December 24, 2004

Mines Management Inc.
905 West Riverside Suite 311
Spokane, Washington
99201

Eric Klepfer
Vice President, Operations

Dear Mr. Klepfer

Montanore Project
Tailings Specifications Review & Tailings Underdrainage Design

1. INTRODUCTION

This letter report presents the results of our review of the tailings facility design for the Montanore project and recommendations on any modifications or updates to the design criteria for the project. A conceptual design for a tailings underdrain system is also included. The Montanore mine is located near the Rock Creek and Troy Mines in Montana, fourteen miles south of Libby, Montana. The Montanore Mine would be a 12,000 to 20,000 tons per day underground copper/silver mine, with a mine life of approximately 16 years (total 120 million tons). Tailings would be stored in an impoundment formed with a 370 ft high cycloned sand dam across the Little Cherry Creek, in the Kootenai National Forest.

A design for the tailings facility was prepared by Morrison Knudson Engineers, Inc. for Noranda Minerals Corp. in 1990, and was submitted as part of the EIS process. In addition, the EIS identified mitigations and alternatives to the design that are documented in the final EIS (1992) for the project. A main technical concern for the EIS is the release of seepage water from the impoundment, which could contain residual dissolved copper (and possibly other contaminants of concern). The observations incorporated into the EIS included additional drainage measures to reduce the estimated seepages losses from 450 gpm to less than 45 gpm. Klohn Crippen has carried out a conceptual design for the tailings underdrainage system, and details are included in this report.

Suite 500 – 2955 Virtual Way, Vancouver, B.C., Canada V5M 4X6 • T 604 669 3800 • F 604 669 3835 • www.klohn.com

2. DESIGN CRITERIA SUMMARY

2.1 Dam Design Guidelines

- USCOLD and ICOLD
- U.S. Corps of Engineers
- Montana Department of State Lands and United States Forest Service Norms

2.2 Storage Criteria

- The facility must be designed for a storage capacity of 120 million tons.
- Production rate of 12,000 tpd for Year 1, increasing up to 20,000 tpd.
- The starter dam will be sized to store 2.5 years of tailings.

2.3 Dam design

The dam design section is based on the modified downstream method. The downstream slope of the dam will be 3H: 1V. The upstream slope of the dam, above the starter dam could be as steep as 1H:1V, or possibly vertical, provided adequate freeboard can be maintained and a spigotted tailings beach can be provided to support the upstream slope.

Two stage cycloning will be used to produce dam construction material; Stage I will be at the mill and Stage II will be at the crest of the dam. The cyclone overflow will be used to create a spigotted tailings beach against the upstream slope of the dam.

The starter dam fill will primarily consist of locally available silty sands and gravels. Geotechnical soil parameters will be determined on the basis of laboratory testing, with appropriate interpretation and comparison with similar materials on other projects.

The starter dam and main dam will be designed for the expected phreatic conditions and potential foundation uplift pressures. Pressure relief wells would be installed, as required, to maintain stability.

The tailings dam classification, using the Montana Department of State Lands and U.S. Forest Service guidelines corresponds to a consequence category of "*moderate to high*", because of the financial and environmental impact of failure, and the potential for "fatalities", and the dam height is over 100 ft.

Static Stability

- Minimum static factor of safety of 1.5; and
- Minimum "end of construction" factor of safety of 1.3.

Seismic Stability

- Probabilistic and deterministic assessment of seismicity;
- M7 at crustal fault (0.20g), 20 km west on the Bull Lake Fault. (Maximum Credible earthquake – MCE)
- Minimum, pseudostatic factor of safety of 1.1 for a seismic coefficient of 0.10g; and
- Maximum dynamic deformation of 2 m.

