EAGLE GOLD PROJECT

Response to June 2012 YESAB Request for Additional Information
(YESAB Assessment 2010-0267)

PURSUANT TO THE YUKON ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT ACT

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1 INTRODUCTION

On June 20, 2012, the Executive Committee requested that Victoria Gold (VIT) provide supplementary information to the proposed Eagle Gold Project (YESAB Project No. 2010-0267) to enable completion of a Draft Screening Report. The request includes 7 individual information requests resulting from Executive Committee review of the Supplementary Information Report submitted to YESAA on May 11, 2012. VIT is providing this report as an addendum to the Project Proposal to assist the Executive Committee in preparation of the Draft Screening Report. This report is organized similarly to earlier responses to comments. The report is organized to provide:

1. **Background Information**—provided in the YESAB request for Additional Information

2. **Information Requests**—each individual information request as provided by YESAB

3. **Response**—supplementary information to the Eagle Gold Mine Project Proposal for each information request.

Some of the individual responses require detailed technical information, data, and figures. Where necessary, this additional supporting information is provided as appendices to the report. The text immediately below provides context for supplementary information provided in this response, and also provides an update on the status of review of the Eagle Gold Project Proposal by the YESAB Executive Committee.

YESAA Overview

The Eagle Gold Mine Project Proposal is undergoing assessment under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) administered by the Yukon Environmental and Socio-economic Assessment Board (YESAB). YESAA provides an environmental assessment process whereby affected governments (territorial, federal or First Nations) use an assessment report and recommendation prepared by an arms-length assessment body to evaluate whether a project can proceed to the regulatory approvals process (permits, authorizations and licenses). Based on the size and complexity of the proposed project, the Eagle Gold Project requires a screening by the YESAB Executive Committee. During the screening, there are two opportunities for the public including governments (First Nations, Federal, and Territorial) and non-governmental organizations to comment on the Project. Notice of these opportunities is published, and all comments may be viewed on the YESAB Online Registry (YOR). During the screening, the Executive Committee evaluates public comments to determine whether YESAB requires additional information from the proponent to complete the assessment. The Executive Committee uses information provided by the Proponent to complete a Screening Report, which includes the Project Proposal and any supplementary information required by the Executive Committee.

There are four main stages of the Executive Committee review process as required by YESAA:

- **Adequacy**—YESAB determines adequacy of information provided by proponent
- **Screening**—YESAB completes assessment and drafts screening report
- **Recommendation**—YESAB provides recommendation to Decision Bodies that the project should proceed, proceed with terms and conditions, or not proceed
- **Decision**—Decision Bodies issue a Decision Document accepting, varying or rejecting the YESAB recommendation.

Timeline for Eagle Gold Project Proposal review

Currently, the Eagle Gold Mine Project Proposal is undergoing a screening. Once complete, YESAB forwards a Screening Report with a recommendation to relevant Government Decision Bodies.

On December 20, 2010, Victoria Gold submitted the Eagle Gold Project Proposal as required by YESAA to the YESAB Executive Committee. The following is a brief summary of YESAA review milestones (also available via the YOR).

- December 20, 2010—Submission of Eagle Gold Mine Project Proposal to YESAB
- January 21, 2011—YESAB Executive Committee determined that Victoria Gold (VIT) met the statutory requirement under s. 50(3) of YESAA relating to consultation
- January 21, 2011—YESAB begins Adequacy Review period to review Project Proposal
- March 23, 2011—YESAB extension of Adequacy Review period
- March 29, 2011—YESAB provides Adequacy Review Report to Victoria Gold that requests supplementary information
- May 24, 2011—Victoria Gold submits supplementary information to YESAB
- June 23, 2011—YESAB extension of Adequacy Review period to review supplementary information
- July 15, 2011—Victoria Gold submits revised Project Proposal including supplementary information
- July 18, 2011—Adequacy Review Complete/YESAB Publishes Notice of Screening

- July 22, 2011—YESAB issues Preliminary Statement of Scope of Project
- July 22, 2011—Screening Review/Public Comment Period begins
- August 12, 2011—YESAB Extension of Public Comment Period to August 31, 2011
- August 24, 2011—YESAB sponsored Public Meeting held in Mayo
- August 31, 2011—Public Comment Period ends
- September 1, 2011—Screening Review/Considering Comments stage begins
- September 14, 2011—YESAB issues revised Preliminary Statement of Scope of Project
- September 16, 2011—YESAB issues Victoria Gold a request for supplementary information as a result of Public Comments
- December 2, 2011—Victoria Gold submits response to YESAB request for supplementary information.
- May 11, 2012—Victoria Gold submits Supplementary Information Report (SIR) to YESAB to support the Project Proposal.
- June 25, 2012—YESAB issues Victoria Gold a Request for Additional Information.
- July 26, 2012—Victoria Gold provides response to YESAB request (this report and attachments).

2 WATER BALANCE AND WATER MANAGEMENT

2.1 BACKGROUND

The SIR included changes to the water management plan as well as changes to the Heap Leach Facility (HLF) design and operation. The Executive Committee has identified a number of issues with the water balance and water management within the HLF and events ponds due to the proposed changes in the SIR. Submissions received from the First Nation of Na-Cho Nyak Dun (YOR 2010-0267-295-1) and Environment Canada (YOR 2010-0267-292-1) identified similar issues, which the Executive Committee has taken into account in preparing this information request.

The number of water management ponds has decreased from nine to six while the total storage capacity has increased from 123 796 m^3 to 154 871 m^3 (including freeboard capacity). Table 5.4-8 (SIR p. 43) shows a comparison of the maximum pond capacities between the original proposal and the changes outlined in the SIR. Table 5.4-3 (SIR, p. 34) shows a comparison of the HLF solution storage and operating capacities between the original proposal and the changes outlined in the SIR. The events ponds will be used to provide storage capacity for surface run-off and snowmelt from the HLF and surrounding area as well as other sources such as sediment control ponds and the open pit as necessary. The events ponds are also available for emergency storage of process leach solution from the HLF. The total operational volume in the events ponds has increased from 175 000 to 182 846 m^3 (approximately 4.6% more). However, when including freeboard capacity the volume has decreased from 229 052 to 216 713 m^3 (approximately 5.4% less). Based on changes to the HLF, the in-heap pond has increased in size from 435 000 to 459 000 m^3 (approximately 5.5% more) and, including freeboard capacity, from 480 000 to 507 000 m^3 (approximately 5.6% more).

The HLF has increased in volume, height, and footprint. The volume of ore loaded onto the HLF has increased from 66 to 92 million tonnes (approximately 40% more). The area under leach has increased from 195 000 to 277 000 m^2 with a corresponding increase in the process leach solution application rates from 1950 to 2770 m^3 per hour (approximately 42% more). Furthermore, the footprint and surface area of the HLF at maximum build-out has increased which results in increased precipitation inputs into the HLF. VIT has estimated that the 1 in 100 year snowmelt volume in to the HLF has increased by approximately 25 percent while the 1 in 100 year, 24 hour storm volume into the HLF has increased by approximately 41 percent.

It is also unclear how VIT will manage water in the events ponds. The SIR provides conflicting water/solution storage strategies for the events ponds. On p. 35, VIT indicates that water may be stored in the events ponds for use in the summer and fall. In contrast, p. 43 indicates that water will be removed within 72 hours and p. 188 indicates the events ponds will be maintained empty.

The HLF has increased in volume and area resulting in increases to the process leach solution application rate and precipitation inputs. However, the water storage volumes in the events ponds and the in-heap pond have increased minimally relative to the changes to the HLF. Furthermore, the mine water treatment plant capacity has decreased from 620 to 600 m^3 per hour.

Considering the project modifications outlined in the SIR, it is unclear how during extreme precipitation events and/or emergencies the larger projected volumes of water/leach solution in the re-designed HLF will be effectively contained and managed. Additional information is required regarding the HLF water balance.

With the lack of information surrounding the HLF water balance, these changes create a greater level of uncertainty about water/solution management within the HLF and events ponds system. The Executive Committee requires additional information in order to determine potential effects relating to the storage, use, and management of water and process leach solution related to the HLF. Therefore, please provide the following information:

R1. A discussion on the Heap Leach Facility water balance modeling assumptions including:

a.) A discussion on how the sequencing of ore loading and leach solution application affect the water balance.

b.) The changes to the total amount of process leach solution inventory in the HLF over time.

c.) Estimates of draindown timing and leach solution travel times.

R1.1 Response

R1-A) provide a discussion on how the sequencing of ore loading and leach solution application affect the water balance.

Ore loading and leach solution application affect the HLF water balance differently. Ore loading consumes water during the crushing and stacking process. Water is "lost" to the heap leach ore pile when the ore is initially wetted resulting in water permanently[1] retained in pore spaces. The ore moisture content of freshly stacked ore is expected to be approximately 5% initially. The permanent volume of water stored in the heap throughout and after all phases of the Project increases as the size of the heap increases.

The leach solution application process temporarily stores water in the heap during a continuous recycling process. Upon wetting under irrigation of barren (non-gold bearing) solution, the ore moisture content is expected to be approximately 13% (optimal moisture content, or the calculated moisture percentage to achieve maximum gold recovery based on the assumed irrigation application rate and sodium cyanide (NaCN) solution concentration, is predicted to be 13.3%). Leached solution will percolate through the heap for temporary storage in the in-heap pond as pregnant (gold-bearing) solution, where it is pumped to the ADR plant to extract gold and then recycled back to the heap as barren solution. The volume of process solution will slowly increase as the volume of ore on the heap continues to grow and new areas are under leach. At any given time the HLF will contain zones under active leach with approximately 13% moisture and zones that are not

[1] Permanently here refers only to the moisture percentage; although there will be ionic exchange within the pore spaces, the moisture percentage is assumed to not decrease below 5%.

under active leach with a decreased moisture content of 5-13% depending on when the zone was previously leached. The temporarily stored process solution (required to reach optimal moisture) will eventually leave the system when the heap is allowed to draindown after mine closure to the residual moisture content.

Table R1-1 presents the key parameters and assumptions for the HLF water balance.

