, the effect of the supplemental mitigation on the predictions of the 2010 EIS (De Beers 2010) on traffic and road issues related to the aquatic environment, the terrestrial environment, and related effects to people also will be negligible. The supplemental mitigation is not expected to cause a noticeable change in air traffic.

11.9 WASTE MANAGEMENT AND WILDLIFE

The Waste Management Plan for the Project, described in the 2010 EIS (De Beers 2010), addresses the recycling, storage, handling, and disposal of all wastes, excluding those that are generated by ore extraction and processing. The Waste Management Plan will not be altered as a result of the supplemental mitigation introduced in 2012. Efforts to prevent wildlife from being attracted to the site will continue as before. Therefore, assessment results presented in the 2010 EIS for this subject of note remain unchanged. The reader is directed to Sections 3.8 and 11.9 of the 2010 EIS for more information on this topic.

11.10 CARNIVORE MORTALITY

11.10.1 Summary of Section 11.10 Before Updates

The wildlife baseline LSA and RSA were used for carnivore baseline studies. In addition, distinct study areas were delineated for each of the carnivores. The study area for grizzly bears and wolverines was approximately 200,000 km^2. The wolf study area as selected to encompass the annual range of the Bathurst caribou herd and was approximately 400,000 km^2.

The Project was expected to disturb less than 0.1% of landscape in the study areas for grizzly bear, wolverine, and wolf (Section 11.10.6.1; De Beers 2010). This section also included an assessment of direct cumulative effects resulting from the Project and previous, existing, and future developments. The cumulative direct disturbance to the landscape from the Project and other previous, existing, and future developments was predicted to be about 2% for the grizzly bear and wolverine study area, and 1.4% for the wolf study area (Section 11.10.6.1; De Beers 2010).

11.10.2 Updates to Section 11.10

11.10.2.1 Overview of Updates

Table 11.10-1 identifies the subsections from Section 11.10 of the 2010 EIS (De Beers 2010) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to Section 11.10 of the 2010 EIS. If the text in the subsection required updates, the changes are provided in the text that follows.

Table 11.10-1 Updated and Unchanged Subsections from Section 11.10

Section 11.10 from the 2010 EIS	Updated in 2012	Reason for Update
11.10.1 Introduction	no	-
1110..2 Existing Environment	no	-
11.10.3 Pathway Analysis	yes	reduction in Project footprint
11.10.4 Effects on Population Size and Distribution of Grizzly Bear and Wolverine	yes	reduction in Project footprint
11.10.5 Effects on Population Size and Distribution of Wolf	yes	reduction in Project footprint
11.10.6 Residual Effects Summary	no	-
11.10.7 Residual Impact Classification	no	-
11.10.8 Environmental Significance	no	-
11.10.9 Uncertainty	no	-
11.10.10 Monitoring and Follow-up	no	-

Note: - = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010).

11.10.2.2 Pathway Analysis

Section 11.10 of the 2010 EIS (De Beers 2010) assessed effects pathways on the abundance and distribution of carnivores (grizzly bear, wolverine, and wolf). The mitigation to the Fine PKC Facility will not alter the determination of primary, secondary, and no linkage pathways considered in the EIS pathway analysis (Section 11.10.3). Of the primary pathways for carnivores, only one pathway is affected by the reduction in the Project footprint:

- Direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter carnivore movement and behaviour.

11.10.2.3 Effects on Population Size and Distribution of Grizzly Bear, Wolverine, and Wolves

In the 2010 EIS (De Beers 2010), the Fine PKC Facility would cover Area 1 within the A1 sub-watershed and Area 2 within Kennady Lake. The supplemental mitigation of the Fine PKC Facility that is relevant to carnivores involves the removal of Area 1 resulting in a reduction in the area of the Fine PKC Facility (mitigated). The supplemental mitigation results in a decrease in the terrestrial habitat disturbed by the Project operations from 392.5 to 332.0 ha (Table 11.7-3), a reduction of 60.4 ha. When compared to the grizzly bear and wolverine study area of 200,000 km^2 (20 million ha) and the wolf study area of 400,000 km^2 (40 million ha), a change of 60.4 ha is negligible.

11.10.2.4 Conclusions

In the 2010 EIS (De Beers 2010), impacts on the abundance and distribution of carnivores by direct changes to habitat from the Project were expected to be negligible to low in magnitude, local to beyond regional in extent, and permanent (Section 11.10.7). The decrease to the amount of disturbed habitat resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification, or the conclusion that the Project will not significantly affect the abundance and distribution of carnivores (Section 11.10.8). Subsequently, the supplemental mitigation will not alter the prediction that the Project will not significantly affect the continued opportunities for traditional and non-traditional use of carnivores.

11.11 OTHER UNGULATES

11.11.1 Summary of Section 11.11 Before Updates

The study area for other ungulates included the wildlife baseline RSA, the Winter Access Road, and the Tibbitt-to-Contwoyto Winter Road. The wildlife baseline RSA, which is the part of the study area relevant to this 2012 Supplement, is approximately 5,700 km^2 in area (Section 11.11.1.3.3; De Beers 2010).

The incremental loss of habitat in the RSA from the Project was predicted to be 2.6% relative to baseline conditions. The cumulative direct disturbance to the landscape in the RSA from the Project and other previous, existing, and future developments was predicted to be between 4.7% during spring to autumn and 5.4% during winter (Section 11.11.6; De Beers 2010).

11.11.2 Updates to Section 11.11

11.11.2.1 Overview of Updates

Table 11.11-1 identifies the subsections from Section 11.11 of the EIS (De Beers 2010) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to Section 11.11 of the 2010 EIS. If the text in the subsection required updates, the changes are provided in the text that follows.

Table 11.11-1 Updated and Unchanged Subsections from Section 11.11

Section 11.11 from the 2010 EIS	Updated in 2012	Reason for Update
11.11.1 Introduction	no	-
11.11.2 Existing Environment	no	-
11.11.3 Pathway Analysis	yes	reduction in Project footprint; increase in mine rock pile
11.11.4 Effects on Population Size and Distribution of Muskoxen	yes	reduction in Project footprint
11.11.5 Effects on Population Size and Distribution of Moose	yes	reduction in Project footprint
11.11.6 Residual Effects Summary	no	-
11.11.7 Residual Impact Classification	no	-
11.11.8 Environmental Significance	no	-
11.11.9 Uncertainty	no	-
11.11.10 Monitoring and Follow-up	no	-

Note: - = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010).

11.11.2.2 Pathway Analysis

Section 11.11 of the 2010 EIS (De Beers 2010) assessed effects pathways on the abundance and distribution of muskoxen and moose. The supplemental mitigation of the Fine PKC Facility will not alter the determination of primary, secondary, and no linkage pathways considered in the EIS pathway analysis (Section 11.10.3). Of the primary pathways for muskoxen and moose, only one primary pathway will be affected by the reduction of the Project footprint:

- Direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter moose and muskoxen movement and behaviour.

Of the secondary pathways for muskoxen and moose, the following pathway was considered because it may be affected by the increase in height of the West Mine Rock Pile:

- Changes to survival and reproduction.

Because the West Mine Rock Pile (mitigated) increased in size from 70 to 94 m, the potential risk to muskoxen and moose survival was reviewed. However, with the implementation of the proposed mitigation (i.e., construction of ramps at closure) and the absence of any recorded muskoxen or moose mortality at existing mines in the NWT (Section 11.11.3.2.2; De Beers 2010), the secondary pathway related to survival and reproduction is not considered further. The increase in height of the West Mine Rock Pile is not expected to change the determination of negligible residual effect on the abundance and distribution of muskoxen and moose in the 2010 EIS.

