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Appendix B

Acid Rock Drainage and Metal Leaching (ARD/ML) Mitigation and Management Plan

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Sand Extraction Project

Acid Rock Drainage and Metal Leaching (ARD/ML) Mitigation and Management Plan

Canadian Premium Sands Inc.

Project number: 60640258

October 20 2022

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1. Introduction

1.1 Background

Canadian Premium Sand Inc. (CPS) is proposing to extract high quality silica sand from the Lake Winnipeg Formation, which is the on-shore extension of the Historical Black Island silica sand deposit. The Project is located on the east shore of Lake Winnipeg, approximately160 km northeast of Winnipeg and about 67 km from Town of Powerview-Pine Falls, Manitoba. The proposed quarry site is located on claim QL-1759, QL-1785, QL-1795, QL-1896 and the main geological units intersected by drilling are the overburden glaciofluvial deposit and the Lower Black Island unit (LBI) sand overlying the Precambrian basement. **Figure 1** shows the location of the sand extraction area.

An open pit quarry operation will be developed with progressive annual reclamation of used quarries. The average size of the quarry is approximately 5 hectares (ha), and the overburden thickness within the quarry ranged from 2.2 m to 9 m (average 7.3 m) and the LBI sand thickness varied from 9.1 m to 12.4 m (APEX 2021) with an average of 10.5 m based on drill hole logs data. Annual reclamation of each quarry cell will occur as mining is completed in each cell. The Project will have a lifespan of 35 years and it is estimated that a yearly average of 350,000 tonnes (t) of overburden will be stripped during the first five (5) years, and more than 550,000 t of sand will be mined each year with an estimated annual production of 300,000 t of pure silica sand. The overburden will be stockpiled near the quarry or used for reclamation.

Mineral processing will result in approximately 135,000 t of coarse and fine sand waste per year that will be hauled back to the quarry for site reclamation or management. Mineral processing will include sand washing and beneficiation using density and magnetic separation methods to separate heavy metals (e.g., iron) and sulphur from quartz. Key components of the Project will include:

- An active open pit sand quarry operated six (6) months per year, including progressive annual site reclamation of closed quarries.
- Silica sand production processing, including a fully enclosed sand processing facility operating from May through October.
- Ancillary facilities, including portable office and storage buildings.
- Access roads.

Knowledge of the potential of the overburden, silica sandstone and quarry waste is required to develop acid rock drainage and metal leaching (ARD/ML) plan and ensure reactive material is managed in a way that is protective of the environment. This report outlines methods for ARD/ML control and mitigation and provide methods for determining and confirming ARD/ML prior to and during construction and operations.

1.2 Objectives

The objectives of this mitigation and management plan (the Plan) are to:

- Provide a framework for the assessment of ARD/ML of excavated material and processing waste.
- Describe methods for confirming ARD/ML during construction and operation.
- Describe options for effective material handling and operational management for potentially acid generating (PAG) materials.
- Mitigate potential impacts due to ARD/ML.

