Mackenzie Valley Land and Water Board Staff Draft Preliminary Screening Document

Giant Mine Remediation Project (GMRP) has provided a Preliminary Screening Document that includes an outline and assessment of 16 "modifications" and 3 potential "modifications" to closure activities since the Report of Environmental Assessment and Reasons for Decisions was issued (EA0809-001). If EA0809-001 was not inclusive of the "modifications" identified by GMRP, the Mackenzie Valley Land and Water Board (MVLWB or the Board) staff will recommend that these Project changes be screened by the Board. To better understand which "modifications" are Project changes, Board staff have completed a Draft Preliminary Screening Document. The Board will also consider reviewer comments and recommendations about Project changes, in addition to comments and recommendations about impacts and mitigation measures identified in the Post-EA Information Package that relate to Project changes (including relationships between Project changes and the rest of the Project).

List of reference documents

CRP – Giant Mine Remediation Project Closure and Reclamation Plan (January 2019)
DAR – Giant Mine Remediation Project Developer's Assessment Report (October 2010)
EA – Report of Environmental Assessment and Reasons for Decision – Giant Mine Remediation Project - EA0809-001 (June 2013)
Planned Minewater Level Raise RRP – Giant Mine Remediation Planned Minewater Level Raise Reclamation Research Plan (January 2019)
PS document – Giant Mine Remediation Project Preliminary Screening Document (January 2019)
UPD document – Giant Mine Remediation Project Updated Project Description (January 2019)

Notes

aligns with Modification #'s used in the Giant Mine Remediation Project Preliminary Screening Document
Measures and Suggestions referenced can be found in the Giant Mine Remediation Project Updated Project Description (January 2019) (p34-40)

#	Modification / Project Change	EA Scope of Activities	Activity addressed in EA process?	Mitigations discussed in EA process?	Magnitude of Modification / Project Change	Board Staff Conclusion
1.	Implement a passive freeze system, using a dry method (i.e., a frozen shell).	1. Immobilization of arsenic trioxide through ground freezing (the frozen block or frozen shell method)	-At the time of EA there were still some unknowns with regards to the freeze system (e.g. if active freezing may be required, if only a frozen shell would be required vs. a completely frozen chamber) (EA p156 - p157). -The Wetting Study (Appendix 5.2A Supporting Document I Frozen Block Wetting Studies) was not complete at the time of the Mackenzie Valley Environmental Impact Review Board (MVEIRB) public hearing, but initial results found wetting the	-Contingency Actions were included for a long-term passive freeze maintenance phase (e.g. investigate causes; replace defective components; modify the ground surface to reduce heat flux, etc.) (DAR p6-44). -"Installation and Operation of Freeze System" effects on changes to existing hydrology, minor operational releases, suspended solids (air), combustion emissions, noise emissions, surface disturbances, community	**Similar / slightly smaller** -Following suggestions from the EA process and findings from the Freeze Optimization Study, the frozen block method was modified by removing the need for freeze pipes underneath the chambers and stopes and eliminating the need to wet the dust within them (keeping the dust dry facilitates potential future extraction if alternative technologies evolve to better manage the dust – this supports Measure 19) (CRP p5-43).	Impacts appear to have been assessed previously. ***Do not include in the preliminary screening scope.***

			dust to be a higher risk option compared to keeping the dust dry (EA p157). -The Developer had not begun discussions with Parties comparing the wet and dry methods at the time of EA (EA p157). -Measure 18 was developed to acceptably mitigate risks associated with freezing the arsenic trioxide dust. -Measure 19 was developed to ensure future reversibility.	effects listed, along with associated mitigations were included in the DAR (DAR p8-7 – 8-122).	-GMRP concludes that this is a confirmation of method, as both the passive and dry method were discussed in EA (PS document p11).	
2. – 4.	Pits -Backfill open pits fully or partially; water diversions/berms and scour protection materials will be installed when needed to reduce risk of water from Baker Creek entering pits. -Engineered covers will be installed where needed to protect underground water quality/quantity. -Place contaminated soils in A1 Pit (with possible placement in B2 Pit if needed). -Re-contour A1 and A2 Pit highwalls.	7. Reclamation of open pits	-Remediation options that were considered for the pits included: backfilling and covering; allowing flooding to form full depth pit lakes; and partially backfilling and flooding to form shallow pit lakes or wetlands. It was decided that a combination that would make use of limited backfill and reduce physical hazards would be used (DAR p6-51- p6-52). -"A combination of remedial actions will take place with the open pits, ranging from remaining open with physical barriers to prevent access to completely backfill with clean fill or a blend of clean fill, waste rock, and contaminated soils" (EA p11).	-For the discussion of method selection, alternatives and preferred alternative in the DAR it was acknowledged that if backfilling were to occur tailings and contaminated soil would need to be used and measures to limit arsenic would be included in the backfill design (DAR 6-52). -For B1 Pit, a security fence to protect the long-term freezing system and human/wildlife interactions was proposed, as well as a cover similar to the cover proposed for the tailings ponds for the SW area beyond the fence (EA p165). -Backfill in B1 Pit would be compacted to prevent	**Larger (backfill open pits fully or partially) / similar** -It is currently proposed that more (all) pits will be filled. One, possibly two, more pits (besides B1) will be filled with contaminated soil. Specifically, A2, C1, B2, and B3 Pits will be filled with clean borrow material sourced and produced from site, while contaminated soil recovered from site will be used to fill A1 and B1 Pits. There is a possibility that B2 Pit will also be used to place contaminated material, if additional capacity is necessary (CRP p5-77). -The material in A1 and B2 (if applicable) Pits would have lower arsenic	Impacts related to water diversions/berms and use of scour protection material, as well as the use of engineered covers, and re-contouring A1 and A2 Pit highwalls appear to have been assessed previously (mitigations assessed for "Earthworks"). The Board's Preliminary Screening will encompass the increase to Geographic Scope associated with re-contouring A1 Pit and A2 Pit highwalls. Board staff recognize that filling pits was discussed during Surface Design Engagement (SDE) and that many participants of SDE voiced support for