11.11.2.3 Effects on Population Size and Distribution of Muskoxen and Moose

In the 2010 EIS (De Beers 2010), the Fine PKC Facility would cover Area 1 within the A1 sub-watershed and Area 2 within Kennady Lake (Figure 3.5-3). The supplemental mitigation of the Fine PKC Facility that is relevant to other ungulates involves the removal of Area 1 resulting in a reduction in the area of the Fine PKC Facility (mitigated). The supplemental mitigation results in a decrease in terrestrial habitat disturbed by the Project operations from 392.5 to 332.0 ha (Table 11.7-3), a reduction of 60.4 ha. Terrestrial habitat includes wetland and riparian classes as well as upland classes (Table 11.7-3). The implications of this change to the RSA, which is the effects study area for other ungulates (muskoxen and moose), are considered negligible (the decrease is approximately 0.01% of the RSA).

11.11.2.4 Conclusions

In the 2010 EIS (De Beers 2010), impacts on the abundance and distribution of moose and muskoxen from direct changes to habitat from the Project were expected to be negligible to low in magnitude, local to regional in extent, and permanent (Section 11.11.6). The decrease in the amount of disturbed habitat resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification, or the conclusion that the Project will not significantly affect the abundance or distribution of other ungulates (Section 11.11.8). No significant effect to the continued opportunities for traditional and non-traditional use of muskoxen and moose is predicted.

11.12 SPECIES AT RISK AND BIRDS

11.12.1 Summary of Section 11.12 Before Updates

The study area for species at risk and birds included the wildlife baseline RSA, the Winter Access Road, and the Tibbitt-to-Contwoyto Winter Road. The wildlife baseline RSA, which is the part of the study area relevant to this 2012 EIS Supplement, is approximately 5,700 km^2 in area (Section 11.12.1.3.3; De Beers 2010).

The total area of the Project footprint is estimated to be 1,235 ha (Table 11.7-3) consisting of approximately 392.5 ha of terrestrial habitat, including upland and wetland/riparian habitat, and 842 ha of open water. The footprint includes 853.3 ha of mine and infrastructure (Table 11.7-2) that will directly affect terrestrial and aquatic resources. An additional 382.1 ha of water (shallow and deep) is not expected to be directly altered by the Project during construction and operations.

In the 2010 EIS (De Beers 2010), the anticipated incremental loss of any habitat type from the Project relative to the 2010 baseline conditions was predicted to be less than or equal to 0.5% of the RSA. Overall, the Project was expected to disturb approximately 2.6% of the landscape in the RSA. The cumulative direct disturbance to the landscape from the Project and other previous, existing, and future developments was predicted to be about 4.7% relative to reference conditions (Section 11.12.4.1.2).

In the 2010 EIS (De Beers 2010), the Fine PKC Facility would cover Area 1 within the A1 sub-watershed and Area 2 within Kennady Lake (Figure 3.5-3). Dyke C, a permanent saddle dam, was going to be constructed to isolate Lakes A1 and A2 in Area 1 from Lake A3 to the north. The 2010 EIS predicted that the greatest increase in lake levels would occur at Lake A3 where surface water elevations would increase from 423.0 to 426.5 m after the construction of Dyke C. The inundation of terrestrial areas surrounding Lake A3 had the potential for disturbance or destruction of bird nests or young.

11.12.2 Updates to Section 11.12

11.12.2.1 Overview of Updates

Table 11.12-1 identifies the subsections from Section 11.12 of the EIS (De Beers 2010) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to

Section 7 of the 2010 EIS. If the text in the subsection required updates, the changes are provided in the text that follows.

Table 11.12-1 Updated and Unchanged Subsections from Section 11.12

Section 11.12 from the 2010 EIS	Updated in 2012	Reason for Update
11.12.1 Introduction	no	-
11.12.2 Existing Environment	no	-
11.12.3 Pathway Analysis	yes	reduction in Project footprint
11.12.4 Effects on Population Size and Distribution of Upland Breeding Birds	yes	reduction in Project footprint
11.12.5 Effects on Population Size and Distribution of Water Birds	yes	reduction in Project footprint
11.12.6 Effects on Population Size and Distribution of Raptors	yes	reduction in Project footprint
11.12.7 Residual Effects Summary	yes	reduction in Project footprint
11.12.8 Residual Impact Classification	no	-
11.12.9 Environmental Significance	no	-
11.12.10 Uncertainty	no	-
11.12.11 Monitoring and Follow-up	no	-

Note: - = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010).

11.12.2.2 Pathway Analysis

Section 11.12 of the 2010 EIS (De Beers 2010) assessed effects pathways on the abundance and distribution of upland breeding birds, water birds, and raptors. The mitigation of the Fine PKC Facility will not alter the determination of primary, secondary, and no linkage pathways considered in the EIS pathway analysis (Section 11.12.3). Of the primary pathways for species at risk and birds, only the pathway "direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter bird and species at risk movement and behaviour" is affected by the reduction in the Project footprint.

11.12.2.3 Effects on Population Size and Distribution of Birds

The supplemental mitigation of the Fine PKC Facility that is relevant to upland breeding birds, water birds, and raptors involves the removal of Area 1 resulting in a reduction in the area of the Fine PKC Facility (mitigated). Area 1 will be isolated from Kennady Lake and the Fine PKC Facility (mitigated). The supplemental mitigation results in a decrease in the terrestrial component of the Project footprint from 392.5 ha (2010 EIS) to 332.0 ha (Table 11.7-3), a reduction of 60.4 ha of terrestrial habitat. The terrestrial habitat disturbed by the Project operations includes wetland and riparian classes as well as upland classes (Table 11.7-3). The supplemental mitigation also results in a decrease of 22.4 ha of open-water lake habitat disturbed by the Project. The implications of this decrease in the footprint compared to the RSA, which is the effects study area for species at risk and birds (upland breeding birds, water birds, and raptors) are considered negligible (the decrease is approximately 0.01% of the RSA).

The removal of Area 1 from the Fine PKC Facility (mitigated) also means that Dyke C, a permanent saddle dam that would isolate Lakes A1 and A2 in Area 1 from Lake A3 to the north, will no longer be required. As a result of the changes to the Fine PKC Facility (mitigated), the flooding of terrestrial habitat adjacent to Lake A3 will no longer occur.

11.12.2.4 Residual Effects Summary

The reduction in size of the Fine PKC Facility (mitigated) results in a minor change to the predictions in the Residual Effects Summary of the 2010 EIS (De Beers 2010). The area covered by the mine and infrastructure that will directly affect terrestrial and aquatic resources will decrease from 853.3 to 794.3 ha (Table 11.7-2). In comparison to the size of the RSA, this decrease is negligible. The anticipated magnitude of the incremental loss of habitat on the landscape within the RSA from the Project relative to the 2010 baseline conditions is unchanged at 2.6%.

11.12.2.5 Conclusion

Impacts on the abundance and distribution of upland breeding birds, water birds, and raptors from direct changes to habitat from the Project were expected to be negligible to low in magnitude, local to regional in extent, and permanent (Section 11.12.8; De Beers 2010). The 60 ha decrease in the amount of disturbed habitat resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification, or the conclusion that the Project will not significantly affect the abundance or distribution of species at risk, upland breeding birds, water birds, and raptors (Section 11.12.9; De Beers 2010). Subsequently, the Project is predicted to not significantly affect the continued opportunities for traditional and non-traditional use of these species.

