Petition for Variance

WQCC Regulations 20.6.2.3109(C) and 20.6.2.3109(H)(3) NMAC

Tyrone Mine Savannah Pit

Prepared for **Freeport McMoRan, Tyrone Inc.**
Tyrone, New Mexico

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1. Introduction

Pursuant to Section 74-6-4(G) NMSA 1978 and 20.6.2.1210 NMAC, Freeport McMoRan Tyrone, Inc. (Tyrone) petitions the New Mexico Water Quality Control Commission (WQCC) for a variance from WQCC regulations 20.6.2.3109(C) and 20.6.2.3109(H)(3) NMAC. Tyrone is seeking variance from these regulations in order to allow a copper ore leach stockpile to be placed in the Savannah pit at the Tyrone Mine located in Grant County, New Mexico, approximately 10 miles south of Silver City (Figure 1). The modification of discharge permit 455 (DP-455) by the New Mexico Environment Department (NMED) is contingent upon WQCC approval of this variance petition.

Section 20.6.2.3109 NMAC stipulates conditions for the approval, disapproval, modification, or termination of discharge permits and abatement plans. Tyrone is seeking variance from certain criteria specified under subpart C of this section, specifically requirements (1) and (2). The NMED has determined that a Savannah pit leach stockpile will not meet requirements (1) and (2). These requirements are as follows:

> Provided that the other requirements of this part are met and the proposed discharge plan, modification or renewal demonstrates that neither a hazard to public health nor undue risk to property will result, the secretary shall approve the proposed discharge plan, modification or renewal if the following requirements are met:
>
> (1) ground water that has a TDS concentration of 10,000 milligram (mg/L) or less will not be affected by the discharge; or
>
> (2) the person proposing to discharge demonstrates that approval of the proposed discharge plan, modification or renewal will not result in either concentrations in excess of the standards of 20.6.2.3103 NMAC or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use, except for contaminants in the water diverted as provided in Subsection D of 20.6.2.3109 NMAC.

Tyrone also requests a variance from 20.6.2.3109.H(3) NMAC. Subpart H of Section 20.6.2.3109 NMAC lists conditions for which a discharge plan will not be approved.

Section 3 of this subpart states that the secretary shall not approve a proposed discharge plan if the discharge may result in a hazard to public health.

Variance from WQCC regulations 20.6.2.3109(C)(1) and (2) and 20.6.2.3109(H)(3) NMAC will allow the NMED to modify DP-455 and permit leaching operations at the Savannah pit. The development of additional leach stockpile capacity at Tyrone is critical to continued operation of the mine. The remaining capacity of existing leach stockpiles is limited and can only support about 80 percent of the remaining reserves at Tyrone. Tyrone has considered alternatives to a Savannah pit leach stockpile, such as construction of a new leach stockpile outside of the existing mine and stockpile area. Results of the alternative analysis show that a Savannah pit leach stockpile is the most environmentally practical and technically feasible solution. Without the added capacity of a Savannah pit leach stockpile, an unreasonable burden will be placed on Tyrone, and the mine will need to evaluate the economics of mining certain reserves and likely begin a lengthy permitting process for another leach stockpile site, adversely impacting copper production at Tyrone.

This document contains Tyrone's variance petition and other supporting documentation. Section 2 provides background information on the history of the mine, an overview of the solution extraction/electrowinning (SX/EW) process Tyrone uses to produce copper from the leaching of ore, and a description of the Savannah pit. Section 3 presents Tyrone's petition in accordance with the requirements of 20.6.2.1210 NMAC. Section 4 presents conclusions as to why the variance should be granted.

2. Background

The Tyrone Mine is a copper mine located in southwest New Mexico. The ore body is a porphyry copper deposit confined to a triangular area bounded by several faults. Sections 2.1 through 2.3 provide an overview of the Tyrone Mine, its history, and current mining operations. Section 2.4 provides an overview of the Savannah pit.