2.4 Deposition Planning

The main criteria for design include:

- Tailings will be spigotted from several positions around the perimeter of the impoundment and from the upstream slope of the dam. One objective of spigotting will be to create, as far as practical, a low permeability layer over the natural soils.
- Beach slopes are assumed to be 1% for discharge of spigotted tailings above water, steepening to 5% below water.
- An average overall dry density dry density of 75 pcf (varies from 70 pcf on discharge to 80 pcf during the mine life) has been assumed for preliminary planning. However, the dry density will be confirmed with respect to the final deposition plan and will be dependent upon: a) discharge density and assessment of segregation within the impoundment; b) tailings underdrainage provisions; c) consolidation characteristics; and d) final spigotting plan.

2.5 Water and Flood Management

Hydrology Methodology:

- Total precipitation is based on frequency analyses of total precipitation (rain and snow) data. All available precipitation data will be reviewed and assessed.

Impoundment Flood Management:

- The impoundment freeboard will include the following:
  - Storage of 20 days of tailings discharge;
  - Storage of the design flood, which is the runoff from the probable maximum precipitation (PMP) plus snowmelt. Unlimited snowpack will be assumed for the analysis; and
  - Freeboard of 3 feet above peak flood water surface.

Diversion Dam

A 100 ft high diversion dam is required to direct runoff from Little Cherry Creek into the diversion channel. The dam will be designed to the same criteria as the main tailing dam.

Diversion Channel:

The main diversion channel will direct flow from Little Cherry Creek (catchment area of 576 acres) around the south side of the impoundment. The criteria for design of the main diversion channel are as follows:

- The channel will be designed such that the PMP/PMF would not cause an overtopping failure of the Tailings Impoundment. Localized erosion could occur.
- The channel will be sized for the 72 hour PMF and the 6 hour peak PMP. Erosion protection will be provided for the 100 year peak flood flow. Energy dissipaters, consisting of cross channel rockfill bars, will be considered in the design if it is necessary to reduce discharge velocities from the diversion channel.

- A low flow sub-channel will be constructed in the base of the main channel to manage average annual flows and minimize the risk of flow reduction in Libby Creek. The channel will be sized for the average high flow and soil lined for the average low flow.
- An energy dissipater will be constructed at the outlet section of the diversion channel to reduce velocities to the natural stream flow velocities dictated by the slope of the existing stream channel between the outlet and Libby Creek. Design flow velocities will be based on the 100-year peak flow.
- The creek section between the channel outlet and Libby Creek, approximately 4,000 feet in length, would be monitored during operations to assure that the naturally developed stream channel is capable of minimizing erosion and hence sediment load to Libby Creek. If required, sediment control structures, such as rockfill check dams and/or sediment ponds would be constructed.

Secondary diversion channels will be constructed within the impoundment area, during operations, to minimize surface runoff into the impoundment. The secondary diversion channels are not required for freeboard control or dam stability and the design flow will be the 2 year return event.

2.6 Geotechnical Properties

Foundation:

Geotechnical investigations have been carried out for the project. The results of the investigations will be re-assessed during detail design to confirm the following parameters:

- Soil strength, which will be determined on the basis of empirical relations with Standard Penetration Tests, soil classifications and moisture contents. Direct shear tests and/or triaxial tests may be carried out on specific soils to provide additional assurance.
- The liquefaction potential of the foundation soils will be determined on the basis of Standard Penetration Tests and the current state of practice for correlation of tests to liquefaction potential.
- Soil/rock permeability, which will be determined from in situ falling head tests in the exploration boreholes, observations of groundwater levels from

piezometers and groundwater monitoring wells, and on the basis of empirical relations with soil classifications and density. In situ falling head tests in test pits within the impoundment may be conducted.

Dam Fill

A starter dam will be constructed of locally borrowed soils. The strength properties of the dam fill will be determined on the basis of empirical relations with compacted density and soil classifications. Direct shear tests may be carried out on specific soils to provide additional assurance. The permeability and filter properties will be determined on the basis of gradation. Permeameter tests may be carried out on selected samples to provide additional assurance.

The properties of the cycloned sand will be determined on the basis of gradation and correlation with tailings properties from other dam projects. Direct shear tests and permeameter tests may be carried out to provide additional assurance, if required.

Filters and drainage systems will use current state of practice criteria for piping control and seepage flow.