11.13 CLIMATE CHANGE IMPACTS

Section 11.13 of the 2010 EIS (De Beers 2010) was the subject of note related to climate change impacts. This section included information on greenhouse gas emissions associated with the Project and an evaluation of the effects of climate change on the Project, including how it may alter Project impacts.

Annual estimates of greenhouse gas emissions in the 2010 EIS were primarily based on emissions from the diesel power generator stacks and mining equipment. Supplemental mitigation of the Fine PKC Facility would have a negligible effect on these estimates. More information on the greenhouse gas assessment for the Project is available in Section 11.13.3 of the 2010 EIS.

In the 2010 EIS (De Beers 2010), it was determined that all of the pathways for climate change had either no linkages (i.e., no connection between climate change and the Project) or minor (secondary) effects from the Project to the environment. Secondary pathways included:

- alterations to surface water runoff volumes and the site water balance;
- shorter operating season for the Winter Access Road and Tibbitt-to-Contwoyto Winter Road; and
- delay or prevention of permafrost development in the Fine PKC Facility, the mine rock piles, and the Coarse PK Pile.

Although climate change could alter the predicted effects of the Project on the environment for these secondary pathways, the change in the predicted effects was limited in magnitude and extent and would not alter the results of the impact classifications. Therefore, residual effects of climate change were not assessed in the 2010 EIS (De Beers 2010).

Potential changes to the site water balance that may be triggered by climate change were expected to be minor because changes in runoff are projected to be modest and well within the range of natural variation. While climate change may affect the duration of the winter road season, these changes would be difficult to distinguish from previous and existing year-to-year variability.

The assessments of potential effects in the 2010 EIS (De Beers 2010) have been completed assuming no permafrost was present within the Fine PKC Facility. Because predictions in the 2012 EIS Supplement related to the Fine PKC Facility also assumed conservatively that the processed kimberlite does not freeze, predicted effects of the Fine PKC Facility on Kennady Lake will not be dependent on the beneficial effects of freezing to reduce seepage. Therefore, effects predicted in the 2012 EIS Supplement will not be affected by climate change. Changes are expected to include a reduction in phosphorus loading to the lake and a reduction in the facility’s footprint.

Performance of the Fine PKC Facility under frozen ground conditions is being modelled separately from the 2012 EIS Supplement to predict realistic performance. These predictions will be used for site operational management; future monitoring data will be compared to these predictions as part of adaptive management.

12 SOCIO-ECONOMIC IMPACT ASSESSMENT

The purpose of the 2012 Environmental Impact Statement (EIS) Supplement is primarily to describe the supplemental mitigation of the Fine Processed Kimberlite Containment (PKC) Facility and resulting minor changes to mine waste management, and assess the biophysical effects of this mitigation. The supplemental mitigation described in the Project Description in this supplement is not expected to change social or economic conditions during the construction, operations, and closure and reclamation of the Project. The socio-economic costs and benefits of the mitigation of the Fine PKC Facility and related mine waste management are expected to be so similar to that assessed in Section 12 of the 2010 EIS (De Beers 2010) that the effect of the mitigation will be negligible. No further socio-economic impact assessment is considered necessary.

As part of the supplemental mitigation, Area A will be isolated from Kennady Lake. During construction and operations, excess surface runoff into the A watershed that would normally flow to Kennady Lake will be managed via a new pipeline to Lake J1b, which empties into Area 8 of Kennady Lake (locations shown on Section 1, Figure 1.3-2). Although the general effect of the supplemental mitigation will be to reduce the physical impact on Area A, the potential effects of the new pipeline on archaeological sites (Section 12.7.5.4 and Appendix 12.III of the 2010 EIS [De Beers 2010]) was reviewed. The actual route of the proposed pipeline has not been examined; however, the route is within the area around Kennady Lake in which a combination of helicopter, boat, and ground reconnaissance has been conducted. There are no recorded sites along this route. Therefore, the proposed pipeline will have no effect on archaeological resources.

13 CUMULATIVE EFFECTS

13.1 SUMMARY OF SECTION 13 BEFORE UPDATES

Cumulative effects are those effects that result from a combination of the Gahcho Kué Project (Project) with other past, present, and reasonably foreseeable future developments (Mackenzie Valley Environmental Impact Review Board 2004). Cumulative effects represent the sum of all natural and human-induced influences on the physical, biological, social, cultural, and economic components of the environment through time and across space. It is the goal of the cumulative effects assessment to estimate the contribution of these types of effects, in addition to Project effects, to the amount of change in the valued components of the biophysical, socio-economic, and cultural environments.

Not every Valued Component (VC) requires an analysis of cumulative effects. The key is to determine if the effects from the Project and one or more additional developments/activities overlap (or interact) with the temporal and spatial distribution of the VC. For some VCs, little or no potential exists for cumulative effects because little or no overlap occurs with other projects (e.g., aquatic environment). For other VCs that are distributed or travel over large areas and can be influenced by a number of developments (e.g., caribou and socio-economics), the analysis of cumulative effects can be necessary and important.

Potential cumulative effects were assessed for the socio-economic, aquatic, and terrestrial environments within the 2010 Environmental Impact Statement (EIS) following the same approach used for the Project-specific effects analysis, impact classification, and determination of significance (De Beers 2010, Section 6). In 2011, the need for supplemental mitigation was identified to address issues relating to potential phosphorus release associated with long-term storage of PK in the Fine PKC Facility. This section of the 2012 EIS Supplement reviews the 2010 cumulative effects assessments to identify any changes due to the supplemental mitigation.

Cumulative effects to the terrestrial environment were summarized in Section 13.5 of the 2010 EIS (De Beers 2010) relating to such valued components as caribou (Section 7; De Beers 2010), carnivores (Section 11.10), other ungulates (Section 11.11), and species at risk and birds (Section 11.12). In brief, cumulative impacts from the Project and other developments were not anticipated to have a significant negative influence on the persistence of caribou, carnivore, or other ungulate populations. In addition, it was predicted that the cumulative impacts from development should be reversible and not significantly affect the future persistence of bird and associated species at risk populations in the region. Subsequently, cumulative impacts from development were not predicted to have a significant adverse effect on continued opportunities for use by people of these various animals as part of their culture and livelihood. Section 13.5 of the 2010 EIS provides more details on cumulative effects of the Project on valued components of the terrestrial environment.

Cumulative effects to the aquatic environment from the Project were addressed in Section 13.6 of the 2010 EIS (De Beers 2010). Downstream Project effects to water quality, quantity, and fish and fish habitat were anticipated to be confined to the aquatic LSA. No prior or active developments were identified within the LSA. The only reasonably foreseeable development (i.e., Taltson Hydroelectric Expansion Project transmission line) anticipated to overlap with the Project was not expected to cause an additional (i.e., cumulative) effect beyond the predicted Project effects. All other existing and planned projects in the Northwest Territories are located outside the LSA. There is no opportunity for effluent releases from other projects to interact with those of the Project.

13.2 UPDATES TO SECTION 13

13.2.1 Overview of Changes

Table 13.2-1 identifies the subsections from Section 13 of the 2010 EIS (De Beers 2010) and specifies whether they are unchanged or updated within this 2012 EIS Supplement. If they are unchanged, the reader is directed to the 2010 EIS. For subsections that require updates, the changes are provided in the text that follows.