2.1 Overview of the Tyrone Mine

The Tyrone Mine and associated facilities are located on approximately 9,000 acres on the northeastern flanks of the Big Burro Mountains, about 10 miles south of Silver City, New Mexico (Figure 1). The climate is generally semiarid with annual evaporation exceeding annual precipitation. The natural ground surface elevation at the mine ranges from about 5,300 to 6,500 feet above mean sea level (feet msl). The vegetation is categorized as a desert scrub grassland in the area where former tailings have been reclaimed, transitioning to a mixed-evergreen woodland at the higher elevations adjacent to the open pits and stockpiles.

The Tyrone copper deposit is a low-grade porphyry copper system within an intrusive quartz monzonite (Hollister, 1978). Intrusion, alteration, and primary mineralization occurred approximately 53 to 56 million years ago (Duhamel et al., 1995). Mineralization is predominantly chalcocite. The deposit is preserved in a graben bound by the Burro Chief fault to the northwest and the Racket-Virginia fault to the south (Duhamel et al., 1995). This graben occupies a regional horst bound by the Austin-Amazon and Sprouse-Copeland faults.

Modern open-pit copper mining involves the excavation of large volumes of overburden, waste rock, and ore. These operations have been conducted at the Tyrone Mine since May 1967. Primary mining operations are located on the southern portion of the mine area (Figure 1). This area includes several open pits, leach and waste stockpiles, an SX/EW plant, a former precipitation plant, an acid unloading facility, and other supporting facilities and maintenance shops (Figure 2). The open pits at the Tyrone Mine encompass approximately 2,000 acres, and include the Main, West Main, Valencia, Gettysburg, Copper Mountain, South Rim, Savannah, and San Salvador pits. The various leach ore and waste rock stockpiles cover approximately

2,800 acres and contain approximately 1.7 billion tons of rock deposited near and adjacent to the open pits. Several of the leach and waste stockpiles have been reclaimed by capping them with a soil cover, reestablishing vegetation, and diverting storm water through rip-rap channels. These stockpiles are denoted with "former" in their designations on Figure 2.

The SX/EW plant is located near the No. 2A leach stockpile and encompasses approximately 51 acres. The SX/EW plant removes copper from pregnant leach solution (PLS) and acidifies water to produce raffinate for leaching. Tyrone currently relies solely on the SX/EW process to produce copper from the leaching of ore. Section 2.3 provides an overview of the SX/EW process.

The northern portion of the mine area along the Mangas Valley contains the former Nos. 1, 1A, 1X, 2, 3X, and 3 tailing impoundments (Figure 3). These impoundments have been reclaimed by capping them with a soil cover, reestablishing vegetation, and diverting storm water through rip-rap channels. The former tailing impoundments cover approximately 2,300 acres and contain approximately 304 million tons of processed tailing generated from milling operations performed at Tyrone from 1969 to 1992.

Tyrone has a total of 10 permitted discharge areas (Figure 4). These discharge permits are associated with former tailing impoundments (DP-27), a former waste stockpile (DP-396), several existing leach stockpiles (DP-166, DP-286, DP-363, DP-383, DP-435, and DP-455), a former leach stockpile (DP-896), and the Little Rock Mine site (DP-1236). The NMED and Tyrone recently agreed to combine DP-670 with DP-455. Therefore, DP-670 no longer exists and the area covered by former DP-670 is now included under DP-455 (Figure 4).

2.2 Mine History

Underground mining operations took place at Tyrone in the late 1800s and early 1900s. Open-pit mining began in 1967. By September 1969, 95 million tons of overburden had been removed, and a mill and concentrator had been constructed. Tailing from the concentrator was sent to six tailing impoundments located in the Mangas Valley (Figure 3). Tyrone operated the mill and concentrator until February 7, 1992. Demolition on the mill and concentrator began in

2004, and reclamation was completed in the mill and concentrator area during 2007 (Golder, 2007). The area around these former facilities has been reclaimed by placement of a soil cover and reestablishment of vegetation.

Limited leaching operations began at the No. 1 stockpile in 1972, with the opening of a precipitation plant (Figure 2). In 1984, Tyrone opened the SX/EW plant and expanded leaching operations in permitted areas. Tyrone closed the precipitation plant 1996 (Golder, 2007). Leach solution from permitted leach stockpiles is currently processed at the SX/EW plant (Figure 2).