			-"The Developer does not propose to completely backfill all open pits because there is not enough low point building material available to fill them" (EA p163). -Table 11.1 Summary of Open Pit Disposition in the EA indicates that Brock and B1 Pits were to be backfilled (Brock with ~6,000 m^3 of local clean material and B1 with ~330,000 m^3 of clean rock and contaminated soil); backfilling was to potential occur at C1, but not in any other pits (EA p164). -"Partial backfilling of the [C1] Pit to form a slope below the re-routed Baker Creek may be required" (DAR p6-55). -During EA YKDFN expressed that all pits should be filled and a measure which required this should be created (EA p165). Suggestion 13 was created to address this concern. -Reviewers expressed concerns about design, goals, and performance of the pit cover due to the proposed deposit of arsenic-contaminated material into B1 Pit (EA p165). -Pit wall stability was discussed in the DAR; an	differential settlement which could damage the freeze pipes and reduce the hydraulic conductivity of the material; before placing contaminated soil, the voids between the crown pillars and arsenic trioxide dust area were to be stabilized (DAR p 6-53). -Contingencies and Adaptive Management were listed for open pits. If settlement of backfill in B1 Pit occurred, the pit would be remediated (regrading or placing additional material) as part of the regular maintenance; stability of all remaining pit walls were to be monitored and damage to berms or fences repaired; freeze pipes would be replaced as necessary if the settlement caused damage (DAR 6-55). -In the DAR Earthworks (including Borrow and Backfill) effects on erosion and sedimentation, changes to existing hydrology, increased turbidity in water, permafrost degradation, suspended solids (air), combustion emission, noise emissions, surface disturbances, community effects listed, along with associated mitigations	contamination and will not be frozen, unlike B1 (PS document p13). -"An increase in the same impacts are anticipated in full or partial filling of additional pits on site (Pits A1, A2, B2, B3, and B4)" (PS document p12). -Backfilling pits could result in geotechnical stability issues under pits, and settlement of materials. Although the general topic of differential settlement of backfill in the B1 Pit was discussed in the DAR (p6-53), additional mitigation methods for pit filling and stabilization of underground stopes to minimize these impacts are outlined in the PS document (p12). -These activities will require additional borrow material. There are associated impacts and mitigations with regards to this additional borrow (see Modification / Project Change #14 "Expansion of onsite borrow areas for required rock material"). -Engineering covers may be placed over filled pits, when needed to protect underground water quality (PS document p32). -"Recontouring highwalls will address potential	the option to backfill pits (PS document p12). However, impacts related to placing arsenic contaminated material in an unfrozen pit do not appear to have been fully assessed in EA. The impacts related to geotechnical stability may also not have been fully considered. ***Include in the preliminary screening scope:*** **Remediation of open pits by backfilling (fully or partially) with clean borrow material sourced and produced from site, or with contaminated material and a layer of clean borrow material placed over the contaminated material.**