2.7 Seepage Control

Seepage control measures are required to minimize the potential for transport of potentially contaminated seepage water from the impoundment into the downstream receiving environment. The current recommended allowable seepage rate is less than 50 gpm. The allowable seepage rate is not a significant consideration in the stability assessment of the dam design and is only required to meet environmental water quality objectives. The following measures are currently proposed for the design and these will be reassessed during the detail design to optimize the effectiveness of meeting the seepage criteria.

- All high permeability foundations soils identified in the dam foundation will be covered with a layer of compacted silt/clay soils;
- A system of seepage collection wells will be installed along the alignment of the dam to collect seepage waters. Provisions will be made to allow pumping from the wells to a central collection pond for reclaim to the mine.
- A tailings underdrain system will be placed within the impoundment area to collect tailings seepage and to increase consolidation of the tailings. This system could potentially reduce seepage losses by 50%.

- A seepage collection pond will be constructed downstream of the main dam. All water, which does not meet discharge criteria will be returned to the tailings impoundment or treated prior to discharge.

2.8 Closure

The tailings facility will be closed as a "dry" facility, which will comprise a combination of shrub/forest and wetland environments, with a small free-water pond. A permanent closure spillway would be constructed to safely pass the PMF. The dam slopes would be covered with topsoil and revegetated. The seepage collection system would be maintained if required to meet discharge control for water quality.

3. TAILINGS UNDERDRAINAGE SYSTEM

3.1 Seepage Analysis and Drain Spacing

A conceptual design of a tailings underdrainage system has been carried out and the design is based on the following criteria:

- Average tailings permeability of 10^{-5} cm/s (with checks for 10^{-4} cm/s and 10^{-6} cm/s.) Consolidation of the tailings, particularly in the base of the impoundment is expected to further reduce the permeability to 10^{-6} cm/s;
- Foundation permeability of 10^{-4} cm/s (with checks for 10^{-5} cm/s and 10^{-6} cm/s); and
- Tailings dam cyclone sand permeability of 10^{-3} cm/s.

A simplified model was developed to assess the potential flow into the drains and the relative benefit of the drains. Figure 3.1 shows the seepage model output for the case with no drains and Figure 3.2 shows the seepage model output for the case with drains at 300 ft centers. The main conclusions of the modeling are:

- Flow into each of the drains (19 total) should be less than 10^{-5} m^3/s (0.15 gpm) per unit area of 3 ft width. The total maximum flow could be up to 3,500 gpm, however this will be limited by the amount of water available. At a production rate of 20,000 tpd. A maximum of up to 1,800 gpm could be available. In addition, consolidation of the tailings should reduce the permeability and the flow. Accordingly, the expected

flow is in the order of 800 gpm, and the flow range is 100 gpm to 1,500 gpm.

- The drains should reduce the total seepage flow into the base soils by 40% to 80%.
- Drain spacings should be in the order of 300 ft to 600 ft. Additional drains may be required near the dam due to the increased flow concentrations associated with the dam.