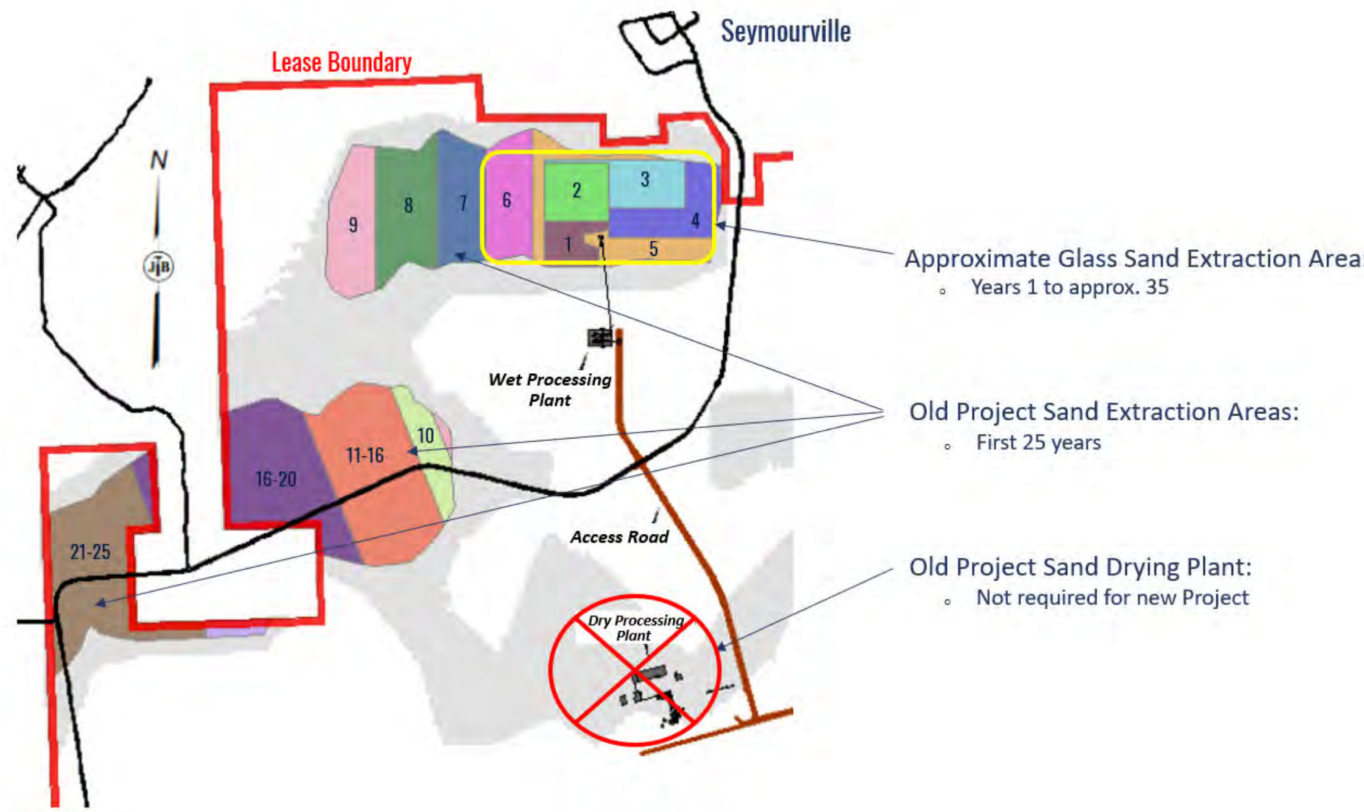

Figure 1 Location of Sand Extraction Area

2. Regulatory Framework and Guidelines

Policies and guidelines providing guidance for the characterization of ARD/ML and the development of mitigation measures to prevent and/or mitigate potential adverse environmental effects are widely available in Canada and globally. These guidelines and policies describe how mined material, and mine and quarry wastes should be characterized. They also describe how excavated material with elevated risk for ARD/ML should be managed to minimize environmental impacts.

Relevant legislation, guidelines and best management practices pertaining to ARD/ML assessment and mitigation includes:

- Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Price and Errington, 1998).
- Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (BC MEM and BC MELP, 1998).
- Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Price, 1997).
- Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials - MEND Report 1.20.1 (Price, 2009).
- MEND Manual Volumes 4, 5 and 6 (MEND 2000a, b, 2001).
- Evaluating the Potential for ARD/ML at Quarries, Rock cut sites and from Stockpiled Rock or Talus Material used by the MOTI (BC MOTI 2013).
- Global Acid Rock Drainage Guide (INAP, 2009).

These guidance documents establish industry standard practice and were utilized to develop this mitigation and management plan.

3. Methodology

This management plan (Plan) describes methods for the characterization of ARD/ML potential for waste materials produced during quarrying, management and storage of excavated material and quarry waste with high potential for ARD/ML in a manner that is protective of the environment. It also describes mitigation measures aimed at minimizing contact water production, limiting geochemical reactions, and geotechnical and water quality monitoring water quality to confirm effectiveness of mitigation measures.

3.1 Waste Characterization

Based on information provided by CPS, the Project annual production rate is estimated at approximately 300,000 t of silica sand. Quarrying will involve excavation, processing and storage of several materials including:

- Overburden soils (average 385,400 t per year [t/year] during the first five years).
- Silica Sand (300,000 t/year).
- Coarse and Fine Sand Rejects (135,000 t/year).
- Slime Rejects (115,000 t/year).

While a comprehensive geochemical characterization program has been completed, the existing samples were sourced from the similar geological formations in areas that were largely outside of the proposed footprint of the glass sand resource area. To confirm the representativeness and characterize the mine waste, it was recommended that additional characterization be completed during quarrying to confirm the ARD/ML potential of each material and guide appropriate management.

Because there is limited geochemical data pertaining to ARD/ML potential of the material in the glass sand resource area and on processing wastes, AECOM recommended additional confirmatory sampling and laboratory testing to confirm the ARD/ML potential of each material within the footprint of quarry operations. Confirmatory sampling and laboratory testing would ideally be completed in advance of quarrying by testing of existing or new drill core or hand sampling of exposed materials on the quarry floor or high wall. However, materials can also be characterized during excavation as long as the waste streams are segregated and stored in separate stockpiles pending completion of laboratory testing and interpretation of the resultant data.