Table R1-1: Water Balance Key Parameters and Assumptions

Parameter	Value
Ore moisture contents	Initial 5.0%, Leaching 13.3%,
Ore loading schedule	250 days per year
Leaching schedule	350 days per year
Solution application method	Drip emitters (buried during cold weather operations)
Solution application rate	10 $l/hr/m^2$
Leach cycle time	150 days
Solution application flow	2,770 m^3/hour

Knight Piésold Ltd. (KP) has completed an update to the monthly site water balance model for the Project as part of this response. Information Requests R1 and R2 resulted in the need to update the overall site water balance model to clarify specific aspects associated with the HLF water balance, which is a key component of the overall site water balance. Tetra Tech was retained by VIT to provide a HLF design, which included the HLF water balance, as part of the 2012 Feasibility Study (FS). KP has completed an integrated overall site water balance model that incorporates the HLF water balance completed for the FS. Upon review of the YESAB Information Request some assumptions have been updated for the HLF water balance model. The updates are described by letter attached as Attachment R1-A - Technical Memorandum titled, Eagle Gold Project – Updated Site Water Balance Model (Knight Piesold, July 24, 2012). This letter should be read in conjunction with the technical memo by Tetra Tech (Attachment R1-B).

Heap Leach Process Overview

The Eagle Gold HLF consists of a valley-fill heap leach pad and a conventional Merrill-Crowe process gold recovery plant. Ore will be crushed and transported to the HLF for heap leach extraction of gold. Ore will be stacked in a geo-membrane lined containment area behind a confining dam. A dilute sodium cyanide leach ("barren") solution will be applied to the top of the ore and allowed to percolate through the heap. As solution migrates through the ore, it leaches gold from the rock and holds it in a solution. Gold-bearing ("pregnant") solution is collected at the base of the leach pad in the pore space within the heap. The pregnant solution will be pumped to the gold recovery plant where suspended solids will be removed and the solution is then treated in a conventional Merrill-Crowe precious metal circuit. The solution will then be reused with the addition of sodium cyanide to create barren solution and pumped back to the HLF for irrigation.

Ore Loading

The ore will be transported by a series of conveyors and placed in 10 m lifts using a radial stacker. As stacking operations advance, ore will be stacked on top of the heap leach pad in 10 m lifts. The stacking plan is based on a loading rate of 41,300 tonnes/day for 250 loading days. Year-round leaching operations are planned. Ore will be processed at a rate of 29,500 tonnes/day through three stages of crushing and stacked on the heap leach pad for approximately 250 days depending on ambient temperature (March through part of November every year). The ore will be processed through the primary crusher and placed on the ore stockpile for approximately 100 days (the last part of November through February every year beginning in November of the first year). 11,800 tonnes/day of partially crushed ore from the stockpile will be sent through the secondary and tertiary crushers and will be stacked on the heap leach pad for approximately 250 days (March through part of November after the first year). 41,300 tonnes/day of fully processed (crushed) ore will be placed on the heap for 250 stacking days (March through part of November after the first year).

Ore Leaching

Barren solution will be applied on the heap leach ore at a rate of 10 L/m^2/hr using buried drip emitters. The leach solution application rate remains constant throughout the life of mine, regardless of the ore loading or stacking rate and sequencing. The application rate is based on a set active leaching area predetermined by process and plant operational constraints. The total area being leached at any one point in time (termed the “active leach area”) will be 277,000 m^2 (maximum). Each active leach area will be under solution irrigation for a defined leach cycle time (typically 150 days).

Solution Recovery and Recycling

Vertical turbine pumps located in wells at the lowest portion of the in-heap storage pond will be used to advance the pregnant solution to the plant at 2,770 m^3 /hr. Solution collection wells are being used in lieu of a gravity return system to avoid potential liner penetrations and associated leakage risks. The operational level in the in-heap pond will fluctuate due to inflows from rainfall events, but the average operational level of pregnant solution in the in-heap storage pond will be optimized to provide a consistent flow of pregnant solution to the

ADR plant while limiting the head on the pond liner. Leach solution pumped from the in-heap pond (along with meteoric water when available) will be processed, recycled and re-applied to the current active leach area.

Effect of Ore Loading and Leaching on Heap Water Balance

The seasonally variable ore loading process is reflected in the annual water balance as lower water losses (associated with lower makeup water demand) during the winter months, since fresh ore is not being delivered and wetted during the winter. The heap leach cycle requires that process solution is continuously recycled through the heap and process plant throughout operations. As described in the SIR, the Project involves three Phases of the HLF. For Phase I operations, the water balance predicts that under average conditions, little to no fresh makeup water will be required during winter months, with solution recycled through the same active leach area. During Phase 2 and 3 operations, the water balance predicts that under average conditions additional makeup water will not be required during the winter months or during the summer period between May and July. This is due to the larger lined heap leach pad catchment area contributing runoff to the overall process. Fresh makeup water demand during the active stacking months is predicted to range up to 90,000 m^3 per month and will be primarily dependent upon inflows from snow (snowmelt) and rain that falls directly onto the lined heap leach pad and ore pile catchment.

R1-B) discuss HLF water balance and the changes to the total amount of leach solution inventory over the life of the project

As described above, the HLF water balance and the total solution inventory is affected by both ore loading and the leaching process. Table R1-2 provides a summary of the annual total leach solution in inventory in the HLF as it increases over the life of the facility. By Year 10, the total leach solution is estimated to be over 1.7 million m^3.

As the leach solution inventory increases, it is recycled and re-applied at a constant rate over a defined active leach area. The maximum active leach area will be 277,000 m^2, which represents about one-fourth of the entire leach pad area at full build-out. Each active leach area will be under solution irrigation for a defined leach cycle time (typically 150 days). As fresh ore is stacked on the pad, the solution irrigation pipelines and drip emitters will be moved or replaced to advance the process throughout the life of the facility. Rainfall directly onto the leach pad lined area will contribute additional water to the system and fresh water makeup will be added at the plant as needed.

As discussed in the SIR, the amount of ore to be mined at the Eagle Gold Project has increased from 66 million tonnes (Mt) to a total of approximately 92 Mt, with a production rate of 10.3 Mt annually. The HLF footprint has increased accordingly from 113 to 139 hectares to accommodate the additional ore volume. The operational life of the HLF was increased from 7.3 years to 10.2 years. The larger footprint increases the amount of precipitation onto the HLF which affects the annual water balance and freshwater makeup demands (see R1-A above). The active leach area has increased from 195,000 to 277,000 m^2 and the solution flow rate has increased accordingly from 1,950 to 2,770 m^3/hr. The increase in total volume of ore and leach area will result in an increase in the overall amount of solution stored in the HLF.

The increased HLF volume and longer life of mine does not change ore loading sequencing; ore will be stacked on the pad in the same procedure. Nor will the larger heap affect the process of leach solution application. The primary effect will be longer time for leach solutions to drain through the HLF as it increases in height.

Table R1-2. Eagle Gold Project – Summary of Estimated Heap Leach Facility Solution Inventory

	Phase 1			Phase 2			Phase 3		
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Solution in the HLF at start of period (m^3)	0	23,961	205,306	403,206	599,932	797,501	995,897	1,194,545	1,393,321	1,585,529
Estimated volume of additional solution applied during period (continuously recycled) (m^3)	5,983,200	23,268,000	23,268,000	23,268,000	23,268,000	23,268,000	23,268,000	23,268,000	23,268,000	23,268,000
Estimated total volume of solution in heap at end of period (m^3)	23,961	205,306	403,206	599,932	797,501	995,897	1,194,545	1,393,321	1,585,529	1,708,912
Average Operating Volume of In-heap pond solution (m^3)	133,000	133,000	133,000	133,000	133,000	133,000	133,000	133,000	133,000	133,000

Solution inventory within the HLF is a function of multiple variables: geometry of the HLF, ore stack height, ore stacking plan, and leach cycling. The solution inventory in the HLF facility is comprised primarily of:

- Moisture permanently held in the ore within the HLF,
- Leaching solution percolating through and temporarily stored in the HLF, and
- Pregnant leach solution in the in-heap pond.

The calculation of moisture in the overall heap takes into account the increased amount of precipitation that falls on the HLF as a result of the larger footprint than previously modeled as part of the Project Proposal. The rate of application of leach solution, however, does not affect the solution inventory as it recycles solution already in the system. Further, the location of the emitters effects only where the solution will be in the system at any given time.

Although this is a complex system, the HLF water balance can be generally as follows. Fresh ore stacked on the HLF will be increased from 5% to 13.3% moisture content by irrigating with make-up water / barren solution in the active leach area. There will be adjacent inactive blocks without active leaching but draining down from previous irrigation, and contain 5% to <13% moisture. In general, the amount of moisture in the ore will increase as heap increases in height. Thus, the water inventory held in the heap will increase over the life of the mine. Similarly, the percolating (or leaching) height will increase as the heap grows so that the solution will stay in the ore for a longer time (i.e. a process lag).

In general, solution inventory within the HLF:

- Will be minimal at startup and closure.
- Will increase slightly during the months of March through November when the ore production rate is increased to 41,300 tonnes/day as more ore is stacked on the HLF, the height of the ore rises and new ore is wetted. Increased ore height results in longer solution travel times through the heap while increased quantity of fresh ore requires additional solution to bring the ore to its optimal moisture content.
- Will stabilize and remain relatively constant during the winter months of December through February when there is no ore being placed on the pad and leachate solution is applied throughout the winter months. Since the active leach area, ore stack height, and solution application flow rate remain constant over this time, equilibrium is reached between the amount of solution applied and what is recovered.

- Will increase when the HLF reaches higher ore heights (relative from the bottom of the Lined Pad to the outermost/highest elevation of the ore being placed). This will occur at somewhere between Years 7 through Year 10 when the height and top area of the HLF are at their maximums. These conditions will create longer travel times within the heap resulting in increased solution inventory.

R1-C) Estimates of draindown timing and leach solution travel times.