			investigation had indicated that A1 Pit had experienced some sloughing. At A1, A2, B1 and C1 Pits tension cracks were evident. Subsistence areas were occurring in C1 and B3 Pits (DAR p5-39).	were included (DAR p8-7 – 8-122). -As the engineered cover design for pits was similar to the proposed tailings cover, similar mitigations were listed for "Earthworks", specifically "contour and cap tailings" (DAR p8-7 – 8-122).	issues with stability in the pit rims for A1 and A2 pits as identified in the DAR" (PS document p14). -Impacts [of re-contouring A1 Pit and A2 Pit highwalls] will be similar to the impacts noted in Modification / Project Change #14 (i.e. dust, noise, and topographic changes) (PS document p14).	
5.	Excavate contaminated sediments in Baker Creek bed and banks down to bedrock or underlying native soils to reduce arsenic loadings to receiving environment.	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials") / Rehabilitation of Baker Creek	-"…a final determination has yet to be made regarding whether removing and/or covering contaminated sediments will outweigh the disruptions to current biological functions… Additional studies are planned to assess these unknowns" (DAR p6-88). -Based on what was known at the time, remediation options included removal of contaminated sediments in Reaches 2, 6, 5 (DAR p6-88 – p89).	-Contingencies and Adaptive Management sections of the DAR indicated that if it was decided to remove the contaminated sediments from the specified reaches, a detailed series of excavation, sediment control and contaminant control plans would be required (DAR p6-89). -In the DAR effects associated with Earthworks: Baker Creek Rehabilitation (including minor operational releases, increased turbidity in water, mobilization of contaminants, erosion and sedimentation, disturbance of existing sediments, changes to existing hydrology, permafrost degradation, suspended solids (air), combustion emissions, noise emissions, surface	**Larger** -During the EA process, the Developer was unsure if they would remediate any contaminated sediments in Baker Creek (i.e. volume unknown). -The CRP indicates that contaminated sediments will be removed from Baker Creek Reaches 0 through 6 and disposed of in the TCAs, with a volume of contaminants indicated to be 119,500 m^3 (Table 5.4-1) (CRP p5-80).	Despite the larger magnitude, the impacts of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***

				disturbances, community effects) and associated mitigations were included (DAR p8-7 – 8-122).		
6.	Remediate Townsite/Marina area soils to residential standards.	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials")	- "…the former Giant Mine town-site will be remediated to industrial standards" (DAR p11-14). - "The City of Yellowknife emphasized the need to remediate, at least the area of the Townsite, to residential standards." Reasons: the Townsite has been traditionally used for residential purposes; there is overcapacity of industrial land in the City; the City would like to reclaim the land for future residential development (EA p166). -The MVEIRB decided this decision was outside the scope of EA. The GMRP agreed to work together with the City to determine whether this was possible (PS document p15; EA p167).	-"All areas that have been stripped of contaminated surface materials will be contoured to promote positive drainage. Drainage pathways will be covered with at least 0.5 m of clean, fine-grained fill to provide a physical barrier…" (DAR 301). -In the DAR, Earthworks: excavation of contaminated soils effects (including erosion and sedimentation, changes to existing hydrology, increased turbidity in water, mobilization of contaminants, permafrost degradation, suspended solids (air), combustion emissions, noise emissions, surface disturbances, and community effects) are identified, and associated mitigations were included (DAR p8-7 – 8-122).	**Larger** -"Impacts in remediation to residential standards are anticipated to be similar as the activities have not changed, with the potential for some increases in dust and erosion, as the extent of remediation efforts will be increased to reach an improved soils quality standard and therefore the amount of soils to be removed will increase" (PS document p15).	Despite the larger magnitude, the impacts of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***
7.	Partial excavation and covering of Shoreline Lands including shoreline soils and near-shore sediments along townsite area, to foreshore tailings cover.	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials")	-"Remediation of the shoreline lands was not discussed during the DAR" (PS document p16).	-"The historic foreshore tailings area will be stabilized using geotextile and riprap below the lake surface" (EA p11). DFO supported this method (EA p170) but recommended that the Developer complete a fish habitat assessment in	**Larger** -The proposed remediation plan assessed during EA included stabilizing the beached tailings by extending the existing geotextile and rip-rap cover below the lake surface to cover the tailings where they	The impacts assessed previously were for covering the foreshore tailings. However, impacts specifically associated with excavating shoreline soils and near-shore sediments along the townsite (adjacent to

				Yellowknife Bay area of the historic tailings (Suggestion 14) and outline measures to mitigate any adverse impacts to fish and fish habitat during construction of the cover through the environmental management plan (EA p170). -In the DAR Earthworks: contour and cap tailings effects (including increased turbidity in water, mobilization of contaminants, disturbance of existing sediments, erosion and sedimentation, changes to existing hydrology, suspended solids (air), combustion emissions, noise emissions, surface disturbances, community effects) and associated mitigations were included (DAR p8-7 – 8-122).	occurred in the littoral zone (DAR p6-67). -The remediation of ~40,000 m^3 of contaminated fine-grained soil will be completed in the Shoreline Lands using specialized and conventional remedial techniques. Specialized techniques are required due to the rugged and steep bedrock dominated terrain (CRP p5-104). -Approximately 10, 000 m^3 of contaminated sediment located immediately adjacent to the shoreline is anticipated to be excavated to allow the engineered cover to be installed over the remaining nearshore sediment (CRP p5-105).	Yellowknife Bay) do not appear to have been fully assessed. ***Include in the preliminary screening scope:*** **Partial excavation of Shoreline Lands including shoreline soils and near-shore sediments along the townsite area, to the foreshore tailings cover.**
8.	Expansion of remediation efforts of tailings impacted soil down-gradient of Dam 3 to industrial standards.	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials")	-"Remediation of a small area of contaminated soils north of Dam 3 was identified in the DAR" (PS document p17). -Table 5.10.1 Estimated Volume of Material with Arsenic Above the NWT Industrial Level in the DAR identifies 800 m^3 of tailings east of Dam 3 (DAR p5-66). -"Seepage from Dam 3 and 11 at the NE end of the	-In the DAR mitigations of effects were discussed for Earthworks: excavation of contaminated soils (including erosion and sedimentation, increased turbidity in water, mobilization of contaminants, changes to existing hydrology, permafrost damage, suspended solids (air), combustion emissions,	**Larger** -"The environmental impacts from implementation of remediation activities in this area were assessed in the DAR and not found to be of significant environmental concern; while the level of effort and therefore the volume of soils to be remediated has increased, the GMRP	The Board's Preliminary Screening will encompass the increase to Geographic Scope associated with expanding the remediation efforts of tailings impacted soil down-gradient of Dam 3 to industrial standards. Despite the larger magnitude, the impacts