The following steps should be implemented:

1. Within the first year of the project, collect samples of each waste stream to meet industry standard sampling frequencies as defined in Price (2009), and verify historical geochemical testing is representative of materials that will be disturbed during quarrying. Sampling frequencies are recommended at least one (1) sample per 1,000 t or three (3) samples per 10,000 t of each type of material generated. Based on the waste material production rates provided by CPS, sampling should at minimum be conducted as follows:

   Before or during the First Year of Operations:

   a. Fifteen (15) samples of overburden from various locations and depths.

   b. Five (5) samples of silica sand from various locations and depths.

   c. Ten (10) samples of sand waste to characterize residuals following processing.

   The samples should be submitted to the laboratory for static testing including Acid-Base Accounting (ABA), ultra trace metal analysis, shake flask extraction (SFE) and mineralogy and results evaluated by a qualified professional to confirm the ARD/ML potential and verify materials are geochemically similar to those previously characterized.

   It is anticipated that the sampling frequency can be reduced in subsequent years of operation. However, during subsequent years of operation the confirmatory sampling should continue to be conducted under the direction of a qualified professional to monitor for any changes in geochemistry. There are considerable advantages to characterizing materials in advance of construction and operation (see Section 3.2.1) as it could clarify the need for waste segregation, stockpiling and/or special management in advance of mining and avoid double-handling of materials.

2. Staff should be trained by a qualified professional to recognize various waste materials and tasked to collect, document, ship the samples to a designated laboratory for testing, and manage the data. The staff should also be trained to recognize and quantify sulphide and carbonate minerals and properly document sampling and handling processes.

3.2 Mitigations

ARD/ML mitigation measures are designed to prevent the occurrence of ARD/ML or reduce its impact on the receiving environment by storing reactive material in suitably designed stockpiles or facilities and collecting and managing metal-laden drainages. ARD/ML mitigation measures are generally grouped as follows (Rob et al., 2000):

- Source control measures to prevent the occurrence of ARD/ML.
- Migration control measures to contain drainages impacted by ARD/ML.
- Discharge control measures focusing on treatment options for contact water and ARD/ML drainages.

3.2.1 Waste Rock and Soil Management

Waste rock management practices at minesites include avoidance, material segregation and the long-term storage of PAG material in engineered facilities such as waste rock piles and tailings storage facilities.

Avoidance as a mitigation strategy aims at avoiding or reducing the excavation of PAG rock or any material with unknown risk for ARD/ML that may contain sulphides and whose excavation is not necessary for development or accessing the resource such as the Precambrian basement rock in this case. Precambrian basement rock underlying the Winnipeg silica sand consists of crystalline mafic volcanic and intrusive rocks that may contain sulphide minerals. This material has never been characterized for its potential to generate ARD/ML and excavating it is not necessary to access the glass sand resource. As such, excavation of this material should be avoided to the extent possible. If excavation can not be avoided, then samples should be collected and tested, and the material managed according to its ARD/ML potential.

Material segregation is the physical separation of PAG material from non-acid generating material (Non-PAG). This helps reduce the volume of material requiring management and allows for the design of effective control measures for potentially problematic material. This in turn will help reduce the costs of mitigation and control measures. Segregation will be an important aspect of ARD/ML control and mitigation for this project considering the limited geochemical characterization of the materials in the proposed quarry footprint.

Overburden: Site overburden consists of glaciofluvial material generally characterized by low sulphide content, thus may have low potential for ARD. However, this type of material may generate ARD and/or ML if it is contaminated by sulphidic weathering products from bedrock or other formations (e.g., pyritic shale) depending on composition and degree of weathering. Laboratory geochemical tests completed on one overburden sample from the southeastern part of the property (i.e., Pyritic Black Shale area) has shown that the overburden in that area had low potential for ARD. However, the sample showed the potential for overburden to release concentrations of aluminum, copper, mercury, and nickel higher than the Canadian Council of Ministers of the Environment (CCME) chronic guidelines for the protection of aquatic life and concentration of lead above the Ontario Full Depth Background Site Conditions (AECOM 2022). This sample was collected from the Pyritic Black Shale area and could have been contaminated by black shale. Considering that similar shale was not found in the sand resource area, the potential for metal leaching from overburden could be low but this should be confirmed by laboratory analysis in accordance with the waste characterization efforts described in Section 3.1. AECOM recommends that this assessment be completed before development starts using the available drill core. Depending on the results of this testing, the material could be segregated into PAG and Non-PAG if material prone to ARD/ML is found. Any overburden classified as Non-PAG could be used as backfill for reclaiming the mined-out areas. PAG overburden, if any, should be stored in a stockpile and capped with a suitable cover to prevent water and oxygen ingress.