Once gold recovery ceases, the HLF will be rinsed and detoxified as described in the SIR. At the completion of rinsing, the draindown phase of the HLF will begin. It is assumed that the moisture conditions of the heap will be as follows:

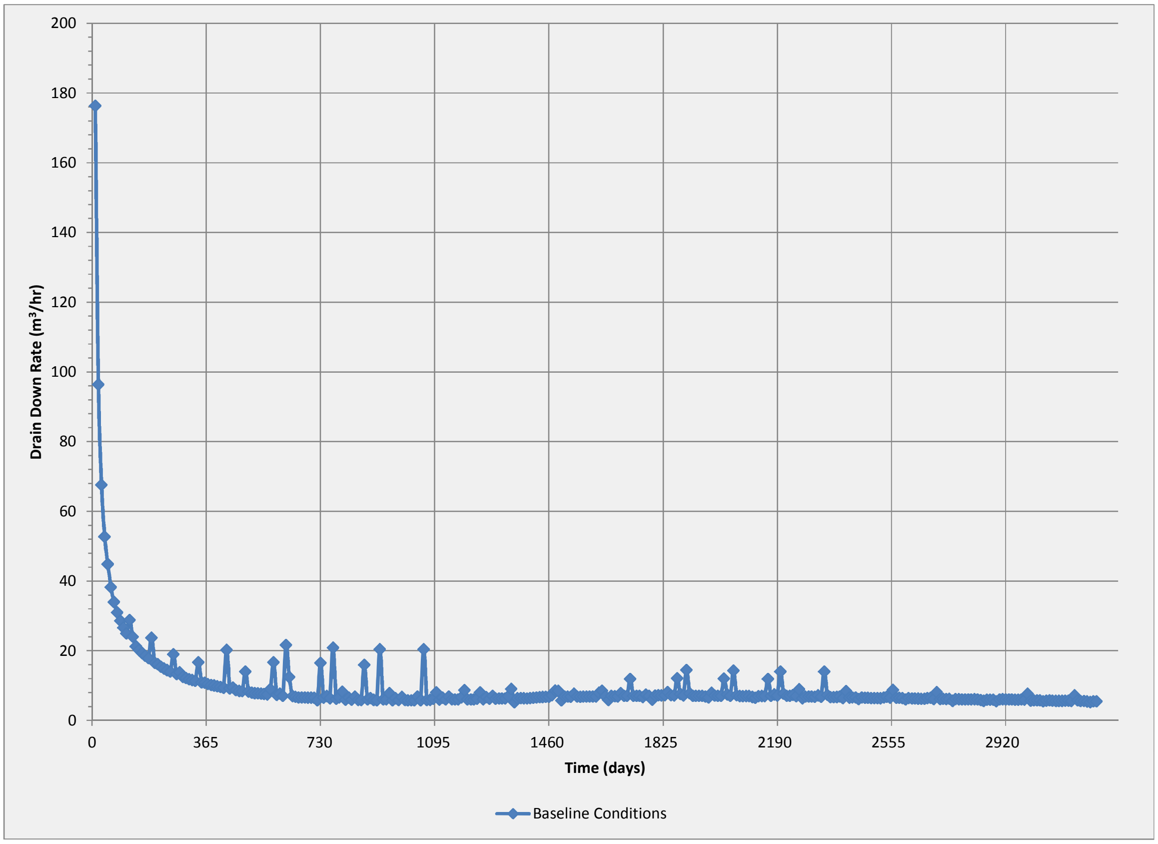
- One quarter of the heap (above the in-heap pond) will have just completed rinsing and have an average moisture content of 13.3%; and
- Three quarters of the heap (above the in-heap pond) will have completed rinsing between 150 and 450 days prior and will contain an average moisture content between 5% and 10%.

Modeling results indicate that the total maximum volume of water within the HLF at the beginning of draindown will be approximately 1,725,000 cubic meters (m^3). A detailed discussion of the model construction and input parameters is provided in Attachment R1-B - Technical Memorandum titled, Seepage and Draindown Evaluation of the 92 Million Tonne Eagle Gold Project Heap Leach Facility – Baseline Conditions (Tetra Tech, 2012).

The previous HLF design included a total of 66 million tonnes of ore, while the current design is for a 92 million tonne facility; this represents an increase in size by approximately one third. The previous draindown modeling estimated that the volume of solution in the heap at the beginning of draindown would be approximately 1,296,000 m^3. The estimated volume of solution within the 92 million tonne heap is approximately 33% larger than previously simulated for the 66 million tonne heap, which is in line with the increased size (~39%) in the overall HLF.

A simulation of draindown resulted in the draindown flow rate curve shown in Figure R1-1. The baseline model results presented in Figure R1-1 was constructed assuming a free draining heap with only precipitation inputs of water (no water management or recirculation). The precipitation inputs (snowmelt or rainfall events) result in the short duration spikes of increased draindown rates shown in the figure. The draindown rate resulting from the modeling of the current 92 million tonne heap is similar to the previous 66 million tonne scenario modeled. Under both heap configurations, the flow rate of the draindown decreases to 10 cubic meters per hour (m^3/hr) after a few years. Within ten years, the flow rate of the draindown is relatively stable at approximately 5 m^3/hr, which is representative of the steady state long term drainage conditions of the heap.

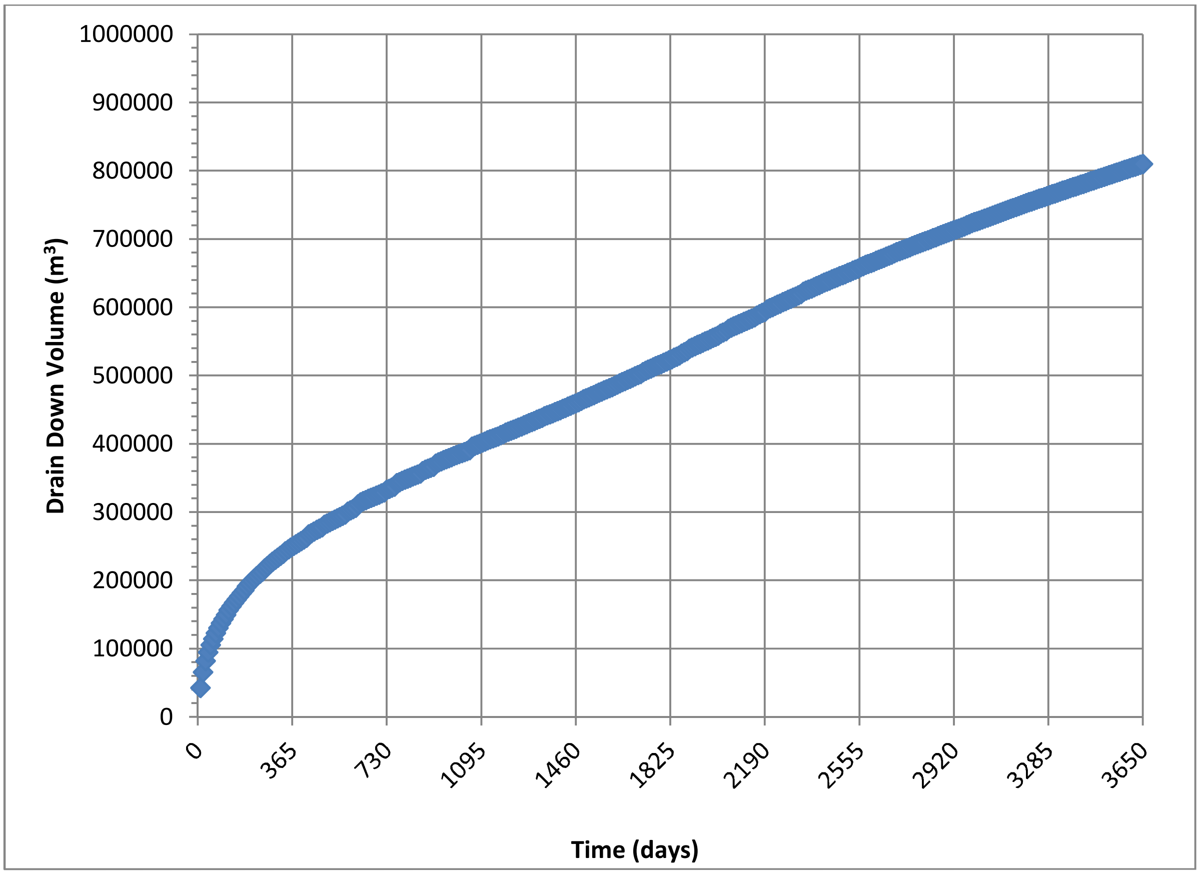
Figure R1-1: Eagle Gold Project – Estimated Heap Leach Facility Draindown Flow Rates



The flow rates presented in Figure R1-1 are estimated to result in approximately 800,000 m^3 of water being drained in the first 10 years after rinsing. This is less water than was previously estimated to have drained over the same period in the 66 million tonne heap models. However, the previous modeling considered only one zone (over the entire heap) draining uniformly from an initial moisture content of 13.3%, while the model now considers that there would be four zones of the HLF that would be in different phases of rinsing and draindown. The modeling for the initial case (66 million tonne heap), was more conservative in that the estimated drainage volumes would be proportionately larger in the same period of time. The current estimated draindown volume of the 92 million tonne scenario is more realistic and has three quarters of the facility at moisture contents of 5% to 10% (assumes that three-quarters of the facility has been draining for 150 to 450 days), and one-quarter of the heap at the initial rinsing moisture content of 13.3%. The draindown volume over time for the simulated 92 million tonne heap is presented in Figure R1-2.

Further, as draindown proceeds towards equilibrium, each year meteoric water is added to the system while rinsate is treated and discharged to the environment so that over time (e.g., within 10 years) most of the water in the heap will be meteoric. For example, if it is assumed that meteoric input is 60,000 m^3 per year, then after ten years the heap will contain 600,000 m^3 of meteoric content. If the "remaining" draindown volume at that time is 890,000 m^3, the meteoric proportion would be almost 70%.

Figure R1-2: Eagle Gold Project – Estimated Heap Leach Facility Draindown Volume



The draindown flow rate presented in Figure R1-1 and draindown volume presented in Figure R1-2 represent the baseline condition that does not include the assumption of an engineered soil cover that limits precipitation infiltration at closure, and does not consider any recirculation of water back to the top of the facility or water management to accommodate the treatment system. Under the optimized system design that will be simulated for the Water Use License application, excess water that cannot be directly routed to the treatment plant will be pumped back to the surface of the HLF and reapplied to the spent ore using the existing emitter system. This recirculation technique will allow for a constant flow rate of water from the HLF to be fed into the treatment plant during the initial draindown period and allow for management of the excess water without relying on any ponds for short-term storage. Recirculation will impact the overall draindown of the HLF by increasing the time required to reach the steady state flow rate of 5 m^3/hr, and it will result in a higher average monthly drainage rate in the early years.