			covered North Pond will be monitored and, if required, the seepage waters will be directed underground for subsequent treatment" (DAR p14-33). -"Seepage through or under Dam 3 has been a concern in the past. Two small dams, known as 3C and 3D, were constructed to contain the seepage downstream of Dam 3 and allow it to be pumped back to the North Pond" (DAR p5-44). -The EA considered contaminated surface materials in a broad sense. (EA p178).	noise emissions, surface disturbances, community effects) (DAR p8-7 – 8-122).	Team believes appropriate mitigations will minimize environmental impacts" (PS document p17). -"Some remediation of contaminated soils in this area was identified and assessed in the DAR; additional efforts in this area would increase the potential from dust, erosion and sedimentation in the direction of Yellowknife River, if not properly mitigated" (PS document p17).	of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***
9.	Fence forested terrain, wetlands, and bedrock areas to encompass area most impacted by roaster emission fallout, a radius of approximately one kilometer from the roaster.	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials") as the DAR (p2-3) noted that: "management of contaminated soils will not necessarily involve removal from site" 8. Ongoing maintenance, monitoring, and management	-"The areas identified as having arsenic concentrations exceeding the industrial land use criterion will be excavated or covered with clean material" (DAR p6-89). These areas are shown on Fig 5.10.1 (DAR p5-62). The fenced area proposed currently encompasses some areas (e.g. around the Mill/roaster area) where it was previously intended that soil would be removed or covered. -"With regard to potential exposures to contaminants, the Roaster Complex area is fenced to keep people from inadvertently coming in contact with the arsenic	-It is possible that mitigations for the fence could have been identified under the impacts associated with Earthworks: site access and preparation. However, nowhere in the tables with effects and mitigations (DAR p8-7 – 8-122) is there anything specifically about effects of fences (e.g. habitat loss).	**Larger / activity is new** -The DAR discussed use of fences to limit access to certain areas of the site, but the area in the DAR is much different to that being proposed in the CRP (PS document p18) and impacts and mitigations specifically related to the activity of using fencing as a replacement to excavating soil is not included in the DAR.	The Board's Preliminary Screening will encompass the increase to Geographic Scope associated with fencing the 1 km radius around the former Roaster stack. The impacts of this activity do not appear to have been fully assessed previously. ***Do include in the preliminary screening scope:*** **Fence forested terrain, wetlands, and bedrock areas of the remediation site impacted by roaster emission fallout that has**

			trioxide dust that remains in and around the roaster building…" (DAR p5-73). -Throughout the DAR, the use of fences (that were being used and were to be established for the remediation project) were discussed to address issues of public safety (around open pits, explosives storage areas, electrical installations, openings to underground, areas with elevated contaminant concentrations, the holding pond, and arsenic trioxide storage areas and associated infrastructure). -In the EA, there was no specific discussion about using fences around contaminated soil instead of excavation.			**contaminated surficial materials.**
10.	Place a coarse rock cover with a geosynthetic liner over tailings ponds.	4. Capping of tailings areas	-"Tailings containment areas will be covered by a layer of quarried rock followed by an upper layer of fine-grained soil. Subject to future consultations, the tailings covers may be revegetated… monitoring will include inspections of tailings covers" (DAR p1-6). -"A study to determine the appropriate design for covers for the tailings is being conducted in the NW Pond" (DAR p547). -"To facilitate covering and prevent water ponding on the surface, regrading of	-Contingencies and Adaptive Management listed in the DAR: "there will be a need for cover maintenance and repair. The sediment control works built for cover construction will need to be maintained until vegetation has established and erosion is reduced to levels typical of natural areas" (DAR p6-67). -"During an interim period after the covers are placed, runoff and dam seepage could require collection and treatment	**Similar** -During the EA process there was uncertainty about what the bottom layer of the tailings cover would be (options: 100 cm thick layer of run-of-quarry material <100 cm in size; 30 cm to 60 cm thick layer of screened run-of-quarry material <50 cm in size with geotextile separation of layers above and/or below; or 15 cm to 30 cm thick layer of crushed gravel <2.5 cm in size with geospatial separation	The impacts of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***