Figure 3.1 Seepage Analysis for Condition With No Underdrainage

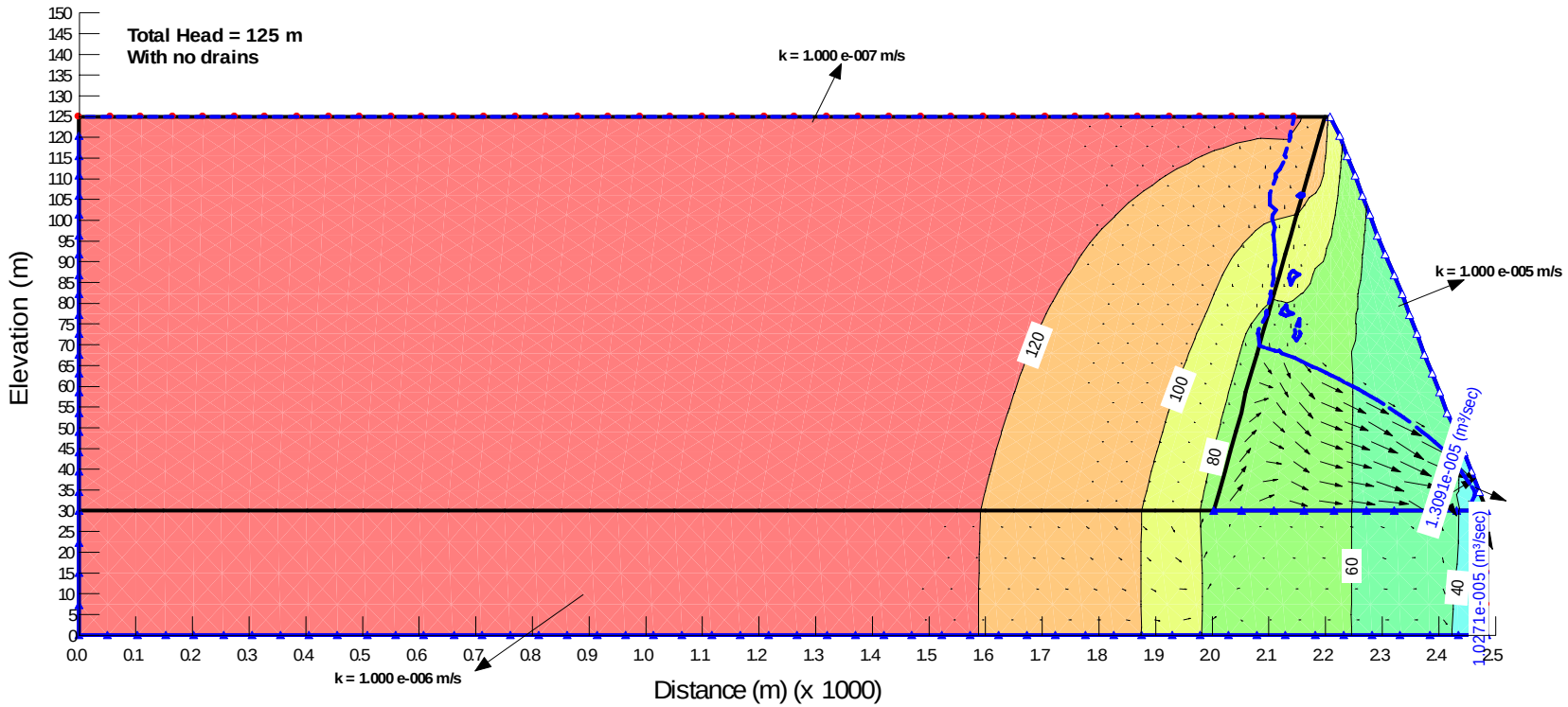
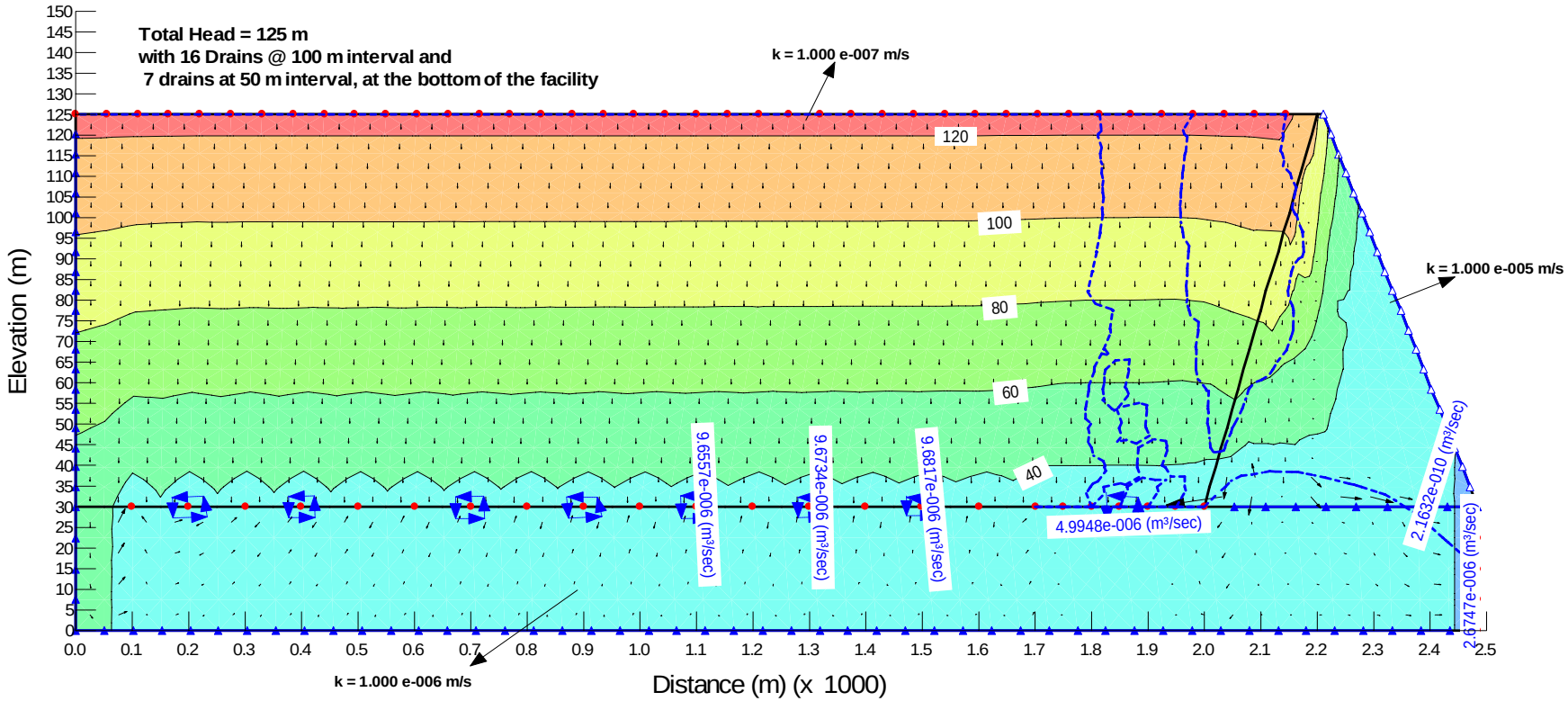