Table 13.2-1 Updated and Unchanged Subsections from Section 13

Section 13 from the 2010 Environmental Impact Statement		Updated in 2012	Reason for Update
13.1	Introduction	no	-
13.2	Approach to Cumulative Effects Assessment	no	-
13.3	Impact Assessment Methods	no	-
13.4	Development Database	no	-
13.5	Cumulative Effects to Valued Components of the Terrestrial Environment	yes	reduction in Project footprint
13.6	Cumulative Effects to Valued Components of the Aquatic Environment	yes	reduction in phosphorus loading to Kennady Lake and downstream waters
13.7	Cumulative Effects to Valued Components of the Socio-economic Environment	no	-

- = Subsection is unchanged and available in the December 2010 EIS (De Beers 2010).

13.2.2 Cumulative Effects to Valued Components of the Terrestrial Environment

The potential influence of the supplemental mitigation on the terrestrial environment has been evaluated in this 2012 EIS Supplement (Sections 7, 11.10, 11.11, and 11.12). The supplemental mitigation will reduce the size of the Fine PKC Facility and, therefore, the Project footprint, which will reduce the area of habitat affected by the Project. This minor change has resulted in no change to the 2010 EIS (De Beers 2010) classification of cumulative effects. No significant effects to the valued components of the terrestrial environment are predicted.

13.2.3 Cumulative Effects to Valued Components of the Aquatic Environment

The supplemental mitigation is expected to decrease the downstream aquatic effects of the Project. Specifically, the change in the Fine PKC Facility (mitigated) will reduce long-term phosphorus concentrations in Kennady Lake, which will reduce the projected concentrations of phosphorus in successive downstream waterbodies. The 2010 EIS (De Beers 2010) conclusion that, since downstream Project effects would be confined to the LSA, there will be no cumulative effects, remains unchanged.

13.2.4 Cumulative Effects to Valued Components of the Socio-economic Environment

Since the supplemental mitigation in 2012 does not change the assessment of the socio-economic environment reported in the 2010 EIS (De Beers 2010, Section 12), there is also no change to the socio-economic cumulative effects. Details on the cumulative effects to valued components of the socio-economic environment were provided in Section 13.7 of the 2010 EIS.

13.2.5 Conclusion

The cumulative effects of the Project on the terrestrial, aquatic, and socio-economic environments presented in Section 13 of the 2010 EIS (De Beers 2010) have not changed as a result of the supplemental mitigation.

14 SUMMARY AND CONCLUSIONS

This section provides a summary of the principal elements of the Gahcho Kué Project (Project) and predictions of the environmental impact of the Project taking into consideration the supplemental mitigation presented in this 2012 Environmental Impact Statement Supplemental Information Submission (2012 EIS Supplement). The assessment approach used in the EIS Supplement is unchanged from that used in the 2010 EIS (De Beers 2010) and 2011 EIS Update (De Beers 2011).

In brief, the Project is expected to have significant positive impacts on the economic environment, and positive and negative (but not significant) impacts on the social and cultural environments. The Project, given the supplemental mitigation, is predicted to not have significant adverse impacts on most components of the biophysical environment (e.g., groundwater and permafrost, hydrology, soils, vegetation, caribou and other wildlife). The cumulative effects of the Project on the terrestrial, aquatic, and socio-economic environments presented in Section 13 of the 2010 EIS (De Beers 2010) have not changed as a result of the supplemental mitigation.

Project Summary

- The Project is a new open-pit diamond mine and processing plant to be located at Kennady Lake, which is approximately 280 kilometres (km) northeast of Yellowknife, Northwest Territories (NWT). De Beers Canada Inc. (De Beers) will mine three kimberlite ore bodies (i.e., 5034, Hearne, and Tuzo) located under Kennady Lake.
- De Beers considered both scientific and traditional knowledge in planning the Project and incorporating environmental design features and mitigation measures to eliminate or reduce any potential harmful effects. These features include the supplemental mitigation presented herein, as well as Project design elements, environmental best practices, management policies and procedures, and social programs.
- In the 2010 EIS (De Beers 2010), the Fine PKC Facility involved storage of fine PK in both Area 1 and Area 2. The Fine PKC Facility's footprint has been reduced by omitting Area 1, which included Lakes A1 and A2 in the 2010 EIS. This reduction in size allowed for a reduction in the long-term phosphorus loadings from the facility. To identify this supplemental mitigation, the term "Fine PKC Facility (mitigated)" has been used in this supplement. With the footprint of the facility reduced to Area 2, the fine PK that was to be stored in Area 1 has been relocated to the 5034 and Hearne Pits. As a result of the supplemental mitigation of the Fine PKC Facility (mitigated), the size of the Project

footprint has decreased by about 83 ha compared to the footprint associated with the Project Description in the 2010 EIS.

- Within the 2010 EIS (De Beers 2010), the 5034 Pit would have contained only mine rock. As part of the supplemental mitigation, 1.5 Mt of fine PK is now anticipated to be deposited at the bottom of the 5034 Pit, which will be overlain by approximately 80 Mt of mine rock. Influences of placing the fine PK in the 5034 Pit on Kennady Lake surface water quality is expected to be negligible.
- In the 2010 EIS (De Beers 2010), reclamation of the Fine PKC Facility involved progressively covering both Area 1 and Area 2 with coarse PK and mine rock. As part of the supplemental mitigation of the Fine PKC Facility (mitigated), the coarse PK and mine rock that was to be used in reclamation of Area 1 will be transferred to the West Mine Rock Pile; this will resulted in an increase in the height of the West Mine Rock Pile. Within the 2010 EIS, the height of the West Mine Rock Pile was estimated at 70 m; given the supplemental mitigation, the height of this pile is now estimated at 94 m. The pile has been referred to as “West Mine Rock Pile (mitigated)” within this supplement to differentiate it from the pile in the 2010 EIS and 2011 EIS Update (De Beers 2011).
- The reduction in the size of the Fine PKC Facility (mitigated) involves a change in the diversion of water in Area 1. In the 2010 EIS (De Beers 2010), a permanent dam (Dyke C) would have been constructed to contain the fine PK in Area 1, raising the water level of Lake A3 and causing the water to flow northeast to the N watershed. However, as a result of the supplemental mitigation, Area 1 will be isolated from the Fine PKC Facility (mitigated) during operations and closure phases of the Project through the construction of a permanent saddle dam (Dyke A1) between Areas 1 and 2. Surface runoff into the A watershed will be managed by a discharging pipeline into Lake J1b, allowing water to flow to Area 8 of the Kennady Lake watershed.
- Since the supplemental mitigation introduced in 2012 does not change the Project’s critical power requirements, it does not alter the 2010 assessment of alternative energy sources. Further details on the subject of note for alternative energy sources are available in Section 11.3 of the 2010 EIS (De Beers 2010).
- The impact of the supplemental mitigation to roads and traffic will be negligible. Therefore, the effect of the supplemental mitigation on the predictions of the 2010 EIS (De Beers 2010) on traffic and road issues related to the aquatic environment, the terrestrial environment and related effects to people also will be negligible.
- Refinements to air quality modelling are currently underway for the Project and are not available at the time of submission of this 2012 EIS Supplement. The supplemental mitigation of the Fine PKC Facility involves a reduction in the facility’s footprint, and potentially less surface

area for dust emission. The effect of the supplemental mitigation is expected to be negligible compared to the reduction in particulate emissions determined by the ongoing modelling.