The modeled leachate solution velocities (or percolation rates) at the beginning of draindown are in the range of 0.0001 to 0.0005 meters per second (m/sec) and which reduce to 0.00001 to 0.000001 m/sec toward the end of model period. This is consistent with unsaturated flow dynamics. The rates of drain down will continue to slow until a steady state condition is reached (5 m^3/hr) and the water content in the heap material reaches field capacity (5% moisture content).

R2. A clear description of how water and leach solution will be managed in the events ponds, i.e. will the ponds store water and leach solution for summer and fall or will they be drained within a defined period of time.

R2.1 Response.

Contrary to that stated on p. 35 of the SIR, the events ponds design and overall site water balance assumes that they will *not* be used for storage of any operational water or leach solution. The events ponds are designed to provide overflow contingency storage for the HLF in-heap pond during the design storm and operational upset events.

The HLF does not require storage of leach solution (barren or pregnant) in the events ponds while the HLF is under active leaching. Barren leach solution will be pumped from a tank at the ADR plant and directly applied to ore in the active leaching area. Pregnant leach solution will be stored in the in-heap pond up to the operational volume and pumped out at a steady rate to the ADR plant. The operational level in the in-heap pond will fluctuate due to inflows from rainfall, however the average operational level of pregnant solution in the in-heap pond is anticipated to provide a consistent flow of pregnant solution to the ADR plant while, at the same time, having an operational goal of limiting the head on the in-heap pond liner.

Fresh water required to create leach solution will be pumped directly from wells or supplied from the Lower Dublin South Pond. The events ponds will be used for contingency storage of overflow water and will be kept empty under normal operating conditions for storage of excess runoff from storm events. The events ponds are sized to contain the runoff from the 100-year 24-hour storm event assuming the in-heap pond is at maximum capacity. Assuming fully saturated conditions (no losses to infiltration) of areas upstream of the in-heap pond, the estimated runoff volume reporting to the events ponds is 132,200 m^3. The configuration of the events ponds has a combined operational storage capacity of approximately 182,846 m^3 plus 1 m of freeboard. The combined ultimate storage capacity of the events ponds including the capacity with freeboard is 216,713 m^3. Therefore, the ultimate capacity of the events ponds is large enough to contain the 100-year 24-hour rainfall event plus the volume of runoff from the average snowmelt which is estimated to be approximately 65,470 m^3. This is the worst case (low probability) scenario assuming the in-heap pond is at its capacity and snowmelt occurs followed immediately by the 100-year 24-hour storm event. The runoff from snowmelt and the 100-year rainfall event would overtop the in-heap pond spillway and flow into the events ponds. This stormwater would consist of highly diluted leach solution that could be used as makeup water for the process circuit and placed back on the HLF as leach solution.

The HLF solution storage and operating capacities are summarized in Table R2-1.

The events ponds were designed with a single composite liner system (geo-membrane over geosynthetic clay liner) since they will be empty during normal HLF operations except during short duration excess water balance conditions from storm events or upset operational flows. The design assumes that any fluid that reports to the events ponds will be pumped out and returned to the process circuit within a short period of time. The events ponds will not have a spillway as all water contained in these ponds will need to be controlled and pumped out without discharge to the receiving environment. This configuration and pond design follows industry best practice for HLF overflow ponds based on standard design criteria similar to requirements in the United States such as Arizona Best Available Demonstrated Control Technology (BADCT) for non-storm water ponds.

From BADCT: "*Non-Storm Water Ponds include lined ponds that receive seepage from tailing impoundment, waste dump and/or process areas where potential pollutant constituents in the seepage have concentrations that are relatively low (e.g., compared to process solutions) but exceed Arizona Surface Water Quality Standards. Non-Storm Water Ponds also include secondary containment structures and overflow ponds that contain process solution for short periods of time due to process upsets or rainfall events. Non-Storm Water Ponds will be designed with a single geomembrane of at least 30 mil thickness (exception - 60 mil if proposing HDPE).*"

Table R2-1. Heap Leach Facility Solution Storage and Operating Capacities

Infrastructure	Project Proposal volume (m^3)	Optimized / Updated Volume (m^3)
Pond Capacities		
In-Heap Pond Total Capacity	480,000	507,000
In-Heap Pond freeboard	45,000	48,000
In-Heap Pond without additional freeboard capacity	435,000	459,000
In-Heap Pond Maximum Operational Volume	60,000	133,000[1]
Events Ponds Total Capacity	229,000	217,000
Events Ponds freeboard	54,000	34,000
Events Ponds without additional freeboard capacity	175,000	183,000
Total Combined System Operating Capacity without freeboard	610,000	642,000
Total Combined System Operating Capacity with freeboard	709,000	724,000
Upset Events		
Drain Down, 72 hours		199,000
1 in 100 year snowmelt volume to In-Heap Pond	52,000	65,000
1 in 100 year, 24 hour event storm volume to In-Heap Pond	93,400	132,000

[1] this volume was presented incorrectly as 60,000 m^3 in the SIR and has been corrected here.

References:

Arizona Department of Environmental Quality (2005). Arizona Mining BADCT Guidance Manual, Aquifer Protection Program. Publication TB-04-01. Phoenix, AZ: ADEQ.

3 GEOCHEMICAL CHARACTERIZATION

3.1 BACKGROUND

VIT has proposed to increase the amount of waste rock generated from 66 to 132 million tonnes and ore from 66 to 92 million tonnes. The size and surface area of the waste rock storage areas (WRSAs), HLF, and open pit walls have all increased accordingly. These rock surfaces have the potential to react with air and water and adversely affect water quality (e.g. acid rock drainage/metal leaching, neutral metal leaching). An understanding of the amounts and types of rocks disturbed/exposed helps make accurate predictions to changes in water quality. The Executive Committee has identified a number of issues with the representativeness of the geochemical characterization for the additional rock being disturbed. Submissions received from Environment Canada (YOR 2010-0267-292-1) identified similar issues, which the Executive Committee has taken into account in preparing this information request.

The geochemical characterization presented in Appendix 8 (Geochemical Characterization and Water Quality Predictions) of the original proposal has not been updated to account for the additional tonnage of rock being disturbed. Sample types, locations, and numbers, are based on the original open pit configuration, waste rock volumes, and ore volumes. It is unclear how representative the original geochemical characterization program is in light of the changes proposed in the SIR.

In the original proposal, VIT predicts that acid rock drainage/metal leaching (ARD/ML) is not a concern with the project based on the geochemical characterization. However, with the disturbance of additional materials, it is uncertain if this conclusion remains valid. The Executive Committee requires additional information in order to determine potential effects relating to the potential for ARD/ML. Therefore, please provide the following information:

R3. Updated cross-section and long-section diagrams of the deposit, including new ore and waste rock units as well as the new pit configuration, similar to those utilized in Appendix 8 (Geochemical Characterization and Water Quality Predictions) of the original proposal.

R3 Response

An updated set of cross-sections are provided that show the increased pit shell, delineation of waste and ore and rock unit boundaries (Figures R3-1 though R3-14 in Attachment R3). It is noted that not all core as shown on these figures was available for sampling and that sampling was therefore focussed on core from primarily 2011 drilling and geotechnical drill holes. Within these limitations of core availability, holes and representative intervals were selected that were best placed in those zones that are currently under represented in the geochemical dataset used in the Project Proposal (PP) and SRK (2010). It is expected that this increased sampling coverage will provide sufficient information to verify rock characteristics as provided in the PP and provide an understanding of variable characteristics that will undergo additional kinetic testwork, as needed.

R4. The volume and destination of each rock unit that will be removed from the pit.

R4 Response

Ore and waste rock material has been categorized into the following lithologies:

- Oxidised Metasediments
- Fresh Metasediments
- Oxidised Granodiorite
- Fresh Granodiorite
- Altered Granodiorite
- Overburden

Figures R4-1 and R4-2 provide the various material types removed from the pit by year and to each destination (waste material to Eagle Pup or Platinum Gulch WRSAs and ore to primary crusher, 100-day stockpile and HLF). The pre-strip material (approx. 5Mt) is included in the Year 0 quantities.