			sections of the tailings and construction of surface water run-off channels will be necessary" (DAR p6-57). -The DAR proposed that the upper layer would be at least 30 cm in depth; a cost-benefit analysis would determine optimum alternatives for the bottom layer. It was noted that it may have been necessary to include geotextile layers to prevent fine tailings from mixing upwards into the bottom layer or fine material in the top mixing downwards (DAR 6-63).	before discharge" (DAR p6-68). -Effects for Earthworks: contour and cap tailings/sludge ponds (erosion and sedimentation, increased turbidity in water, mobilization of contaminants, changes to existing hydrology, suspended solids (air), disturbance of existing sediments, combustion emissions, noise emissions, surface disturbances, community effects) and associated mitigations were included in the DAR. (DAR p8-7 – 8-122). -The Developer noted that it would conduct a geotechnical investigation inspection of potentially vulnerable structures (in the instance of a seismic event), including tailings covers (EA p46). -Alternatives North requested that the Developer prepare a comprehensive air quality monitoring program to test the performance of the tailings covers with regards to dust control (EA 168). -Several measures (22, 23, 24) were made in the EA to address uncertainty around the tailings cap	layers above and/or below) (DAR p6-63). -Currently it is proposed that the tailings cover will be rockfill on top (expected to be cobble- and gravel-sized particles (300 mm or less)) with nominal thickness of 0.7 m; geotextile next (optional), a fine-grained soil or sand protective layer (nominal 0.3 m thickness) and the tailings on the bottom (CRP p5-184). -"…the cover is no longer designed to be vegetated" (PS document p19). -The PS document (p19) includes mitigations related to dust, erosion, wildlife and wildlife habitat.	

				design (EA p176-177). These measures were to help ensure impacts associated with the coarse rock cover and geosynthetic liner would be mitigated.		
11.	Relocate South Pond and consolidate in North and Central Ponds to reduce tailings footprint.	4. Capping of tailings areas (South Pond tailings, after relocation, will still be covered by the tailing cap placed over Central and North ponds) (PS document p20)	-"DAR stated that TCAs would remain in place and be covered" (PS document p20).	-Could argue that some impacts and mitigations for this activity overlap with those presented in the DAR (Earthworks: excavate contaminated soils), however no specific mitigations were considered as the activity is new.	**Activity is new** -Examples of impacts include those related to water quality, dust and erosion (PS document p20).	The impacts of this activity do not appear to have been assessed previously. ***Do include in the preliminary screening scope:*** **Relocate tailings in South Pond and consolidate in North and Central Ponds.**
12.	Minewater will be treated using an ion exchange method to meet the arsenic concentration of 10 µg/L and approved EQC for all other parameters of concern at the point of discharge.	2. On-going treatment of contaminated water to remove arsenic. This includes: Construction of a new water treatment plant	-The DAR proposed meeting CCME Guidelines for the protection of aquatic life for arsenic and the Canadian drinking water quality guideline of 10 µg/L "within a short distance of the outfall on a consistent basis" (DAR p6-81). -Ion exchange was a method that was discussed in the EA following a request from the MVEIRB for more information about alternative methods of water treatment and management that do no rely on the diffuser on Yellowknife Bay (EA p147-148). -Measure 14 requires the Developer to add an ion	-"Alternative North acknowledges that ion exchange would improve arsenic levels over the current proposal, but do not accept the Developer's conclusion of no significant effects because of the lack of far field and thermal modelling, or any site-specific ecological risk assessment using the species present in Yellowknife Bay" (EA p149). -Ion exchange was not a topic discussed in the DAR, although effects (minor operational releases, combustion emissions) and mitigations for Water Management:	**Similar / new activity (disposing spent ion exchange adsorptive media in the onsite landfill)** -"During the public hearings the Developer estimated that the water treatment plant would initially produce approximately 6.3 m^3 of sludge per day" *(EA p173).* -In CRP: "the estimated quantity of sludge is 275 m^3/yr [~0.75 m^3/day]. The sludge will be composed mostly of iron hydroxides, with ferric arsenate, ferric antimonate, calcium sulphate, and any residual suspended particulate matter present in the influent" (CRP 5-244).	The impacts of using an ion exchange method appear to have been assessed previously. The impacts of disposing of spent ion exchange adsorptive media in the onsite landfill do not appear to have been assessed previously, and it is unclear which media products will be used ("Further testing is being undertaken to verify that spent adsorptive media is suitable for disposal in the on-site landfill" (CRP p5-244)). ***Do include in the preliminary screening scope:***