- The assessments of potential effects in the 2010 EIS (De Beers 2010) have been completed assuming no permafrost was present within the Fine PKC Facility. Because predictions in the 2012 EIS Supplement related to the Fine PKC Facility also assumed conservatively that the PK does not freeze, predicted effects of the Fine PKC Facility on Kennady Lake will not be dependent on the beneficial effects of freezing to reduce seepage. Therefore, effects predicted in the 2012 EIS Supplement will not be affected by climate change. Performance of the Fine PKC Facility under frozen ground conditions is being modelled separately from the 2012 EIS Supplement to predict realistic performance. These predictions will be used for site operational management; future monitoring data will be compared to these predictions as part of adaptive management.

Aquatic Impacts

The potential effects of changes to nutrient levels in the aquatic environment were presented in the 2011 EIS Update (De Beers 2011), which was an update to the 2010 EIS (De Beers 2010).

- The results of the assessments for permafrost, groundwater, and hydrogeology are unchanged given the supplemental mitigation presented within this document. The reader is directed to Section 11.6 of the 2010 EIS (De Beers 2010) for further information on these topics.
- Although the water balance for the Project was updated due to the change in the Project footprint and diversion of the A watershed associated with the supplemental mitigation, the results of the hydrological assessment are unchanged. Following closure, the hydrology of the reconnected Kennady Lake system is expected to be similar to existing conditions once Kennady Lake is refilled and Dyke A is removed. In the 2011 EIS Supplement (De Beers 2011), Lake A3 was permanently diverted to the N watershed; however, due to the supplemental mitigation associated with the Fine PKC Facility, the A watershed will be reconnected to Kennady Lake at closure.
- Based on the updated water quality modelling, maximum total concentrations for two metals (i.e., cadmium and copper) are projected to be higher than Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999) during the post-closure period. These metals have been measured in Kennady Lake above guideline concentrations under existing (baseline) environment conditions. All other water quality parameters are expected to be below CCME water quality guidelines and so will have a negligible effect on surface water

quality. In the 2011 EIS Update (De Beers 2011), chromium and iron were also predicted to be higher than guidelines.

- Based on the results of the revised water quality modelling, the aquatic health assessment predicted maximum concentrations of substances of potential concern in Kennady Lake and Area 8 are below chronic effects benchmarks, with the exception of total copper. However, the potential for adverse effects to aquatic organisms in Kennady Lake from copper is considered to be low, and residual effects to aquatic communities are still expected to be negligible.
- Similar to the 2011 EIS Update (De Beers 2011), in the aquatic health assessments, changes to water quality are predicted to have negligible residual effects to aquatic communities in Kennady Lake, Area 8, and downstream waterbodies (i.e., Lake N11 and Lake 410) under the assessed conditions.
- An evaluation of the water quality in Kennady Lake for the supplemental mitigation, incorporating the most recent results from ongoing and supplemental geochemical testing, indicates total phosphorus concentrations will be less than presented in the 2011 EIS Update (De Beers 2011) following refilling of Kennady Lake, with the trophic status returning to oligotrophic conditions. In the 2011 EIS Update, the lake was predicted to be more productive, with a change in trophic status to mesotrophic.
- Based on the updated nutrient predictions, lower trophic communities are expected to be more productive than baseline conditions, but to remain reflective of oligotrophic systems. In general, biomass of plankton and benthic invertebrates is expected to be higher in the refilled Kennady Lake compared to baseline. This may result in increased growth and production of the small-bodied forage fish species community. Due to the increased food base, there may also be increased growth and production in large-bodied fish species.
- The conclusions of the 2011 EIS Update (De Beers 2011) remain unchanged in that Kennady Lake during the post-closure phase of the Project is expected to retain sufficient levels of dissolved oxygen during winter to support fish, including sensitive species, such as lake trout. However, the dissolved oxygen modelling conducted for the supplement indicates that the overwintering habitat conditions in the refilled Kennady Lake will be less limiting than presented in the 2011 EIS Update.
- As per the 2011 EIS Update (De Beers 2011), the fish species assemblage (i.e., fish species present) within Kennady Lake is expected to be similar to pre-development conditions, including the re-establishment of large-bodied fish populations, such as, northern pike, Arctic grayling, burbot, round whitefish, lake trout, and possibly longnose sucker. Although all large-bodied fish species, including lake

trout, are expected to return to Kennady Lake, the relative abundances of the large-bodied fish species may change from baseline conditions. During the succession process, both abiotic and biotic factors may affect the final community structure.

- Although Kennady Lake at post-closure is predicted to return to oligotrophic conditions and not be mesotrophic, the time for the lower trophic communities and fish populations to develop and stabilize is expected to be similar under both scenarios (i.e., as described in the 2011 EIS Update [De Beers 2011]).
- Total phosphorus concentrations in the downstream watershed will also be less than presented in the 2011 EIS Update (De Beers 2011), with the lakes and streams in the L and M watersheds remaining oligotrophic in the long-term, compared to mesotrophic in the 2011 EIS Update. Although the overall biological productivity in the downstream watershed is expected to increase in comparison to the nutrient-limited pre-development conditions, changes to habitat suitability or availability (i.e., spawning habitat or winter dissolved oxygen levels) will be less than in the 2011 EIS Update.
- There are no changes to the evaluation of environmental significance compared to the 2011 EIS Update (De Beers 2011). The projected impacts on the suitability of water within the Kennady Lake watershed and downstream water bodies to support a viable and self-sustaining aquatic ecosystem, and on the abundance and persistence of Arctic grayling, lake trout, and northern pike are considered to be not environmentally significant for both Kennady Lake and its downstream watershed.
- The calculations of the habitat areas affected by the revised Project footprint will be included as part of the development of the detailed fish habitat compensation plan. The habitat compensation plan will be designed to create new fish habitat to offset predicted habitat losses so that there is no net loss of fish habitat. The detailed compensation plan will be developed in consultation with Fisheries and Oceans Canada (DFO), and with input from local communities.
- The determination in the 2010 EIS (De Beers 2010) of "no linkage" is unchanged in regard to the pathways from Project effects to the Hoarfrost and Lockhart rivers, and Great Slave Lake. Further details on the assessment of impacts to Great Slave Lake are available in Section 11.2 of the 2010 EIS.

Terrestrial Impacts

- Overall, the area of the Project footprint decreased from 1,235.4 ha in the 2010 EIS (De Beers 2010) to 1,152.8 ha in 2012. The resulting change in the area of the Project footprint is not expected to result in significant adverse impacts to the persistence of vegetation ecosystems and listed plant species, including the use of traditional plants.

- Given the supplemental mitigation, the dominant ecological landscape classifications classes that changed from the original EIS (De Beers 2010) include a decrease of 39.4 ha for upland classes, a decrease of 20.9 ha for wetland and riparian classes, and a decrease of 22.4 ha for the water class. This represents an overall reduction of disturbance by 82.6 ha within the local study area.

- Within the regional study area, the broad ecosystem unit classes that changed from the 2010 EIS (De Beers 2010), considering the operations case, include a decrease of 20.1 ha for upland classes, a decrease of 44.7 ha for wetland classes, and a decrease of 17.9 ha for water classes. This represents an overall reduction of disturbance by 82.6 ha within the regional study area.

- The change in Project footprint is not expected to result in a change to the findings for terrain and soil when compared to the 2010 EIS (De Beers 2010).

- The decrease in the area of disturbed caribou habitat in the local study area resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification from that in the 2010 EIS (De Beers 2010). The implications of this change to the annual and seasonal ranges of caribou were considered negligible. More specifically, impacts on the abundance and distribution of caribou from direct changes to habitat from the Project remain unchanged from the 2010 EIS, where they were expected to be negligible to low in magnitude, local to beyond regional in extent, and permanent. No significant effects on the abundance or distribution of caribou, or the continued opportunities for traditional and non-traditional use of caribou were predicted.