Figure 3.2 Seepage Analysis for Condition of Drains at 300 Foot Centers



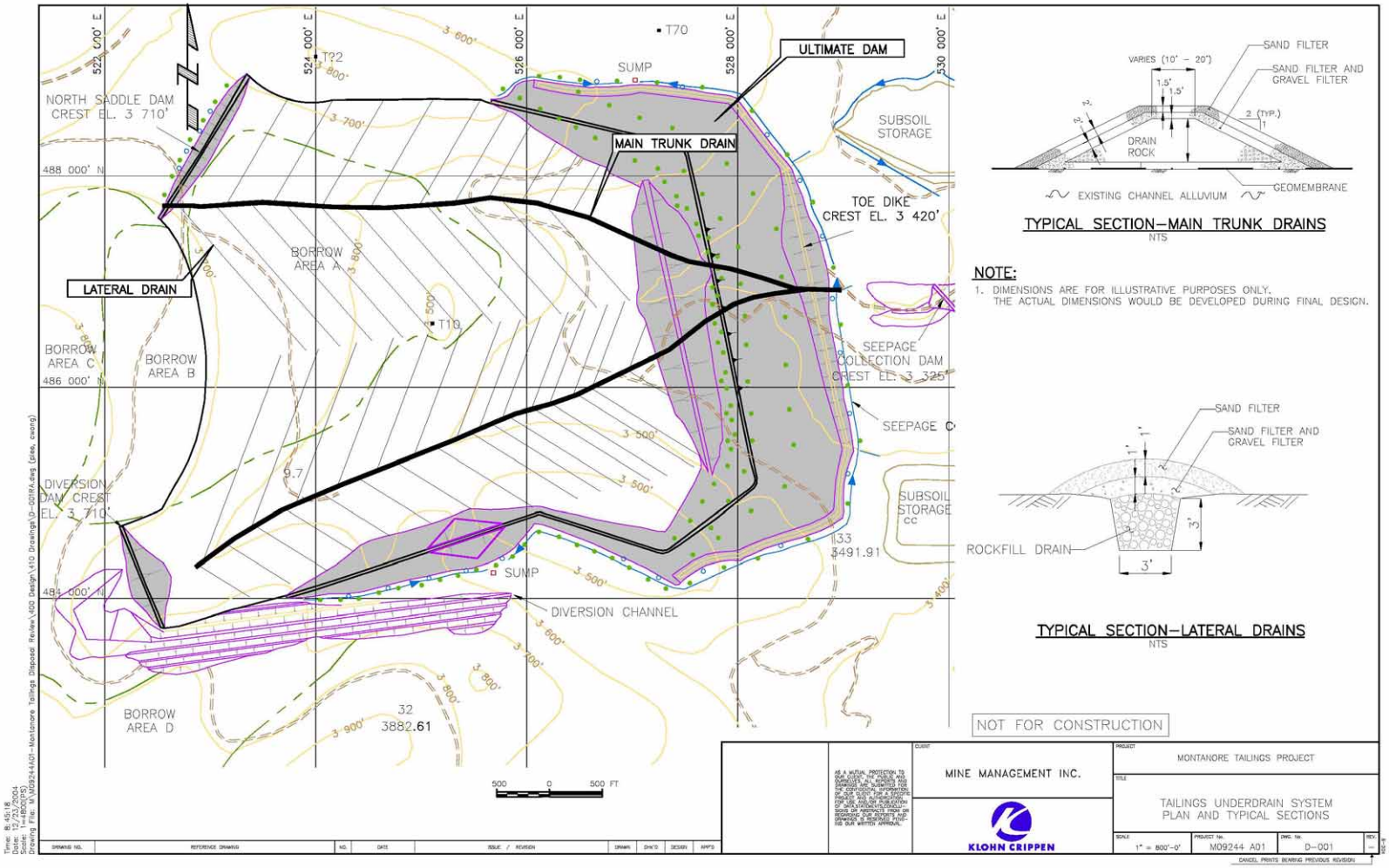
3.2 Conceptual Drain Design

A preliminary design for the underdrainage system has been carried out and is shown in plan and typical sections in Figure 3.3. The system would include two main trunk drains, which would be constructed in the two main drainage channels within the impoundment. Lateral drains would then feed into the trunk drains. Lateral drains were laid out on 400 ft centers. The flow in the lateral drains could be up to 50 gpm and the flow in the trunk drains could be up to 750 gpm. A rockfill drain capable of handling at least 50 times the flow has been designed on the basis of Wilkins Equation for drain design (Wilkins, 1956). The sizing is considered appropriate at this stage to account for uncertainties in flows, drain construction, and consolidation/settlement beneath the impoundment. The required sectional areas vary from 10 ft^2 for the lateral drains, up to 250 ft^2. Perforated pipe could be considered to reduce the size of the drains.

The drain design includes a geomembrane liner between the drain and the foundation soils for the main trunk drain to prevent the trunk rains from directing seepage flow into potential pervious soils. The lateral drains would not have a geomembrane liner, and would help to depressurize the foundation soils.

Detail design of the drain will confirm the benefit of the drains, drain design and drain spacing.

Figure 3.3 Underdrainage System: Plan and Typical Sections



4. SUMMARY

This letter report presents an update of our review on the Tailings Facility design specifications for the Montanore Project. The proposed design is considered to be appropriate for the design criteria of the project. Detail design will provide additional assurance of the design components and will optimize the cost and benefit of the design. The main items that require design optimization are the seepage reduction measures. These studies will also be carried out in conjunction with a detailed assessment of the site conditions and additional site investigations, as required.

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.

Harvey McLeod, P.Eng., P.Geo.
Senior Geotechnical Engineer

Len Murray, P.E (___), P.Eng.
Project Manager