2.3 Overview of Leaching and Solution Extraction/Electrowinning Process

Tyrone currently uses conventional open-pit mining, stockpile leaching, and operation of a SX/EW plant to produce copper. Figure 5 is a diagram of the leaching and SX/EW processes. Large quantities of ore are mined from open pits and then placed on leach stockpiles. A weak sulfuric acid solution, called raffinate, is applied to these stockpiles by spray and drip systems. Raffinate leaches copper and other constituents from the ore to create copper-rich PLS. The PLS is collected at the base of stockpiles by surface catchments or wells and is then directed to lined holding ponds. From the lined holding ponds, PLS is pumped to the SX/EW plant for processing. The SX/EW plant has been in operation since 1984.

The SX/EW process begins with the solution extraction (SX) stage, where PLS is contacted with an organic solution. This stage extracts copper from PLS, leaving behind many impurities in the aqueous solution that is recycled back into the process as raffinate. The copper-bearing organic solution is then mixed with an acidic solution to strip copper from the organic solution, placing copper back into an aqueous phase. The organic solution is returned to the SX stage of the process. The copper-bearing aqueous phase is then advanced to the electrowinning (EW) stage, where the aqueous solution is placed into large tanks with cathode starter sheets. Here copper is reduced electrochemically from aqueous solution and plated as a metallic copper cathode.

The existing permitted leach stockpiles do not have enough remaining capacity for all of the existing and probable ore reserves at Tyrone. It is critical to continued operations at Tyrone that there be sufficient stockpile capacity to run the SX/EW plant.

2.4 Savannah Pit

The Savannah pit is located between the Main and Gettysburg pits (Figure 6) and is administered under DP-455 (Figure 4). The pit covers an area of approximately 130 acres with an approximately 1.8-mile perimeter. The Savannah pit is approximately 600 feet deep with a bottom elevation of 5,600 feet msl. The bottom elevation of the Savannah pit is similar to that of the Gettysburg pit and is about 650 feet higher than that of the Main Pit.

Fine-grained waste rock has been placed at angle of repose (1.5 horizontal to 1 vertical [1.5H:1V]) along the northwest side of the pit to form a haul road between the Savannah and Main pits. High walls along the east side of the Savannah pit expose geologic units present in the area. Appendix A contains photographs of these high walls taken in July 2010. The photographs show between 100 to 250 feet of Gila conglomerate with an approximately 10- to 50-foot-thick zone of ferricrete at its base. Underlying these units are quartz monzonite or monzonite porphyries.

The 6B leach stockpile is located southwest of the Savannah pit. If the variance is granted, a Savannah pit leach stockpile would basically be an extension of the 6B leach stockpile into the Savannah pit. Currently, PLS from the 6B leach stockpile is collected at the stockpile toe, which is located at an elevation of 5,750 feet msl at the southwest end of the Savannah pit (Figure 6).

The Savannah pit was mined until 2003. The pit is currently used to manage and store mine water. Beginning in about March 2010, with the approval of NMED, Tyrone began to pump mine water, primarily from the Main pit, to the Savannah pit. Currently, the water level in the Savannah pit is approximately 5,700 feet msl (Figure 7), so the depth of water in the pit is about 100 feet. Prior to March 2010, storm water accumulated in the bottom of the pit, and the water level elevation was generally below 5,620 feet msl. The NMED has permitted Tyrone to raise the water level elevation in the Savannah pit up to a maximum of 5,750 feet msl.

Figure 8 is a 2010 regional groundwater level elevation map of the Tyrone mine and stockpile area. Groundwater in the mine and stockpile area generally flows to the east-northeast and ultimately enters and is pumped from either the Main, Gettysburg, or Copper Mountain pits. As indicated in Figure 8, the regional aquifer water level beneath the deepest portion of the Savannah pit is about 5,500 feet msl; based on existing monitor well observations and input from mine personnel, the Savannah pit sits about 100 feet above this regional water table elevation.