- The increase in height of the West Mine Rock Pile (mitigated) has not changed the determination in the 2010 EIS (De Beers 2010) of a negligible residual effect on the abundance and distribution of caribou populations.

- The decrease to the amount of disturbed habitat resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification, or the conclusion that the Project will not significantly affect the abundance and distribution of carnivores and “other” ungulates (e.g., non-caribou species). Subsequently, the supplemental mitigation will not alter the prediction that the Project will not significantly affect the continued opportunities for traditional and non-traditional use of carnivores and other ungulates, such as muskoxen and moose.

- The decrease in the amount of disturbed habitat resulting from the change to the Fine PKC Facility (mitigated) will not alter the impact classification, or the conclusion that the Project will not significantly affect the abundance or distribution of species at risk, upland breeding birds, water birds, and raptors. As a result, the Project is predicted to not significantly affect the continued opportunities for traditional and non-traditional use of these species.

- The Waste Management Plan will not be altered as a result of the supplemental mitigation introduced in 2012. Efforts to prevent wildlife from being attracted to the site will continue as before. Therefore, assessment results presented in the 2010 EIS (De Beers 2010) for this subject of note remain unchanged. The reader is directed to Sections 3.8 and 11.9 of the 2010 EIS for more information on this topic.

Socio-economic Impacts

- Engagement activities have been on-going during the environmental impact review process for the Project. However, because the supplemental mitigation associated with the deposition of fine PK and related Project activities evaluated within this 2012 EIS Supplement do not influence the content of Section 4 in the 2010 EIS (De Beers 2010), the content of Section 4 has not been revised within this document.
- The reader is directed to Section 5 of the 2010 EIS (De Beers 2010) for details relating to traditional knowledge and the Project. One slight change from the 2010 EIS concerning environmental design features relevant to the traditional knowledge has been noted in Section 5 of this supplement.
- The supplemental mitigation is not expected to change social or economic conditions during the various phases of the Project. The socio-economic costs and benefits of the mitigation of the Fine PKC Facility and related mine waste management are expected to be so similar to that assessed in Section 12 of the 2010 EIS (De Beers 2010) that the effect of the mitigation will be negligible. No further socio-economic impact assessment was considered necessary.

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16 ACRONYMS AND GLOSSARY

16.1 ACRONYMS AND ABBREVIATIONS

3-D	three dimensional
AG	acid generating
AN	ammonium nitrate
ANFO	Ammonium Nitrate Fuel Oil
AP	acid potential
ARD	acid rock drainage
ATOCA	Apprenticeship, Trade and Occupations Certification Act
BAF	bioaccumulation factor
BAGD	bare ground
BC	Scrub Birch – Bluejoint Shrub Tundra (riparian)
BE	Scrub Birch – Crowberry Tundra (upland)
BEAS	Bedrock Association (greater than 80% Bedrock)
BEU	Broad Ecosystem Unit
BF	Boulderfield (sparsely vegetated, upland)
BISE	Birch Seep (riparian)
BL	Scrub Birch – Labrador Tea Tundra (upland)
BOAS	Boulder Association (greater than 80% Boulders)
BR	Scrub Birch – Cloudberry Low Shrub Tundra (wetlands)
CA	Water Sedge – Narrow-leaved Cottongrass Fen (wetlands)
$CaCO_3$	calcium carbonate
CCME	Canadian Council of Ministers of the Environment
CE	Round-Fruited Sedge – Chamisso's Cottongrass Fen (wetlands)
CEB	chronic effects benchmark
CP	Collection Pond
CPR	Cardio Pulmonary Resuscitation
DBsa	De Beers Société Anonyme
De Beers	De Beers Canada Inc.
DEWA	Deep Water
DFO	Fisheries and Oceans Canada
DMS	dense-medium separation
DO	dissolved oxygen
DOC	dissolved organic carbon
e.g.	for example (Latin *exempli gratia*)
EA	Sheathed Cottongrass – Bog Rosemary Sedge Fen (wetlands)
EIR	Environmental Impact Review
EIS	Environmental Impact Statement
EIS Supplement	EIS Supplemental Information Submission
ELC	Ecological Landscape Classification

EM	Water Sedge – Horsetail Shallow Shore Marsh (wetlands)
ESCO	Esker Complex
et al.	group of authors
FA	Floating Aquatic (wetlands)
FTE	Full Time Equivalent
GEMSS®	Generalized Environmental Modelling System for Surface waters
h	hour
HADD	Harmful Alteration, Disruption or Destruction
HEBE	Heath / Bedrock (30 to 80% Bedrock)
HEBO	Heath / Boulders (30 to 80% Boulders)
HETU	Heath Tundra (less than 30% Rock)
HPGR	high pressure grinding rollers
HU	Habitat Unit
i.e.	that is [Latin *id est*]
INAC	Indian and Northern Affairs Canada
LA	Lake (open water)
LSA	Local Study Area
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
N	nitrogen
n/a	not applicable
NOEC	no observed effect concentrations
non-AG	non-acid generating
NWT	Northwest Territories
OHDW	Open Herb-Dominated Wetlands
OW	Shallow Open Water (open water)
P	phosphorus
PAG	potentially acid generating
PD	Pond (open water)
PE	Spruce – Lichen Woodland (upland)
PEBO	Peat Bog
PK	processed kimberlite
PKC	processed kimberlite containment
PLC	Public Limited Company
Project	Gahcho Kué Project
RB	Scrub Birch – Riparian Shrub
RO	Rock Outcrop (sparsely vegetated, upland)
ROM	run of mine
RP	Road (anthropogenic, upland)
RR	Camp (anthropogenic)
RSA	Regional Study Area
SEWE	Sedge Wetlands
SH	Willow – Sedge Low Shrub Fen (wetlands)

SHE	Safety, Health and Environment
SHWA	Shallow Water
SOD	sediment oxygen demand
SOI	substance of interest
SOPC	substance of potential concern
SPFO	Spruce Forest
SR	Willow – Nagoonberry Shrub (riparian)
SS	Saxifrage – Moss Campion Xerophytic Tundra (upland)
TASH	Tall Shrub (riparian)
TDS	total dissolved solids
Terms of Reference	Terms of Reference for the Gahcho Kué Environmental Impact Statement
TP	total phosphorus
TSP	total suspended particulate
TSS	total suspended solids
TUHU	Tussock-Hummock (Sedge Association)
UC	Unclassified
VC	Valued Component
WHMIS	Workplace Hazardous Materials Information System
WMP	Water Management Pond
WQG	water quality guidelines
YOY	young-of-the-year