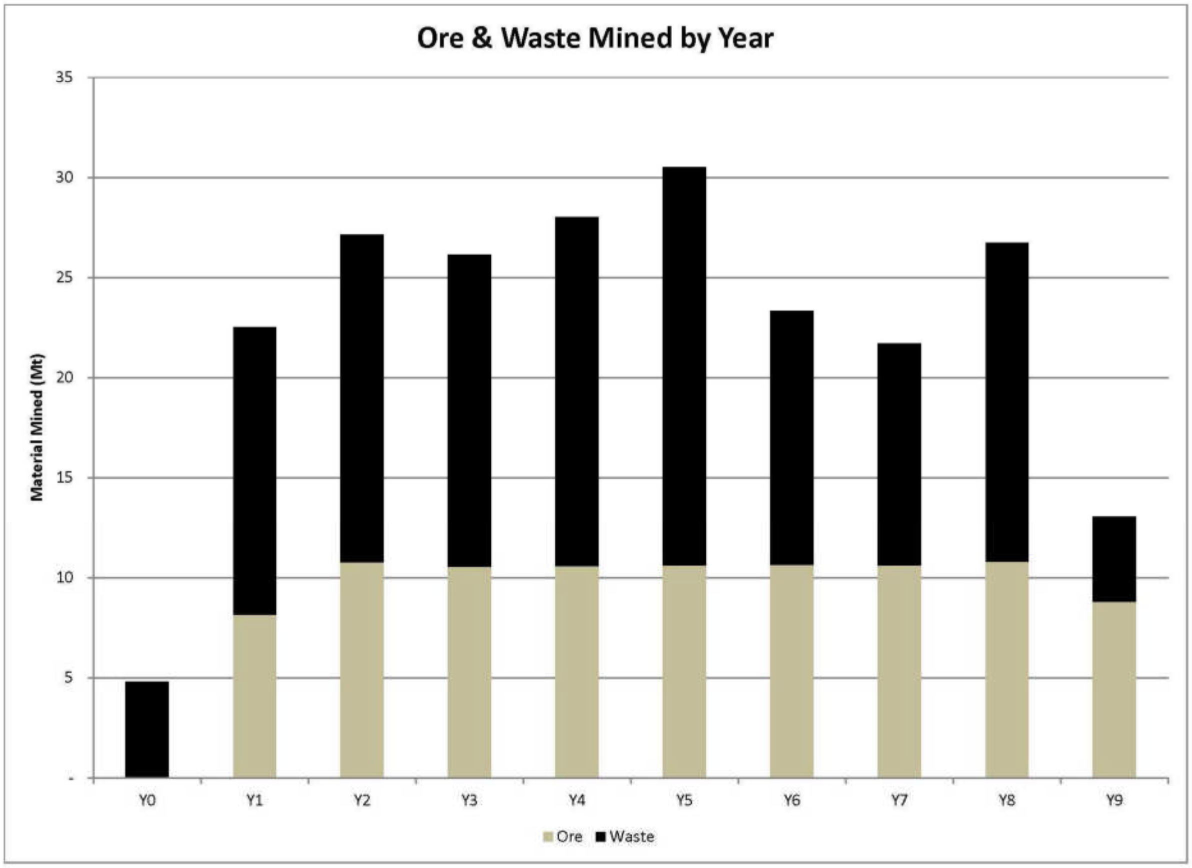


Figure R4-1: Ore & Waste Mined by Year

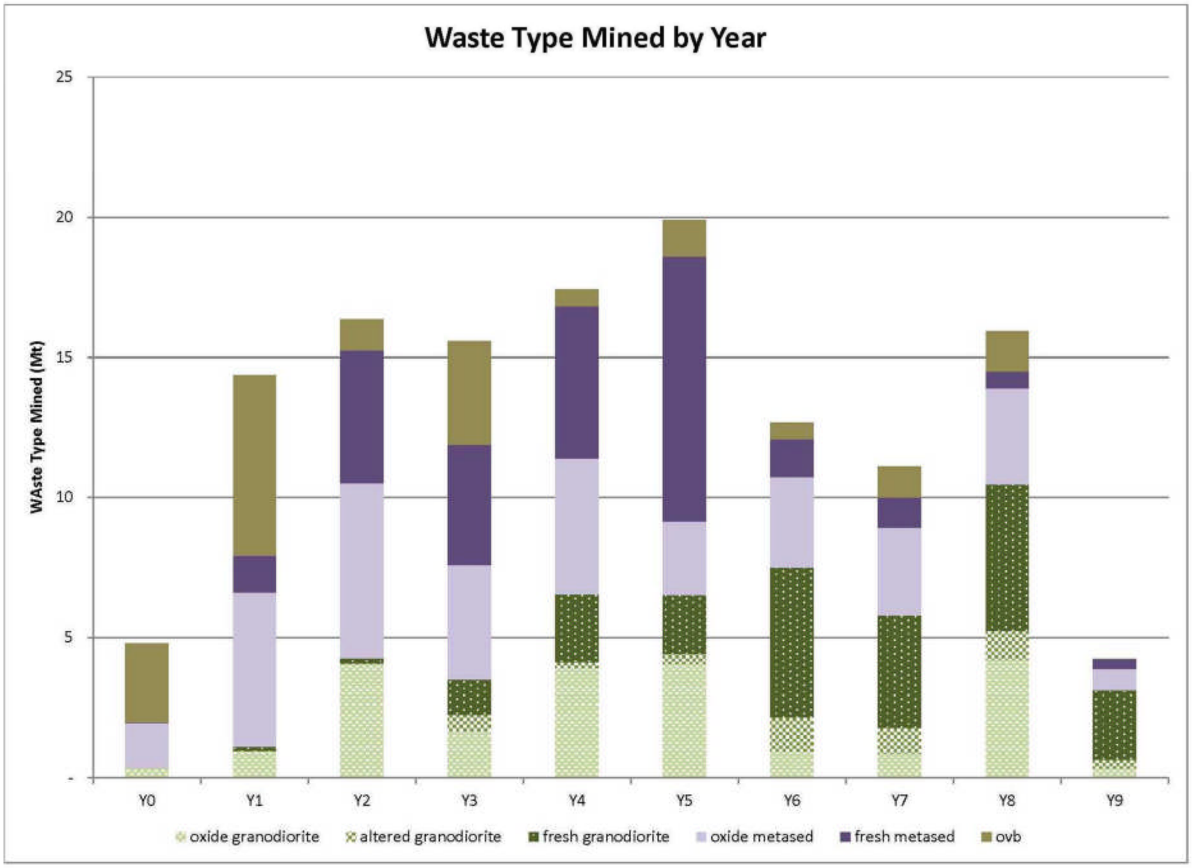


Figure R4-2: Waste Type Mined by Year

The annual amount of each waste rock type mined was calculated by querying the geological block model between the yearly mined-out surfaces generated from the final production schedule of the Feasibility Study (FS). The destination of each waste type was estimated by visually comparing source locations to the planned waste dump lifts being constructed on a yearly basis following the same process as when the destination schedule was developed for the FS. All the more competent granodiorite material is planned to be sent to the Eagle Pup waste rock storage area (except the pre-strip material which will be used for construction aggregate or overliner material for the HLF), especially in the lower lifts, to enhance its stability. The upper portion of the Platinum Gulch WRSA will consist primarily of overburden type material, which will allow it to be reclaimed after it is no longer needed (end of production year 3) by pushing this material down and covering the lower lifts with dozers.

The yearly amount of each ore rock type mined comes directly from the FS report. All ore from the pit will be sent to the primary crusher. Most of this material will then be sent on to the HLF; however, starting in year 2, a 100-day stockpile will temporarily store ore material mined in the winter months after primary crushing. Each year, the ore from the stockpile will be transferred to the HLF for leaching over the remaining 250 days (approximate duration based on ambient temperatures).

R5. Demonstrate how the geochemical characterization presented in Appendix 8 (Geochemical Characterization and Water Quality Predictions) of the original proposal is applicable and representative for those rock units that make-up the additional waste rock volumes, ore volumes, and new pit wall configuration.

R5 Response

Project modifications and expansion of facilities associated with the May 2012 Feasibility Study, while they include increased volumes of ore and waste rock, do not represent exposure of new rock types or lithological units. A detailed comparison of volumes (and surface areas) of waste and ore by rock type as provided in the Project Proposal and Feasibility Study using an updated drillcore assay dataset is provided in Attachment R5-A (SRK Memo to VIT July 15, 2012). Based on the review of the assay data, there is no indication that the additional waste rock or ore will be substantively different than that characterized previously in the Project Proposal.

Confirmatory geochemcial testwork was initiated in early 2012 and is currently underway to expand the characterization work presented in the Project Proposal. Testwork includes acid base accounting and metals analyses as well as an anticipated subset for mineralogical analysis and humidity cell testing. The results of this additional testwork will likely be complete in Q4 2012 and will support the regulatory review process including the application for a Type A Water Use License as required under the *Yukon Waters Act* administered by the Yukon Water Board. Results of the confirmatory testing will be reviewed when available and if necessary additional kinetic testing will be conducted.

4 HEAP LEACH LINER SYSTEM

4.1 BACKGROUND

VIT has proposed to change the liner system below the HLF. The Executive Committee has identified a number of issues with the information regarding the new proposed liner system. Submissions received from the First Nation of Na-Cho Nyak Dun (YOR 2010-0267-295-1) and the Yukon Conservation Society (YOR 2010-0267-291-1) identified similar issues, which the Executive Committee has taken into account in preparing this information request.

The original proposal (p. 5-20 and Fig. 5.4-11) proposed a liner system in the in-heap pond portion of the HLF that included three poly-vinyl chloride (PVC) geomembrane liners, two leak detection recovery systems (LDRS), and two low permeability layers. The liner system in the upslope area of the HLF included two PVC geomembrane liners, one leak detection recovery system, and two low permeability layers.

The SIR (p. 37 and Fig. 5.4-3) proposes a liner system in the in-heap pond portion of the HLF that includes two linear low density polyethylene (LLDPE) geomembranes, one geosynthetic clay liner, one LDRS, and one low permeability layer. The liner system in the upslope area of the HLF includes one LLDPE geomembrane and one geosynthetic clay liner.

VIT indicates that the new liner system has been improved (SIR p.3) and meets the requirements of the Nevada State guidelines (SIR, p.38). However, there are no details or comparison to indicate that the new liner system is an improvement over the original proposed liner system. It is unclear how a single LDRS is an improvement over two LDRSs. It is unclear how two LLDPE geomembranes will improve performance compared to three PVC geomembranes.

VIT has indicated that the HLF liner will be designed to meet the Nevada State Guidelines (Nevada Administrative Code). The Nevada Administrative Code sets out minimum design criteria for selected mining infrastructure including – ‘Liners’ (NAC 445A.438) and ‘Leach pads and other non-impounding surfaces designed to contain and promote the horizontal flow of process fluids’ (NAC 445A.434). It is unclear how applicable the Nevada Administrative Code is to the Eagle Gold Mine particularly because NAC 445A.434 [3]) state:

> *“If leach pads or other nonimpounding surfaces are located above areas where groundwater is considered near the surface* [as is the case with the Eagle Gold project]*, the Department may require a liner system with a higher level of engineered containment.”*

The proposed HLF liner system is to be constructed below the water table and should liner failure result in an uncontrolled release of process leach solution it is very likely that the discharge would flow into Dublin Gulch or Haggart Creek, Both watercourses are fish-bearing and can have multiple water users.

The Executive Committee requires additional information in order to determine the significance of potential effects relating to the proposed liner system. Therefore, please provide the following information:

R6. Provide rationale outlining the suitability of the liner system outlined in the Supplementary Information Report, considering:

a.) the northern location;

b.) the local hydrological and hydrogeological regimes (i.e. proximity to surface and groundwater).

c.) the increased height, weight, and volume of ore on the heap leach facility.

d.) amount of hydraulic head predicted below and above the liner system.