			exchange process to its proposed water treated process (EA p152). -Placement of water treatment plant sludge in an onsite landfill was assessed as part of EA: "sludge containing iron hydroxides with ferric arsenate, ferric antimonite, and calcium sulphate will also be generated. This waste material will be pumped into the freezing zone until frozen and inaccessible and then deposited in a separate stand-alone facility or in a separate cell located within the on-site engineered landfill" (EA p173).	sludge management were discussed (DAR p8-7 – 8-122). -Measure 16 requires the Developer to model re-suspension of arsenic from sediments and bioavailability in the vicinity of the outfall and modify the outfall design, if necessary; Measure 17 requires the Developer to implement a comprehensive aquatic effects monitoring program to determine if water quality objectives (as required through Measure 15) are being met (EA p154). -These measures require mitigations by the Developer (e.g. outfall design) if significant effects are found as a result of using the ion exchange method.	-It is still being verified if the spent adsorptive media from the ion exchange method will be suitable for disposal in the on-site Landfill (i.e. will be non-toxic). Initial estimates for the volumes of waste adsorptive media are between 40 to 200 m^3/yr (CRP 5-244).	**Dispose of spent ion exchange adsorptive media in the onsite landfill.**
13.	Install a near-shore outfall in the vicinity of Baker Creek.	2. On-going treatment of contaminated water to remove arsenic. This includes: Storage of treated water and eventual discharge to Great Slave Lake	-"The DAR proposed a diffuser system that would extend into Yellowknife Bay and discharge around Latham Island" (PS document p21). -The Yellowknives Dene and other Parties indicated they did not agree with the diffuser, associated with ice safety issues and the level of water treatment that would be occurring at the water treatment plant to	-Measure 16 requires the Developer to model re-suspension of arsenic from sediments and resulting bioavailability in the vicinity of the outfall. If the results indicate that the outfall could re-suspend arsenic from sediments, the Developer must modify the outfall design until the operation does not cause re-suspension. This measure addresses impacts that	**Similar** -The near-shore outfall will require less installation compared to the diffuser, that was proposed to be installed farther out in Yellowknife Bay. Discharge locations (Baker Creek and the outfall mixing zones) will now be combined. -GMRP's comment on addressing Measure 16 was that "GMRP is taking amore protective approach and mitigating	The impacts of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***

			require the diffuser (EA p150-152). -Outfall alternatives to the diffuser included a near shore outfall (recommended for effluent containing 5-10 µ/L of arsenic). Advantages of a near shore outfall identified in the EA included: less disruption of sediments during construction, less capital cost, and a location immediately adjacent to the mine site that is easier to define and indicate to the public via signage (EA p148).	could be caused by an outfall with regards to sediment resuspension if not properly designed/not properly mitigated (EA p154). -Construction of Surface Infrastructure: Great Slave outfall/diffuser effects (increased turbidity in water, mobilization of contaminants, disturbance of existing sediments, suspended solids (air), combustion emissions, and community effects) and mitigations are discussed and support this modified activity (DAR p8-7 – 8-122).	the potential of sediment resuspension through design of a sediment cover, rather than modelling" (UPD document p37).	
14.	Expansion of onsite borrow areas for required rock material	Supports achievement of EA Scope and Activities: 7. Reclamation of open pits; 4. Capping of tailings areas; and 5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials")	-Using quarry to remediate certain features was discussed throughout the EA: "The proposed tailings covers consists of a lower coarse protective layer of gravel, crush or quarry rock and an upper vegetation support layer of silt and clay" (EA p11); "Surficial waste rock that contains total arsenic above the industrial land use criterion will be backfilled into the unfrozen section of the B1 Pit, with the remainder of the pit filled with quarry rock…" (EA p165); "The Developers have identified several onsite bore areas that should provide approximately one million	-Earthworks: borrow and backfill effects (increased turbidity in water, erosion and sedimentation, changes to existing hydrology, mobilization of contaminants, noise, permafrost degradation, surface disturbances, suspended solids (air), combustion emissions, and community effects) and mitigations are discussed (DAR p8-7 – 8-122). Specific examples include: -"Borrow sources will be regraded, contoured and, where possible, re-vegetated to encourage conformity with the	**Larger requirement for coarse-grained material** -The DAR discussed needing borrow materials to support remediation, focused mostly on fine-grained borrow sources; it stated that a shortage in fill material exists, and identified potential to source borrow material within the GRMP Boundary and around the Site in support of remediation activities. *(PS document).* -"The Project will require the extraction of approximately 1.4 million m^3 of borrow material from approximately 30 potential borrow source areas" (DAR p8-105).	Board staff recognize that filling pits was discussed during Surface Design Engagement (SDE) and that many participants of SDE voiced support for the option to backfill pits, which requires more fill material to be sourced (Preliminary Screening document p22). However, not all impacts of this activity appear to have been assessed previously. The EA process did not discuss specific mitigations regarding water quality impacts from nitrogen from blasting and excavation that will be