16.2 UNITS OF MEASURE

%	percent
<	less than
>	greater than
°	degree
°C	degree Celsius
µg/L	micrograms per litre
cm	centimeter
dam^3	cubic decametres
g DO/m^2/d	grams of dissolved oxygen per square metre per day
ha	hectares
kg/t	kilogram per tonne
km	kilometre
km^2	square kilometre
kW	kilowatt
kW(e)	kilowatt electric
L	litre
m	metre
m/s	metres per second
m^2	square metre
m^3	cubic metre
m^3/a	cubic metre per annum
m^3/d	cubic metre per day
m^3/sec	cubic metre per second
m^3/y	cubic metre per year
masl	metres above sea level
mg N/L	milligrams nitrogen per litre
mg P/L	milligrams phosphorus per litre
mg/kg	milligram per kilogram
mg/kg ww	milligrams per kilogram wet weight
mg/L	milligrams per litre
mg/m^3	milligram per cubic metre
Mil	thousandth of an inch
mm	millimetre
Mm^3	million cubic metres
Mm^3/y	million cubic metres per year
Mt	million tonnes
MW	mega-watt
pH	concentration of hydrogen ions
t	tonne
t/d	tonne per day

t/hr	tonne per hour
t/m^3	tonne per cubic metre
wt%	percent by weight

16.3 GLOSSARY

Abiotic	Non-living factors that influence an ecosystem, such as climate, geology, and soil characteristics.
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.
Acidification	The decrease of acid neutralizing capacity in water, or base saturation in soil, caused by natural or anthropogenic processes. Acidification is exhibited as the lowering of pH.
Active layer	The layer of ground above the permafrost that thaws seasonally during the summer and refreezes in the fall.
Acute	A stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96 hours or less is typically considered acute. When referring to aquatic toxicology or human health, an acute effect is not always measured in terms of lethality.
Alberta Environment (AENV)	Provincial ministry that looks after the following: establishes policies, legislation, plans, guidelines and standards for environmental management and protection; allocates resources through approvals, dispositions and licenses, and enforces those decisions; ensure water infrastructure and equipment are maintained and operated effectively; and prevents, reduces and mitigates floods, droughts, emergency spills and other pollution-related incidents.
Alkalinity	A measure of water's capacity to neutralize an acid. It indicates the presence of carbonates, bicarbonates and hydroxides, and less significantly, borates, silicates, phosphates and organic substances. Alkalinity is expressed as an equivalent of calcium carbonate. Its composition is affected by pH, mineral composition, temperature and ionic strength. However, alkalinity is normally interpreted as a function of carbonates, bicarbonates and hydroxides. The sum of these three components is called total alkalinity.
Ammonium nitrate fuel oil (ANFO)	A widely used explosive mixture.
Anthropogenic	Pertaining to the influence of human activities.
Armouring	Protecting a channel from erosion by covering with protective material.
Backfilling	Using material to refill an excavated area.
Background	An area not influenced by chemicals released from the site under evaluation.
Barren kimberlite	Non-diamond bearing kimberlite.
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.
Benthic invertebrates	Invertebrate organisms living at, in or in association with the bottom (benthic) substrate of lakes, ponds and streams. Examples of benthic invertebrates include some aquatic insect species (such as caddisfly larvae) that spend at least part of their lifestages dwelling on bottom sediments in the waterbody. These organisms play several important roles in the aquatic community. They are involved in the mineralization and recycling of organic matter produced in the water above, or brought in from external sources, and they are important second and third links in the trophic sequence of aquatic communities. Many benthic invertebrates are major food sources for fish.
Biochemical Oxygen Demand (BOD)	An empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of wastewaters, effluents and polluted waters.

Bioconcentration	A process where there is a net accumulation of a chemical directly from an exposure medium into an organism.
Biophysical	The biological (e.g., plants, animals) and physical (e.g., air, water, soil) components of the natural environment.
Bioremediation	Use of microorganisms or their enzymes to return soil altered by contaminants back to its original condition.
Biotic	Living components of an ecosystem.
Bog	A peat-covered area or peat-filled wetland. The water table is at or near the surface. The surface is often raised, or level with the surrounding wetlands, and is virtually unaffected by the nutrient-rich groundwaters from the surrounding mineral soils. Hence, the groundwater of the bog is generally acid and low in nutrients. The dominant peat materials are sphagnum and forest peat underlain, at times, by fen peat. The associated soils are Fibrisols, Mesisols, and Organic Cryosols. Bogs may be treed or treeless and they are usually covered with Sphagnum and feather mosses, and ericaceous shrubs.
Boulder	A large rounded mass of rock lying on the surface of the ground or embedded in the soil.
Breccia	A fragmental rock whose fragments are angular.
Catchment	An area of land where water from precipitation drains into a body of water.
Chronic	The development of adverse effects after extended exposure to a given substance. In chronic toxicity tests, the measurement of a chronic effect can be reduced growth, reduced reproduction or other non-lethal effects, in addition to lethality. Chronic should be considered a relative term depending on the life span of the organism.
Chronic effects benchmarks	Water concentration above which changes to aquatic health could occur on the scale of individual organisms.
Coarse kimberlite	Coarse kimberlite particles range in size from 1.0 mm to 6 mm.
Cumulative effects	Cumulative effects are those effects that result from a combination of the Project with other past, present, and reasonably foreseeable future developments.
Degrit	A degrit module consists of cyclones that separate the fine kimberlite (less than 0.25 mm) from the grits (greater than 0.25 mm but less than 1.0 mm).
Diabase	A dark coloured, fine to medium-grained igneous intrusive rock.
Dissolved Organic Carbon (DOC)	The dissolved portion of organic carbon water; made up of humic substances and partly degraded plant and animal materials.
Dissolved Oxygen (DO)	Measurement of the concentration of dissolved (gaseous) oxygen in the water, usually expressed in milligrams per litre (mg/L).
Downstream	Away from the source of a river or stream.
Dyke	A levee, a natural or artificial slope, or wall to regulate water levels.
Ecological Landscape Classification (ELC)	An ecological mapping process that involves the integration of site, soil, and vegetation information.
Ecoregion	Subdivisions of ecozones that are relatively homogeneous with respect to soil, terrain, and dominant vegetation.
Ecozone	Broad geographical unit defined according to general climate, vegetation, and terrain conditions.
Entrainment	The entrapment of one substance by another substance.
Esker	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.

Eutrophic	The nutrient-rich status (amount of nitrogen, phosphorus and potassium) of an ecosystem.
Fen	A wetland, covered or filled with fen peat, having a high water table, which is usually at or above the surface.
Fetch	An area of a waterbody where waves are generated by a wind having a constant direction and speed (also called Generating Area).
Fine processed kimberlite	Fine processed kimberlite material with a particle size that smaller than 0.25 mm.
Fines	Silt and clay particles.
Finger reef	A reef constructed for the purpose of creating high value fish habitat. These reefs are configured to be somewhat irregular in size and shape and relatively long and narrow. Longer and narrower reefs have more “edge” habitat. Edges are important to fish that feed in one habitat type and rest or seek refuge in another.
Flocculant	Chemicals that promote flocculation by causing colloids and other suspended particles in liquids to aggregate, forming a floc.
Forage fish	Small fish that provide food for larger fish (e.g., lake chub, fathead minnow).
Freeboard	The distance between the water level and the top of a containing structure such as a dyke crest or channel top of bank.
Freshet	Seasonal surface runoff associated with spring melt.
General fill	Rock not graded as to size or quality.
Glacial till	Unsorted and unstratified glacial drift (generally unconsolidated) deposited directly by a glacier without subsequent reworking by water from the glacier. Consisting of a heterogeneous mixture of clay, silt, sand, gravel and boulders (i.e., drift) varying widely in size and shape.
Granular fill	Screened and sized rock material for earthworks/construction.
Grits	Processed kimberlite particles between 0.25 mm and 1.0 mm in size.
Grizzly	A grating, usually constructed of steel rails to separate coarse material from plant feed.
Groundwater	That part of the subsurface water that occurs beneath the water table, in soils and geologic formations that are fully saturated.
Habitat	The place or environment where a plant or animal naturally or normally lives or occurs.
Habitat fragmentation	A process by which habitats are increasingly subdivided into smaller units, resulting in their increased restriction as well as an overall loss of habitat area and biodiversity.
Heat-traced pipes	Piping with electric heating elements to prevent freezing.
Humidity cell	A type of kinetic test in which a small sample (about 1 kg) is placed in an enclosed chamber in a laboratory, alternating cycles of moist and dry air is constantly pumped through the chamber, and once a week the sample is rinsed with water; chemical analysis of rinse water yields concentrations of elements and other parameters used to calculate reaction rates.
Hydraulic gradient	The difference in piezometric level or hydraulic head between two points over a change in distance in the direction, which yields the greatest change in hydraulic head.
Hydrocarbons	Oil based products.
Hydrology	The science of waters of the earth, their occurrence, distribution, and circulation; their physical and chemical properties; and their reaction with the environment, including living beings.

Infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project, or community to function.
Key Line of Inquiry	Topics of the greatest concern that require the most attention during the environmental impact review process, and the most rigorous analysis and detail in the EIS.
Kimberlite	Igneous rocks that originate deep in the earth's mantle and intrude the earth's crust. These rocks typically form narrow pipe-like deposits that sometimes contain diamonds.
Landfarm	Facility that contains soil during bioremediation.
Littoral	The shallow, shoreline area of a lake.
Make-up water	The process water required to replace that lost by evaporation or leakage in a closed-circuit, recycle operation.
Map unit	A combination of kinds of soil, terrain, or other feature that can be shown at a specified scale of mapping for the defined purpose and objectives of a particular survey.
Meromictic	Characterization of a lake where two disctint water layers are present within the water column that are permanently stratified (by temperature, for example) and, therefore, do not mix completely throughout the basin.
Mesotrophic	Trophic state classification for lakes characterized by an intermediate level of productivity and nutrient inputs, i.e., their productivity is greater than oligotrophic lakes, but less than eutrophic lakes.
Mine rock	Excavated bed rock surrounding the kimberlite deposits. Mine rock consists primarily of granitic rock material.
Mineralization	Diamond bearing material.
Monimolimnion	Lower dense stratum of a meromictic lake that does not mix with waters above it.
Muskeg	A soil type comprised primarily of organic matter. Also known as bog peat.
Oligotrophic	Trophic state classification for lakes characterized by low productivity and low nutrient inputs (particularly total phosphorus).
Open-pit mine	A mine where rock or mineral extraction from the earth is done using a pit or borrow open to the surface, rather than using a tunnel into the earth.
Ore body	An accumulation of ore, which is a type of rock that contains minerals with important elements that are typically mined.
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.
Overwintering	To pass through, or wait out the winter season; generally applied in this supplement to fish and the habitat where fish live during the winter.
Peat	A deposit consisting of decayed or partially decayed humified plant remains. Peat is commonly formed by the slow decay of successive layers of aquatic and semi-aquatic plants in swampy or water-logged areas, where oxygen is absent.
Pelagic	Inhabiting open water, typically well off the bottom. Sometimes used synonymously with limnetic to describe the open water zone (e.g., large lake environments).
Permafrost	Permanently frozen ground (subsoil).
pH	The degree of acidity (or alkalinity) of soil or solution. The pH scale is generally presented from 1 (most acidic) to 14 (most alkaline). A difference of one pH unit represents a ten-fold change in hydrogen ion concentration.
Pipes/kimberlite pipes	Typically vertical structures of volcanic rock in the Earth's crust that can contain diamonds.

Plant phenology	The study of periodic plant life cycle events and how these are influenced by seasonal and interannual variations in climate.
Potable water	Water that is suitable for drinking.
Potentially acid generating	Rock with a ratio of neutralizing potential to acid potential (NP:AP) of less than 3 as determined by static tests.
Process Water	Water used for processing kimberlite ore to remove diamonds or to carry fine processed kimberlite as a slurry to surface PKC facilities or backfilled mine pits.
Processed kimberlite	The material that remains after all economically and technically recoverable diamonds have been removed from the kimberlite during processing.
Processed kimberlite containment	On-site storage facility for storing processed kimberlite.
Propagules	Root fragments, seeds, and other plant materials that can develop into a plant under the right conditions.
Pycnocline	The layer of water with the highest density gradient between the two waters of varying density.
Reagent	A substance or compound that is added to a system to bring about a chemical reaction or is added to see if a reaction occurs.
Rearing	Raising of offspring, particular at the early stages of development.
Riparian	Refers to terrain, vegetation or simply a position next to or associated with a stream, floodplain or standing waterbody.
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.
Run-of-mine	Not graded according to size or quality.
Sediment	Solid material that is transported by, suspended in, or deposited from water. It originates mostly from disintegrated rocks; it also includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope soil characteristics, land usage, and quantity and intensity of precipitation.
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.
Soil	The naturally occurring, unconsolidated mineral or organic material at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth. Soil extends from the earth's surface through the genetic horizons, if present, into the underlying material, normally about 1 to 2 m. Soil development involves climatic factors and organisms, conditioned by relief and water regime, acting through time on geological materials.
Spawning	The process of aquatic animals releasing eggs and sperm.
Subject of Note	Issues that require serious attention and substantive analysis as defined by the Terms of Reference (Gahcho Kué Panel 2007).
Sub-watershed	A smaller portion of a watershed containing a drainage area that is connected to the larger portion by a single channel.
Succession	The progressive replacement of one dominant type of species or community by another in an ecosystem until a stable climax community is established.
Sumps	A well or pit in which liquids collect below floor level.
Talik	A layer of year-round unfrozen ground that lies in permafrost areas.

Terrain	The landscape or lay of the land. The term comprises specific aspects of the landscape, namely genetic material, material composition, landform (or surface expression), active and inactive processes (e.g. permafrost, erosion) that modify material and form, slope, aspect, and drainage conditions.
Thermistors	An instrument used to measure temperature.
Till	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 (TDS)	The sum of the concentration of all major dissolved materials found in a water sample.
Total Organic Carbon (TOC)	Total organic carbon is composed of both dissolved and particulate forms. Total organic carbon is often calculated as the difference between Total Carbon (TC) and Total Inorganic Carbon (TIC). Total organic carbon has a direct relationship with both biochemical and chemical oxygen demands, and varies with the composition of organic matter present in the water. Organic matter in soils, aquatic vegetation and aquatic organisms are major sources of organic carbon.
Total suspended solids (TSS)	The amount of suspended particulate material 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.
Toxic	A substance, dose or concentration that is harmful to a living organism.
Trace metals	Metals in extremely small quantities, which are ultimately present in the cells and tissues of animal and plant cells. Examples include arsenic, chromium, cobalt, copper, iron, lithium, magnesium, manganese, molybdenum, nickel, vanadium, selenium, and zinc.
Trophic	Pertaining to part of a food chain, for example, the primary producers are a trophic level just as tertiary consumers are another trophic level.
Tundra	Treeless terrain, with a continuous cover of vegetation, found at both high latitudes and high altitudes. Tundra vegetation comprises lichens, mosses, sedges, grasses, forbs and low shrubs, including heaths, and dwarf willows and birches. The term is used to refer to both the region and the vegetation growing in the region.
Turbidity	The cloudiness or haziness of a fluid caused by individual particles (suspended solids) in water that are generally invisible to the naked eye.
Utilidors	A utility corridor built underground or aboveground to carry utility lines such as electricity, water and sewer.
Valued Components	Valued components represent the physical, biological, cultural, social, and economic properties that society considers to be important.
Watershed	The entire catchment area of runoff containing a single outlet.
Young-of-the-year (fish)	Fish at age 0, within the first year after hatching.