R6. Response

The Eagle Gold HLF design has been prepared in accordance with generally accepted engineering practices and Best Available Technology (BAT) industry practice to provide a high level of groundwater protection. The HLF and associated facilities are designed to operate without any structural failures that may cause a discharge to the underlying aquifer.

The successful application of a liner containment system depends upon site evaluation (including local climatic, topographic, geologic, hydrologic, and hydrogeologic conditions), overall HLF design, material selection, construction, operation and maintenance. Current industry BAT practice for containment of mine process fluids was incorporated in the design of the Eagle Gold HLF liner system.

R6-a) <u>Suitability of Liner System Design to Northern Location</u>

For mine sites located in sub-arctic regions (or at high altitude sites with similarly cold climates), special considerations are required for design of the HLF. There are three types of HLF designs that have been successfully implemented in sub-arctic regions:

1. Valley-fill leach pad where the leach solution is impounded within the leach pad behind a confining embankment (as with the current project proposal).
2. Modified valley-fill leach pad with a similar construction including a confining embankment, but with the leach solution that is allowed to drain through a solution collection system via gravity to external process ponds.
3. Conventional leach pad without a confining embankment but with a solution collection system where leach solution drains via gravity directly to external process ponds.

Table R6-1 provides a comparison of the selected liner system for the Eagle Gold HLF with existing or recent projects in cold climates. While it is recognized that each project has site-specific constraints related to proper liner system selection, it is noted that recently constructed valley-fill heap leach projects in cold climates include liner systems similar to the selected Eagle Gold HLF liner system. This includes a liner system:

- with a single geo-membrane making up the composite liner system in the upper heap leach areas above the in-heap pond storage area where groundwater is at significant depths below the liner (~20 m bgs), and where hydraulic heads above the liner will be low, and
- a double geo-membrane making up the composite liner system within the in-heap pond area where depth to groundwater is closer to the base of the liner system and where hydraulic heads above the liner will be significant.

The preferred geo-membrane material for heap leach pad installations since the mid-1990's is LLDPE. This preference is due to LLPDE's superior characteristics, as compared to polyvinyl chloride (PVC) and high density poly-ethylene (HDPE) liners, with respect to tensile strength, flexibility, cold temperature characteristics and resistance to puncturing. The various selected geo-membrane liner thicknesses are based on site-specific evaluations with consideration to ore loading, foundation and subgrade characteristics, drainage rock (over-liner) characteristics as well as laboratory testing of the liner systems to simulate operational conditions.

The proposed Eagle Gold HLF is a valley-fill leach pad with a confining embankment. A primary design consideration for cold weather heap leach pad construction is the suitability of the selected geo-membrane liner system to the expected climatic conditions during construction and temperature ranges during operations. Other components of the liner system are not particularly sensitive to cold conditions. Table R6-2 presents a summary of the liner system design components for the Eagle Gold HLF.

Table R6-1. Comparison of Liner Systems Used at Cold-Climate Mine Sites

Item	Description/Criteria	Eagle Gold Project Victoria Gold Yukon Territory, Canada (Proposed)	Fort Knox - Walter Creek Kinross Gold Corporation Fairbanks, Alaska (2010 - Present)	Veladero Mine Barrick Gold Corporation San Juan Province, Argentina (2006 - Present)	Brewery Creek Viceroy Gold Yukon Territory, Canada (1996 - 2002)
Average Minimum Temp	Average annual low temperature at site taken from available climate records.	Average Low Temperature: -31 C	Average Low Temperature: -35.5 C	Average Low Temperature: -30 C	Average Low Temperature: -40 C
Heap Leach Type	Based on available project records and design reports.	Valley-fill with in-heap pond - Single composite liner in areas with limited hydraulic head, double composite liner in areas with higher hydraulic head.	Valley-fill with in-heap pond - Single composite liner in areas with limited hydraulic head, double composite liner in areas with higher hydraulic head.	Valley-fill with in-heap pond - Single composite liner in areas with limited hydraulic head, double composite liner in areas with higher hydraulic head.	Conventional heap leach pad with external process ponds (no in-heap pond)
Overliner Material	Layer to protect the lining system from damage by ore placement whilst not impacting the conveyance of solution to the recovery wells.	Minimum 1m of crushed ore to protect the lining system from damage by ore placement.	36" (1m) overliner cover maintained over 10" (250mm) and 24" (600mm) main solution collection headers	0.6m thick drain cover fill layer	1.0 m granular overliner of plus 6.4 mm minus 25 mm screened ore
Overliner Pipework	Network of pipes installed within the overliner material to collect and convey leachate by gravity to the PLS collection point.	450mm, 375mm, 250mm, and 100mm diameter corrugated, dual-wall, perforated ADS N-12 pipes designed to limit hydraulic head over the liner to less than 1m.	600mm, 300mm, 250mm, 200mm, and 150mm diameter perforated CPT solution collection headers	None described	None described
Upper Liner (in-heap pond areas)	Suitable liner material to provide required puncture resistance, elastic strain range and resistance to solution attack, together with good cold weather performance.	60 mil LLDPE liner geomembrane	80 mil LLDPE geomembrane	100 mil LLDPE geomembrane	40 mil PVC geomembrane liner over 300 mm thick compacted silt layer (Note 1)
Leak Detection & Recovery System (in-heap pond areas)	A system in to collect leakage through the upper liner and convey it to monitoring points.	High load geocomposite to collect and convey any leaked solution to LDRS sump.	Geocomposite on steeper slopes, 12" (0.3m) sand layer with slotted HDPE collector pipes on flatter base area, 36" (1m) additional sand layer in LCRS sump	High stress, high tenacity granular soil	Geotextile filter over a granular layer of minus 25 mm aggregate
Lower Liner	Compacted fine grained soil below a geosynthetic liner to provide a composite liner to minimize leakage. Objective maximum permeability 1 x 10-5 cm/s.	60 mil LLDPE liner over GCL over compacted fine grained subgrade. GCL has a maximum permeability equivalent to 12" (300 mm) of 1 x 10-6 cm/s soil.	80 mil LLDPE geomembrane over 12" (0.3m) thick prepared subbase below the geomembrane with a permeability less than 1 x 10-5 cm/s	80 mil LLDPE geomembrane with 0.3m thick liner bedding soil layer	30 mil PVC geomembrane liner over 300 mm thick compacted silt layer
Underdrain System	Network of pipes and/or gravel drains installed below the liner system to collect and convey groundwater by gravity to a point downstream of the Heap Leach Facility.	"French" drains constructed of clean gravel, corrugated, dual-wall, perforated ADS N-12 pipes and geotextile.	Trench drains constructed on the side slopes filled with clean drainage rock	None described	None described

Note 1) The Brewery Creek heap leach pad was a conventional facility with external ponds and did not include an in-heap pond. The entire heap leach pad area incorporated a double composite geomembrane liner system.

Table R6-2: Heap Leach Facility Liner System

Component	Description
GCL	CETCO Bentomat DNM, or equivalent, installed in entire HLF area.
Soil Liner	Low permeability seal zone constructed of compacted, low-permeability soil on the HLF confining embankment upstream slope
Primary Geomembrane	60 mil (1.5mm) Linear Low Density Polyethylene (LLDPE)
LDRS (In-heap pond area)	Leak Detection and Recovery System comprising High Load Geocomposite
Secondary Geomembrane (In-heap pond area)	60 mil (1.5mm) Linear Low Density Polyethylene (LLDPE)

The geo-membrane liner selection process for the Project considered four important technical factors associated with the geomembrane liner: 1) resistance to rock puncture, 2) elongation capacity to withstand foundation settlements under high heap loads, 3) long-term exposure to temperature extremes (particularly temperature expansion and contraction), and 4) constructability considerations. Linear Low Density Polyethylene (LLDPE) geo-membrane was selected for the leach pad over HDPE or PVC geo-membranes for the following primary reasons:

- LLDPE geo-membrane has significantly better elongation performance and puncture resistance compared to HDPE or PVC geo-membranes. LLDPE geo-membranes are very flexible, with a higher tensile break elongation than HDPE geo-membranes and, therefore, greater ability to maintain their integrity under localized differential settlement without puncturing, tearing, or cracking (Koerner 2005).
- The low temperature impact resistance of LLDPE is far superior to that of PVC (Scheirs 2009). LLDPE geo-membrane remains flexible (retains full ductility) at temperatures well below freezing to about -25°C with a low temperature brittleness of -70°C according to ASTM D-746. PVC loses its flexibility and becomes brittle at -25°C, leading to loss of integrity (failure) of the PVC liner. The average minimum air temperature at the Eagle Gold site is -31°C, however the liner temperature is expected to remain significantly higher than ambient temperatures once buried and insulated by the overliner and ore pile.

- LLDPE has superior stress crack resistance at low temperatures compared to HDPE or PVC, which is important in cold climates (Koerner 2005). This is in part due to HDPE being prone to environmental stress cracking due to its crystal lattice structure.
- Geo-membrane industry studies indicate that by far the predominate mode of geo-membrane failure is man-induced damage during construction, such as stone punctures, damage by mobile equipment, worker traffic, and depth stake puncturing (Peggs, 2010). Although it may seem intuitive that a triple composite liner system would provide better containment performance over a double composite liner, this is not necessarily the case. Given the increased likelihood of damaging previously installed liners while constructing subsequent liner components in a triple liner system, the resulting increased failure and leakage rate will outweigh the potential benefits of the additional geo-membrane layer. The proposed in-heap pond double geo-membrane liner is necessary due to the designed higher hydraulic head levels. A third geo-membrane liner is not warranted provided the double liner system is installed with appropriately selected components and with a high level of QA/QC. A double liner system for the up-gradient heap areas is not warranted given the low hydraulic heads on the liner system. Please see R6-d below for further discussion of expected hydraulic head levels within the heap.