Sand: In 2019, one LBI sand sample was collected from the current quarry footprint and analyzed for its geochemical properties. The results indicated low potential for ARD due to low sulphur content. However, the sample had the potential for releasing leachate with concentrations of aluminum and copper higher than the CCME chronic guideline for the protection of aquatic life and concentrations of nickel and lead marginally above the Alberta Tier 1 Guidelines, Natural Area, Coarse-Grained Soil. This singular sample is unlikely to capture the spatial variability of the composition of silica sand processed over the life span of the project. The potential for metal leaching from the sand should be confirmed by laboratory analysis in accordance with the waste characterization efforts described in Section 3.1. AECOM recommends that this assessment be completed before development starts using the available drill core. The handling and processing of the material can then be optimized and the sand waste can be managed in accordance with material classification based on analytical results. If presently available, samples of sand waste from metallurgical tests done by APEX (2021) should also be collected and analyzed to determine ARD/ML potential, as this material may contain high concentrations of iron, total suspended solids, and sulphide minerals as a result of the density and magnetic separation processes used to purify the sand product. If processing sand waste is not currently available, samples for geochemical testing should be collected following commencement of operations as outlined in Section 3.1 to guide appropriate management of waste materials.

Until an adequate number of samples have been collected, analyzed and evaluated by a qualified professional the sand processing waste and all other uncharacterized materials should be stockpiled and covered until laboratory results are available, then classified according to its ARD/ML potential and managed accordingly. If materials have not been characterized, they must be managed as PAG until characterization is complete. Laboratory ARD/ML analysis takes several weeks to complete and the need for segregation, stockpiling and careful management of waste materials may impact the flow of operations and cause delays. For this reason, it is highly recommended that the geochemical characteristics of quarry wastes be evaluated before development using waste derived from metallurgical testing and pilot plant testing.

Laboratory tests should include ABA, ultra trace metals analysis by *aqua-regia* digestion, mineralogy by x-ray diffraction and SFE on select samples.

3.2.2 Waste Rock and Soil Handling and Storage

The limited ARD/ML data available for the sand resource area have shown that the silica sand found at the project site does not contain readily available neutralization potential to buffer acidity. Therefore, temporary storage at ground surface is not recommended without adequate mitigation. Two options are conceivable for handling and storage of any PAG material produced during quarrying. The PAG rock or spoils could be permanently stored in designed stockpiles on ground surface or used to backfill closed quarries following short-term adequately managed storage on ground surface. Progressive reclamation of the quarry using PAG material requires a detailed plan and studies that have not yet been conducted. The plan cannot be developed until the volumes of PAG waste materials, their spatial distribution and geochemical properties (i.e., ARD/ML potential) are known.

This management plan is therefore focused on management of PAG at ground surface. For long-term storage of PAG material at ground surface, engineered stockpiles must be constructed to effectively contain the material and minimize potential impacts to the environment via discharge from ARD/ML stockpiles or repositories. The disposal area should be located away from surface water bodies taking into consideration geotechnical stability, hauling distance and availability of material for construction. The area selected for construction of the waste rock/soil stockpiles should be cleared of vegetation and stripped of topsoil. Topsoil should be stockpiled for later use as part of the cover. PAG material should be hauled by trucks, and end dumped in the designated disposal area. The waste rock/soil stockpiles should be constructed with Non-PAG rock or clean borrow material, and the piles should be capped with inert low permeability soil, and vegetated to prevent oxidation and leaching by minimizing water and oxygen infiltration in the piles and for erosion control. The surface of the stockpiles should be appropriately graded to direct drainage to sedimentation ponds so that runoff from the surface of the piles is directed away from natural water bodies and transport of suspended solids and any associated metals to receiving environments is avoided.

The stockpiles can be constructed as blended piles and amended with limestone or lime to create alkaline conditions depending on the sulphur content of waste materials and availability of nearby sources of alkaline rock (e.g., limestone) or amendments (e.g., lime). In a blended stockpile, PAG material is mixed with limestone or lime so that acid generated from sulphide oxidation is neutralized in situ. In a general configuration, PAG material is placed below the neutralizing material or rock with high neutralizing capacity. The need for a low permeability basal clay or geomembrane liner and/or cover should be evaluated during design of the waste stockpile.