			cubic meters of cover material, Baker Creek diversion excavation materials, and several rock quarry areas that can be used to create spillways for the drainage of the covered Northwest, North, Central, and South Ponds" (EA p168). -There were investigations into borrow sources during/prior to the DAR (Giant Mine Borrow Investigation (Golder Associates Ltd. 2004), Air Photo Interpretation of Potential Borrow Areas North of Giant Mine (Golder Associates Ltd. 2004), Summary of Potential Borrow Sources on Giant Mine Lease and in the Immediate Area (SRK 2005)) (DAR p2-10).	surrounding landscape" (DAR p8-105). -"Previously disturbed borrow sources will be used preferentially over new sources where permafrost may be present" (DAR p8-38). -"New borrow sources will be used only in situations where insufficient material is available from previously disturbed areas; any disturbed areas will be revegetated and/or offset by naturalization activities in other areas; The Project Team will secure the input of government wildlife regulators and traditional knowledge holders during work schedule planning to ensure that remediation activities consider the presence and key life stage of resident species; re-naturalizing areas using indigenous species to encourage re-colonization; detailed habitat surveys of any areas that are to be disturbed to confirm that habitat for certain life stages for rare or endangered species, if present, will not be affected" (DAR p8-68). -Measures were included in the DAR to ensure that undiscovered heritage resources would not be	-During EA it was anticipated that the project was to require: 47,000 m^3 of rip rap/waste rock; **610, 943 m^3** of coarse borrow (sand to gravel); and 745,982 m^3 of fine borrow material (silt to silty clay) (DAR p8-121). -Currently the project requirements for borrow material are 3,580,000 m^3 coarse-grained (of which 28% [**1,002,400 m^3**] will come from borrow areas) and 620,000 m^3 fine-grained (of which 27% [167,400 m^3] will come from borrow areas). The rest of the borrow will be sourced from closure activities (CRP p5-200). -"Blasting may be a contributor of nitrogen-nutrient concentrations in surface drainage water. An estimation of nutrient loads from blasting materials to surface runoff will be completed; the necessity of having water quality criteria for nitrogen will be assessed. An Explosives Management Plan will be developed" (CRP p5-151).	associated with this activity, nor was there an inclusion of a geochemical investigation of potential borrow material to minimize the potential for acid generation. ***Do include in the preliminary screening scope:*** **Quarrying onsite for required rock material.**

				adversely affected (e.g. developing protocols for the management and reporting of new archaeological finds) (DAR p8-102). -Including a Traffic Management Plan with Environmental Management Plans was proposed to control transportation movements associated with the Project (including from haul trucks transporting borrow materials on public roads) (DAR p8-117).		
15.	Install a freshwater intake in Yellowknife Bay.	Supports 8. Ongoing maintenance, monitoring, and management	-"All of the fresh water used for boilers, fire suppression and sanitary purposes at the active mine buildings is potable water obtained from the City of Yellowknife, and is currently trucked to storage tanks onsite" (DAR p5-55). -This specific activity was not proposed in the DAR.	-Construction of Surface infrastructure: Great Slave outfall/diffuser effects (increased turbidity in water, mobilization of contaminants, disturbance of existing sediments, suspended solids (air), combustion emissions, and community effects) and mitigations could be similar (DAR p8-7 – 8-122).	**Activity is new**	The impacts of this activity do not appear to have been assessed previously. ***Do include in the preliminary screening scope:*** **Install a freshwater intake in Yellowknife Bay.**
16.	Construction of long-term underground access	Supports 8. Ongoing maintenance, monitoring, and management	-"The requirements for new underground access will be determined by the size and manoeuvrability of the underground drilling equipment, the equipment used for the installation of the freeze pipes and the equipment used to service the freezing system, all of which will be assessed as part of the FOS [Freeze	-New Underground Development: backfill, drifts, installation of infrastructure, etc. effects include combustion emissions (from internal combustion engines) with possible air quality affects; associated mitigations discussed (DAR p8-7 – 8-122).	**Activity is new** -There will now be access to B2 Pit (there is a possibility that contaminated materials will be placed in B2 Pit). -Security is a potential concern if the access point into the underground is not properly monitored and maintained (PS document p25).	All impacts of this activity do not appear to have been assessed previously. ***Do include in the preliminary screening scope:*** **Construction of long-term underground access.**