Figure 9 shows the same regional groundwater level elevation contours and data as Figure 8, but at a larger scale and focused on the area of the Savannah pit. Groundwater beneath and in the vicinity of the Savannah pit flows to and is captured at the Main pit. Any regional groundwater impacted in the future by the proposed in-pit leach stockpile will flow toward and be captured at the Main pit. Section 3.5 provides a more detailed discussion of the hydrogeology in the vicinity of the Savannah pit.

3. Required Elements of the Petition

This section provides information required by 20.6.2.1210 NMAC (Sections 3.1 through 3.9). The information is presented in the same order as requirements 1 through 9 of 20.6.2.1210 NMAC. In addition to presenting the required elements of a petition, this section discusses abatement of water pollution, if the variance is granted, and modification of DP-455.

3.1 Petitioner's Name and Address

Freeport McMoRan Tyrone, Inc.
Highway 90 South
Tyrone, NM 88065

3.2 Date of Petition

April 22, 2011

3.3 Description of Facility or Activity for Which the Variance is Sought

Tyrone is seeking a variance to allow a leach stockpile and associated surface collection pond to be placed in the Savannah pit. Initially, waste stockpile material will be placed near the base of the pit to create a level surface for the placement of leach stockpile material. Leach stockpile material will then be placed on top of the waste rock, forming an in-pit leach stockpile.

The in-pit stockpile will be built on the north side of the 6B leach stockpile and will be contiguous with the existing stockpile (Figure 6), eventually covering the existing 6B leach stockpile as the Savannah pit stockpile is raised. Three deep wells installed through the 6B leach stockpile and one shallow well at the north toe of the 6B leach stockpile are currently used to collect PLS from the 6B leach stockpile. These wells will be abandoned when the Savannah pit stockpile is constructed. The in-pit stockpile design will incorporate a PLS collection and pumping system to capture and deliver PLS from both the 6B and Savannah pit leach stockpiles. Figure 10 is an engineering drawing of the proposed Savannah in-pit stockpile and related operational facilities.

Leach stockpile material will be leached with a raffinate solution as is done at other stockpiles at Tyrone. PLS will be collected in a pond constructed at the bottom of the pit at an elevation of approximately 5,600 feet msl (Figure 10). Tyrone plans to use barge pumps to maintain fluid levels in the pond and to transfer fluids from the pond to a booster station above the rim of the pit. The booster station will then pump the PLS to the SX/EW plant for processing. Fluids will be conveyed through high-density polyethylene (HDPE) pipe. The PLS collection system will be designed for a flow of 12,000 gallons per minute (gpm).

During leach operations, PLS will flow along the bottom of the Savannah pit to the collection pond under the influence of gravity. Mining activities have shaped the current topography within the Savannah pit, leaving behind high vertical walls, haul and access roads, and a bedrock pit bottom composed of igneous intrusive rocks (e.g., Tertiary quartz monzonite and monzonite porphyries). Before stockpile material is placed in the Savannah pit, Tyrone will grade and make other necessary improvements to remove obstructions that could hinder the flow of PLS. These efforts will be taken to prevent PLS from mounding within the stockpile. Stockpile material is very permeable with saturated hydraulic conductivities of between 3 and 300 feet per day (ft/d) (DBS&A, 1999). The high permeability allows relatively rapid movement of fluids through the ore. Stockpile material is several orders of magnitude more permeable than the igneous intrusive rocks that compose the pit bottom and walls. Estimated permeability of the underlying bedrock beneath the No. 2 stockpile west of the Savannah pit was estimated to be 0.002 ft/d (DBS&A, 1999). Due to the low permeability and slope of the bedrock, PLS will primarily flow along the stockpile/bedrock contact toward the PLS collection pond located at the base of the Savannah pit, with little buildup or rise of PLS levels within the stockpile. A small percentage of the PLS, however, is expected to seep downward and eventually reach regional groundwater.

Tyrone will build an access road along the side slope of the stockpile. This road will be maintained to provide access to the collection pond and associated facilities so that repairs can be made and emergencies can be addressed. In order to accommodate a road, the stockpile will be sloped at a ratio of 2H:1V.

3.4 Address or Description of the Property upon which the Facility is Located

The physical address of the Tyrone Mine site is Tyrone Mine Road, Tyrone, New Mexico. The mine is located in Grant County, approximately 10 miles southwest of Silver City along Highway 90 South (Figure 1).