3.2.3 Water Management

Water is the primary catalyst of ARD/ML and the pathway connecting acid mine drainages to the receiving environment. Water management is therefore an important aspect of ARD/ML control and mitigation. Water management structures (e.g., ditches, berms, and drainage channels) should be constructed around stockpiles containing PAG waste rock to intercept and divert surface water flow around the piles to minimize the interaction between non-contact (clean) surface water and waste materials. Engineered covers should be placed on permanent stockpiles and temporary covers should be placed on any small temporary stockpiles to prevent water and oxygen infiltration.

Collection ditches and ponds should be built around the downstream toe of stockpiles to capture seepage and runoff which may contain metals (commonly referred to as contact water). Contact water and processing wastewater collected in sedimentation ponds should be tested to ensure they meet discharge standards before water is released to the environment. Records indicating that runoff and discharges are being appropriately tested and managed should be kept for review and reporting. Sediments accumulated in sediments/settling ponds should be excavated and analyzed for metals concentrations on an annual basis. Sediments should be managed in accordance with laboratory results, or conservatively stored in PAG stockpiles in the absence of laboratory testing results. Waste materials should be disposed in accordance with applicable regulations and permits.

3.3 Monitoring

Monitoring should be conducted to assess the effectiveness of mitigations in preventing ARD/ML and need for corrective actions. Walk around surveys of stockpiles should be undertaken during and after construction to check for any evidence of ARD/ML. Measurements of pH and electric conductivity of seepage and surface runoff from the stockpiles and any pooled water on quarry floors should be collected on a weekly basis and documented in a log. Contact water should be collected and tested when pH readings show decreasing consecutive pH measurements or a pH <6.0. Contact water should be captured and treated to meet discharge criteria before releasing into the environment when testing indicate acidic pH or concentrations of parameters above regulatory or discharge limits. Evidence of oxidation such as snow melt areas, presence of staining and oxidation products, etc. should be documented. The results of early monitoring should be reviewed quarterly and used to improve and upgrade mitigation measures.

Geotechnical inspections of waste piles should be conducted to identify early signs of instability and document performance of the waste pile under the direction of a professional geotechnical engineer. The inspection program should be designed to meet regulatory requirements and document the performance of the waste piles, liners, covers and associated drainage infrastructure. Signs of physical instability such as settling, tension cracks, bulges at the toe and excessive erosion should be recorded. Inspection results should be recorded on an inspection checklist and archived for later review. Recommendations for any repairs or rehabilitation should be implemented in accordance with the recommendations.

3.4 Contingency

Contingency measures should be in place to address unforeseen deficiencies of mitigations as determined by physical and water quality monitoring. Contingency measures may include making lime or limestone available for drainage treatment by pH control. Active water treatment may be needed to lower the concentrations of metals in collection and sediment/settling ponds to levels that meet regulatory criteria and are acceptable for discharge to the receiving environment.

4. References

AECOM. (2022). Acid Rock Drainage and Metal Leaching Assessment – Wanipigow Sand Extraction Project. Prepared for Canadian Premium Sands Inc. August 2022.

APEX Geoscience. (2021). Inferred Resource Estimation on Canadian Premium Sand Inc.'s Wanipigow Silica Sand Glass Project In Manitoba, Canada. NI 43-101 Technical Report. October 14, 2021.

Bowell, R., Dey, M., Pooley, F., and Williams, K.P. (2000). ARD In Waste Rock: Preventive Methods. Mining Environmental Management, May 2000.

British Columbia Ministry of Energy and Mines and British Columbia Ministry of Environment, Lands and Parks (BC MEM and BC MELP). (1998). Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. British Columbia Ministry of Energy and Mines and 3 British Columbia Ministry of Environment, Lands and Parks.

British Columbia Ministry of Transportation and Infrastructure (BC MOTI). (2013). Evaluating the Potential for Acid Rock Drainage and Metal Leaching at Quarries, Rock cut sites and from Stockpiled Rock or Talus Material used by the MOTI.

International Network for Acid Prevention (INAP). (2009).Global Acid Rock Drainage Guide.

Mine Environment Neutral Drainage (MEND). (2000a). MEND Manual Volume 5 - Treatment. MEND Report 5.4.2e.

Mine Environment Neutral Drainage (MEND). (2000b). MEND Manual Volume 6 - Monitoring. MEND Report 5.4.2f.

Mine Environment Neutral Drainage (MEND). (2001). MEND Manual Volume 4 - Prevention and Control. MEND Report 5.4.2d.

Price, W.A. (1997). Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.

Price, W.A. and Errington, J.C. (1998). Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. British Columbia Ministry of Energy and Mines.

Price, W.A. (2009), Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. Version CANMET – Mining and Mineral Sciences Laboratories, Smithers, BC.

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