			Optimization Study]" (DAR p 6-22). -There was no specific discussion regarding a long-term underground access during the EA proceeding, however this activity supports the Developer addressing Measure 19 (the Developer will not adopt any method of freezing that significantly reduces the opportunities for future arsenic removal or other remediation by future technologies) (EA p160).			
Potential Modifications / Project Changes						
1.	Development of a wetland treatment system or use of other passive treatment technology in Baker Creek (CRP Appendix 5.5B)	Supports 6. Rehabilitation of Baker Creek	-"The Review Board's expert Katherine Enns asked the Developer whether it had considered the use of an engineered wetland in conjunction with the water treatment plant to reduce concerns at the outfall. Enns noted that using wetlands for bioremediation has been very successful at other sites" (EA p146). -Suggestion 10 is for the Developer to investigate potential advantages and disadvantages of adding an engineered wetland (EA p193). -Options for the Baker Pond (Reach 6) presented in the DAR included isolating the tailings and contaminated sediments by capping, turning the area of exposed	-Although no specific mitigations associated with development of wetland treatment systems were identified in the DAR, in a response to an information request (IR) issued by the MVEIRB the GMRP team gave a technical synopsis of constructed wetlands, including challenges/disadvantages (Constructed Wetland Viability Summary Table Public Registry #641). -Effects (erosion and sedimentation, increased turbidity in water, mobilization of contaminants, changes to existing hydrology, suspended solids (air), disturbance of existing sediments, combustion	**Larger** -In the DAR it was discussed that the north end of Baker Pond may be turned into a wetland. -In the CRP the excavation of Baker Pond and historical Jo-Jo Lake and potential application of water treatment technologies (e.g. constructed wetland treatment) was the preferred closure option for Baker Pond (i.e. Reach 6) (constructed wetland currently undergoing evaluation as part of the RRP) (CRP p5-102).	Despite the larger magnitude, the impacts of this activity appear to have been assessed previously. ***Do not include in the preliminary screening scope.***

			tailings at the north end of the pond into a wetland, and keeping Baker Pond a pond; another option was to cap the tailings and contaminated sediments and convert the area into a wetland with an isolated channel (DAR p6-88). -"Construction of small terminal delta wetlands off the main channel [of Baker Creek] to promote depositional processes" is a mitigation listed for Earthworks effects on hydrology (DAR p8-12).	emissions, noise emissions, surface disturbances, community effects, permafrost degradation) and mitigations associated with Earthworks: Baker Creek rehabilitation could be applicable to this work (DAR p8-7 – 8-122).		
2.	Raise the minewater elevation in underground mine workings (Appendix 5.1B)	2. On-going treatment of contaminated water to remove arsenic. This includes: c. Storage of treated water and eventual discharge to Great Slave Lake	-"The first stage, while the freezing is in progress, will be to flood the mine to a safe distance below the bottom of the lowest arsenic stope. This is close to the 425 Level. Once the freezing is complete, the mine could be allowed to flood further, to a maximum level just below the bottom of the lowest open pit (i.e., A2 pit, just below the 100 Level) (DAR p6-69). -"…once monitoring establishes that all chambers and stopes are completely frozen, the mine dewatering system will be adjusted to allow the underground mine to flood to a level that is as high as possible, while preventing the formation of	-In the DAR it states that: "The mine flooding is expected to generate poor quality water. Most of the (non-arsenic dust) stopes that will be flooded contain tailings backfill that will release soluble arsenic. Groundwater quality around the frozen zones is also expected to be poor. The access drifts around the chambers and stopes contain significant amounts of tailings and mine muck, and some of them undoubtedly include arsenic trioxide dust residues from historical spills or escapes. However, the regional dewatering provided by the minewater withdrawal system will prevent any	**Similar / unknown** -In the Planned Minewater Level Raise RRP there is a discussion of information presenting in the DAR that suggested where the minewater level could be raised to: "The DAR stated that once freezing was complete, the minewater could be raised to a proposed maximum level of just below the bottom of the A2 pit which is at an elevation of approximately 120m". The RRP does not specifically indicate what elevation the minewater may be raised to above the 750 L – just that the minewater level may be raised to maintain freeze containment criteria and limit impacts to chemical and physical stability	In the PS document (p26) the GMRP Team indicates that the RRP is required to develop more site-specific mitigations, suggesting that all impacts of this activity may not have been assessed previously. ***Do include in the preliminary screening scope:*** **Partially raise the minewater elevation in underground mine workings.**

			pit lakes. The level is expected to be just below the base of the A2 Pit" (DAR p6-32) (Fig 6.8.1). -…"a final decision from MVEIRB was not made in this matter in the Report of EA." *(PS document p26)*	escape of contaminated groundwater. In addition, the minewater treatment system will be designed to accommodate the short duration of higher contamination that is anticipated to occur after the mine has been flooded" (DAR p6-33). -Effects and mitigations in Chapter 8 (Assessment of Likely Environmental Effects and Mitigations) are discussed with regards to Water Management: drawdown of the minewater, but not for raising the minewater (DAR p8-7 – 8-122).	(Planned Minewater Level Raise RRP p2-3).	
3.	Continued research in area north of Dam 3 (in addition to Modification / Project Change #8), to identify whether further remediation efforts in this area would be valuable (Appendix 5.4B)	5. Removal of contaminated soils from mine site and tailings area (more appropriately "remediation of surficial materials")				The impacts of this activity appear to have been assessed previously. See modification #8. ***Do not include in the preliminary screening scope.***