The Leak Detection and Recovery System (LDRS) design for the in-heap pond area includes a drainage layer between the upper and lower liners designed to allow flow of any leaking solutions to a collection sump thereby preventing any build-up of hydraulic head on the lower liner. The drainage layer used for the in-heap pond area will be a geo-composite; a tri-axial geonet structure with thermally bonded nonwoven geotextiles on both sides. This product is capable of providing high drainage rates under both low and high loads to accommodate the various loading conditions anticipated during the life of the HLF. The specified geo-composite product (Tenax Tendrain 770) has been tested to simulate heap ore stack heights up to 255m or 4413 kPa (see response to R6-c below). Results indicate some deformation of the geo-net which may result is some reduction of transmissivity. Manufacturer testing of this product indicates flow rates of 1 x 10^{-3} m^2/s under loads of 1200 kPa. The maximum anticipated ore stack height within the in-heap pond area is approximately 150 m which corresponds to 1813 kPa. The final HLF design will consider these results and refinements will be made to ensure the geo-composite layer is paired with a sand layer in the high load areas of the in-heap pond, to add redundancy, and to ensure satisfactory performance of the LDRS under maximum load operational conditions.

The design utilizes a Geo-synthetic Clay Liner (GCL) in lieu of the 150 mm-thick layer of low permeability soil prescribed by State of Nevada guidelines. This modification is due to the limited availability of suitable onsite low-permeability soil borrow materials. The GCL soil liner provides an equivalent 300 mm (12 inch) minimum thickness of $1x10^{-6}$ cm/sec or lower permeability soil layer, which results in superior engineered containment when compared to the State of Nevada prescribed liner system. Leakage calculations have been performed to demonstrate permeability performance of the GCL layer (see response to R6-b).

A suitable compacted subgrade is an important component of the liner system as it provides a smooth, debris free, and firm base for placement of the geo-synthetics. Subgrade preparation for the GCL placement will involve compaction of 150 mm-thick layer (minimum) to 95 percent of the maximum dry density based on ASTM D 698. Rocks larger than 38 mm (1.5 inches) in diameter will first be removed from the upper 150 mm of the subgrade prior to compaction. If the in-situ site soils are not suitable for subgrade, appropriate material such as locally derived silt or processed placer tailings will be imported, placed and compacted to form the subgrade.

An over-liner drainage and cushion layer will be placed over the entire leach pad liner system. The primary functions of the over-liner are as follows:

- to minimize the head on the liner to reduce the risk of process solution leakage,
- to protect the synthetic liner from damage during ore placement; and
- to maximize the return of the gold containing pregnant solution for processing.

The proposed over-liner will consist of a 1 meter thick layer of crushed ore or waste rock. A network of perforated collection piping will be embedded in the over-liner to help convey the solution within the layer. Solutions collected in the over-liner will report to the in-heap storage pond and solution collection wells located upstream of the in-heap embankment. The over-liner will be produced from the crushing of clean durable rock to produce a free draining, non-plastic, material sized at minus 1.5 inches, and containing less than 20 percent fines passing the No. 4 ASTM sieve size, and less than 5 percent fines passing the No. 200 ASTM sieve size. The minimum in place hydraulic conductivity of the over-liner material will be $2x10^{-4}$ m/s. Methods will be developed on site for placing the material in a manner that will protect the geo-membrane liner and drain pipework from damage and keep compaction of the material to a minimum. The design will ensure fully drained heap conditions are maintained throughout operations in the up-gradient HLF areas.

The over-drain pipework selected for the Project is dual-wall polyethylene (PE) pipe (ADS N-12). The specified pipe has been evaluated to ensure its integrity and function under the designed maximum ore loads. The calculations indicate a maximum pipe deflection of approximately 6.8 percent. The pipe load testing by Thiel and Smith (2003) indicates ADS N-12 pipe can withstand up to 25 percent vertical deformation without buckling. The design will therefore provide a minimum factor of safety of over 3 against pipe failure for the Eagle Gold HLF over-drain pipes when installed with competent crushed gravel cover. Detailed calculations are presented in Appendix C of the HLF design report (Tetra Tech 2012a, Attachment R7-A).

R6-b) Suitability of Liner System Design to Local Hydrology and Hydrogeology Regimes (i.e., the Proximity to Surface Water and Groundwater).

The HLF at maximum build out will cover almost the entire Ann Gulch sub-basin and extend into and across the Dublin Gulch valley. The Ann Gulch sub-basin is underlain entirely by metasediments, while a thin wedge of alluvium is present near the sub-basin mouth where it joins the Dublin Gulch valley. A thin veneer of colluvium and weathered bedrock generally overlies the metasediments.

The Ann Gulch watercourse is generally dry during most of the ice-free season such that the water table is below the gulch channel and does not have a surface expression, except during freshet when flow can be observed in the lower hundred meters of the channel. Based on groundwater monitoring wells, test pits and geotechnical borings, the depth to groundwater in the upper and mid basin has been observed to range from 15-25 m bgs depending on location; the depth to groundwater decreases towards to about 5-10 m bgs in the lower basin where it joins with the Dublin Gulch valley (see Figure 5-2 in Appendix 15, Environmental Baseline Report Hydrogeology, Stantec 2011). Depth to groundwater in the Dublin Gulch valley at the proximity of the heap embankment varies between 2-8 m bgs due primarily to the variation in placer topography.

In general, based on continuous and instantaneous groundwater level data collected from wells in the Ann Gulch basin, the seasonal and year to year variation in depth to groundwater has been less than 1 m at any particular location as indicated by Figure R6-1 (Stantec 2012). Figure R6-2 provides a hydrogeological cross section for the Ann Gulch Valley where the HLF will be constructed to illustrate the baseline groundwater conditions and HLF infrastructure. Figure R6-2 is reproduced in this response from Figure 5-2 of the Stantec 2011, Hydrogeology Baseline Report Appendix 15 to Project Proposal. Since the proposed HLF will occupy the entire sub-basin once the HLF is fully constructed, the HLF will intercept essentially all of the incident precipitation, which will correspondingly reduce recharge/infiltration and induce an overall lowering of the water table throughout the sub-basin.

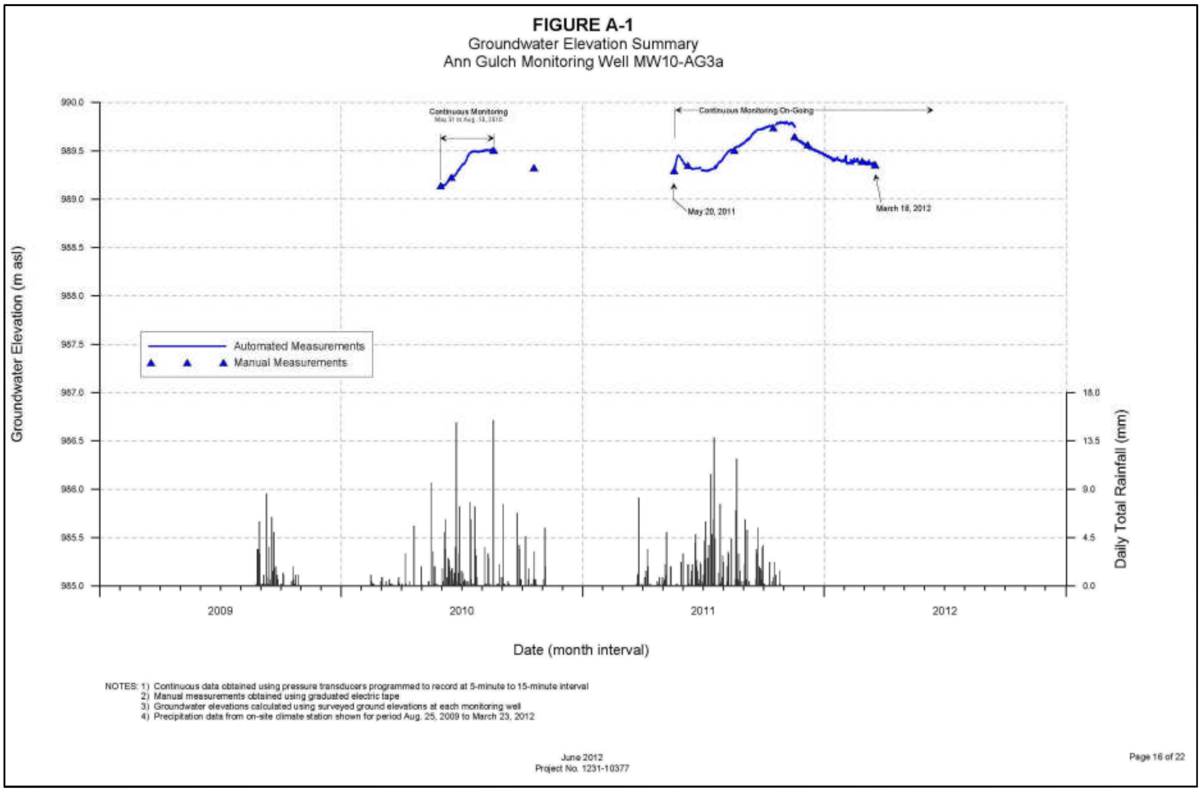


Figure R6-1 Groundwater Elevation Summary, Ann Gulch Monitoring Well MW10-AG3a

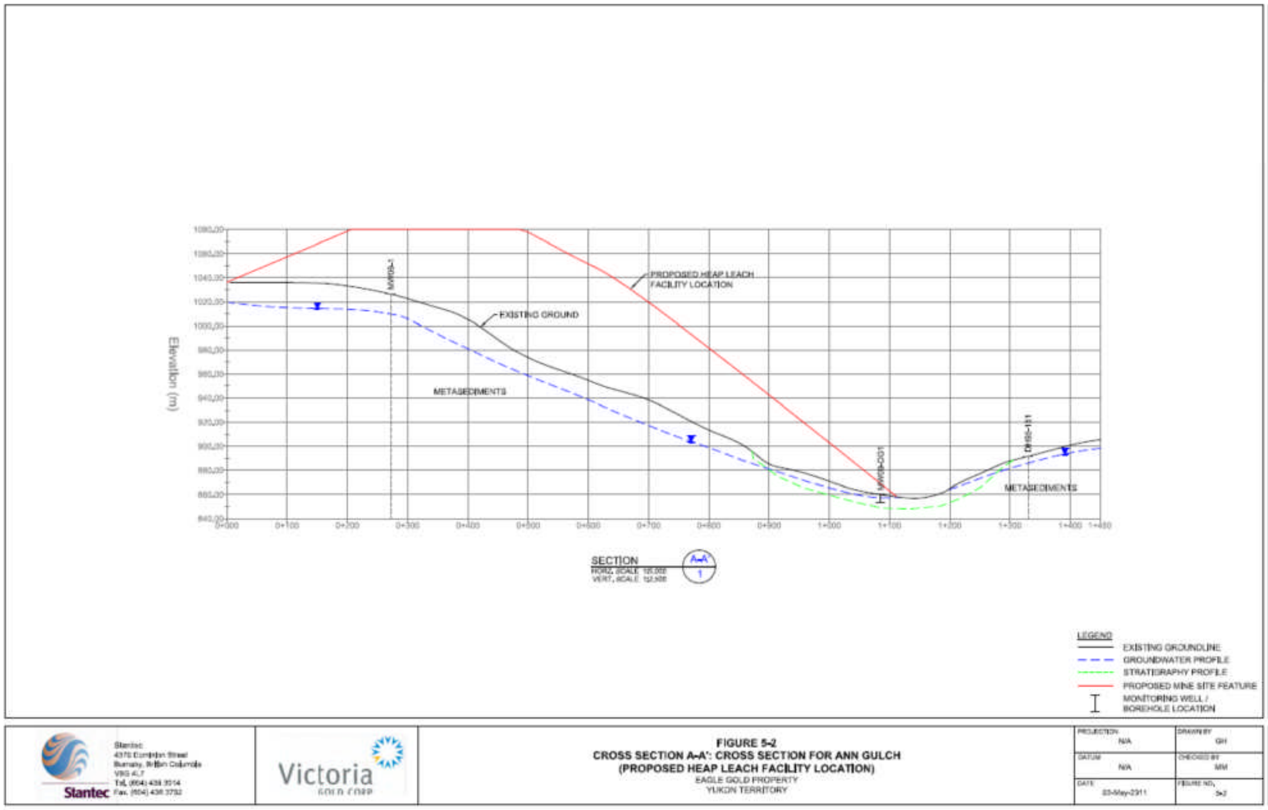


Figure R6-2 Cross Section for Ann Gulch Groundwater Profile at Proposed HLF Location
*(reproduced from Stantec 2011, Hydrogeology Baseline Report Appendix 15 to Project Proposal)

The HLF liner system design addresses the initial (or baseline) and evolving site-specific groundwater regime at the Project site and provides a high level of engineered containment using industry-standard approaches. With standard levels of liner installation quality assurance, the calculated containment performance of the proposed Eagle Gold HLF liner system exceeds the performance of the liner system prescribed by the State of Nevada as well as the PVC liner system previously proposed, but without the disadvantages described above in R6-a. Attachment R6-A presents the liner leakage calculations performed for the proposed Eagle Gold liner system. To provide a comparison, similar calculations were performed for the prescribed State of Nevada liner system and the PVC liner system previously proposed. The analyses calculated the potential leakage rate for the alternative liner systems through the secondary liner sump of equal size with the same parameters and hydraulic conditions. The leakage rates for each liner configuration and are presented in Table R6-3.

Table R6-3– Comparison of Liner System Leakage Rates

System	Description	Calculated Leakage Rate
Proposed Eagle Gold liner system	1.5mm LLDPE underlain by GCL (k=1x10^{-9} cm/s)	3.5 L/day
State of Nevada prescribed liner system	Geomembrane underlain by 1.0 ft of low permeability soil (k=1x10^{-6} cm/s)	12.87 L/day
Previously proposed PVC liner system	0.75mm PVC geomembrane underlain by 0.3 m of low permeability silt (k=1x10^{-5} cm/s)	70.72 L/day

As shown in Table R6-3, the proposed Eagle Gold HLF liner system provides superior containment over the other liner systems evaluated. The calculations indicate leakage rates are reduced by a factor of 4 for GCL versus a low permeability soil layer having permeability of 1x10^{-6} cm/s. This factor is over 20 when comparing GCL to the State of Nevada prescribed system with a low permeability soil layer having a permeability of 1x10^{-5} cm/s. Additional calculations supporting these findings demonstrating that GCL provides a superior level of engineering control when compared to a low permeability soil can be found in Section 3.0 of Attachment R6-A.

R6-c) Suitability of Liner System Design Associated with the Increased Height, Weight, and Volume of ore on the Heap Leach Facility

A 1.5-mm (60-mil) LLDPE geo-membrane was selected for the leach pad, based on results of laboratory testing that simulated the loading of ore using parameters that exceeded the expected height, weight and volume of ore to be placed on the HLF. Large scale puncture tests were performed on the entire proposed liner system. Representative samples of soil subgrade materials collected from the site were compacted into a mould and covered with the liner system components and over-liner gravel derived from site samples. A normal stress of 4413 kPa (640 psi) was applied for 48 hours and the liner inspected for damage. The loading represents an equivalent static load of 255m of ore. No punctures were observed visually or with a vacuum box test with a negative pressure of 41 kPa (6 psi). The planned maximum ore stack height over the liner system is approximately 150 m which allows for a factor of safety of 1.7 against liner puncture due to ore static loading. Results of the liner puncture testing are presented in Attachment R6-B.

Proper installation of the liner system is critical to the operational performance of the system. A liner system Quality Assurance/Quality Control (QA/QC) Program will be developed and implemented that meets or exceeds the geo-membrane manufacturer's minimum requirements including inspection procedures, field testing (including limits for test failure and a description of the corrective procedures to be used upon failure), laboratory testing, and repair of seams during installation and final inspection of the completed liner for functional integrity. Geo-membranes will be installed in compliance with manufacturer's seaming and seam testing recommendations for installation. The QA/QC Program will also address site and subgrade preparation, and installation and testing of the low permeability soil component of the HLF confining embankment. Additionally, guidelines for the operation and maintenance of the liner system will be formulated and implemented for the life of the facility.

R6-d) Suitability of Liner System Design associated with the amount of hydraulic head predicted below and above the liner system.

The selected liner system is designed to control hydraulic head conditions above and below the liner system. The amount of hydraulic head over the HLF liner (upgradient of the in-heap pond) is designed to be limited by the proposed over-liner system consisting of a 1 meter thick layer of clean, crushed gravel and a network of perforated pipes to collect and convey leachate to the in-heap storage pond. The over-liner system and collection piping are designed to minimize the hydraulic head on the liner thereby reducing the risk of process solution leakage as well as to protect the synthetic liner from damage during ore placement. This protection is further enhanced by the underlying GCL liner. To further minimize the potential for leakage through the pads' liner system, the hydraulic head above the liner is designed to be less than a maximum height of 2.0 m (average of 1.0 m). Piezometers will be installed within the liner cover fill at the strategic locations to monitor the hydraulic head on the liner system during pad operation. These instruments will provide important information regarding solution levels within the heap leach ore pile and verify the over-drain system is functioning as designed.

Hydraulic head levels on the lower liner within the in-heap pond will be minimized by the LDRS, which will be constructed between the lower and upper geo-membrane liners and allow for the pumping back of any leaked solutions via a pump installed in the LDRS sump. A flow meter will be installed in the pump's outlet to monitor leakage rates and ensure the liner, leak detection and recovery system are working as per design. This system has been designed to result in minimal hydraulic head on the lower geo-membrane liner and provides for the collection and removal of solutions from between the upper and lower geo-membrane liners. The network of perforated piping and drain rock within the LDRS system is designed to evacuate leaked fluids and eliminate hydraulic heads on the primary geo-membrane liner. The LDRS includes a sump designed to collect any leaked solutions, and these will be recovered via a dedicated, automatic, fluid-level activated submersible pump (see Attachment R6-A). The pump will be large enough and capable of pumping the necessary flow rates to maintain minimal head on the bottom liner.

An under-drain system will be constructed below the composite liner system to remove any near surface groundwater. The under-drains will be entrenched and constructed with geo-fabric wrapped around granular drain rock backfill materials and perforated piping to form a "French" drain. The drains will convey fluids by gravity to a point down-gradient of the HLF where flows can be monitored for quantity and quality. The Ann Gulch area under-drain system design incorporates 100 mm diameter corrugated perforated PE (ADS N-12) pipes in each trench surrounded by clean durable crushed gravel. The geo-fabric will form a separation between the gravel and the surrounding soils to prevent contamination of the gravel. The trench drain pipes will be connected to a collection header trench containing two 200 mm diameter pipes. Additional trench drains with 200 mm diameter pipes will be installed in the Dublin Gulch area of the HLF. The collection pipes will be installed below the HLF confining embankment and under the events ponds at a minimum one percent grade to a concrete sump to be located below the events ponds. The sump will be designed to accommodate an automated pump arrangement that will be capable of pumping flows back to the HLF, if needed. The sump will be monitored for flow quantity and water quality.

Appendix C of the HLF design report (Attachment R7-A) contains the drainage and hydraulic head calculations (Tetra Tech, 2012) and Appendix A of the report presents the design drawings. Details of the liner system can be found in Figures 5 and 8, details of the underdrain system are in Figure 6, and details of the over-drain system are found in Figures 10 through 12 of the report. Preliminary technical specifications for the over-drain and under-drain materials can be found in Appendix D in Section 3.7 of the report.

References:

Scheirs, John (2009), A Guide to Polymeric Geomembranes: A Practical Approach

Peggs, Ian (2010), Geomembrane Liners for Resource and Environmental Protection: Ensuring Long Term Performance.

Koerner, Robert M. (2005), Designing with Geosynthetics (5th Edition)

Stantec (2012), Eagle Gold Project – Environmental Baseline Data Report: Hydrogeology 2011 – 2012 Update.

Tetra Tech (2012a), Eagle Gold Project – HLF Overdrain Pipe Deflection Analysis, 21 February 2012.

Tetra Tech (2012b), Eagle Gold HLF – Drain Pipe Design, Technical Memorandum, 10 February 2012.

Thiel, R. and Smith, M. E. (2003), State of the practice review of heap leach pad design issues, Proc. of the December GRI conference, Las Vegas, Nevada, December.

5 MISCELLANEOUS

R7. Appendix 4 – Heap Leach Facility design references five appendices (Appendix A through E) which were not provided. Please provide these appendices.

R7 Response

The entire Heap Leach Facility Design Report, including the Appendix A through E are provided as attachment R7-A to this response.