The Tyrone Mine is located on approximately 9,000 acres northeast of the Big Burro Mountains (Figure 1). Active mining operations are located on the southern portion of the mine area. These operations consist of open-pit mining and stockpile leaching and are supported by several facilities also located in the southern portion of the mine area. These facilities include an SX/EW plant, vehicle maintenance and other shops, and mine offices. Reclaimed tailing impoundments are located within the Mangas Valley, north of the open pits and stockpiles.

The Savannah pit is located between the Main pit to the northwest and Gettysburg pit to the southeast. The No. 5A waste and No. 1B leach stockpiles are located to the east of the Savannah pit. The No. 6B leach stockpile lies along the southwestern rim of the Savannah pit. The Savannah pit is approximately 600 feet in depth with a bottom elevation of 5,600 feet msl.

3.5 Water Body or Water Course Affected by the Discharge

The following sections provide an overview of Tyrone Mine site hydrogeology and discuss the hydrogeology and groundwater quality, surface water course, and waters in pit bottoms and process collection sumps in the vicinity of the Savannah pit.

3.5.1 Overview of Tyrone Mine Site Hydrogeology

Numerous groundwater studies have been conducted at the Tyrone Mine. These studies include both local field investigations associated with individual DPs, regional field investigations associated with mine closure requirements, and numerical groundwater flow modeling (DBS&A, 2007b). The most comprehensive hydrogeologic studies performed at Tyrone are a preliminary groundwater study (DBS&A, 1997a) and two supplemental groundwater studies (DBS&A, 1997b and 2007a). These studies, along with routine water level and water quality monitoring required by the various operational DPs, form the basis of the current understanding of the hydrogeology at the Tyrone Mine.

Groundwater at Tyrone occurs within Quaternary alluvium, Quaternary-Tertiary Gila conglomerate, and intrusive igneous rocks (e.g., Tertiary quartz monzonite and Precambrian granite), and is present in both regional and perched groundwater flow systems. Regional groundwater, which is predominantly unconfined, exists throughout the site (Figure 8). In the Mangas Valley, regional groundwater occurs within Gila conglomerate and, along the major axis of the valley, within Quaternary alluvium. On the southeast side of the mine, east of the Sprouse-Copeland fault (Figure 8), regional groundwater exists within Gila conglomerate. In the mine and stockpile area, regional groundwater occurs primarily within Tertiary quartz monzonite and Precambrian granite, although in some areas, such as east of the Townsite fault (Figure 8), regional groundwater occurs within Gila conglomerate. Perched zones have been identified in several areas around the perimeter of the mine and stockpile area. These perched seepage zones occupy the base of alluvium-filled channels that have been eroded into Gila conglomerate or igneous rock. These paleochannels are generally coincident with existing ephemeral streams.

Prior to surface mining, groundwater flow was either to the northwest into the Gila-San Francisco underground basin or toward the southeast into the Mimbres Valley underground basin. The groundwater divide separating these two underground basins was nearly coincident with the surface water divide that separated the same basins (Figure 1). Since surface mining began at Tyrone, groundwater flow conditions have changed due to dewatering activities. Significant dewatering of the regional aquifer likely began with pumping from the Burro Chief Shaft during the late 1970s, and continued with pumping from the Main and Gettysburg pits from the early 1980s to the present time (DBS&A, 1997a). At present, capture zones are associated with dewatering activities in the Main, Gettysburg, and Copper Mountain pits. Figure 8 shows regional groundwater level elevations for the mine and stockpile area. The figure shows the influence of dewatering activities in the Main, Gettysburg, and Copper Mountain pits on groundwater levels and the control of some faults on groundwater flow directions. Groundwater flows from areas of high water level elevation (e.g., flanks of the Big

Burro Mountains) to areas of low water level elevation (e.g., Main pit). Groundwater not captured at one of the Tyrone pits either flows toward the Gila-San Francisco underground basin northwest of the mine, or toward the Mimbres Valley underground basin southeast of the mine.

Numerous faults have been mapped within the mine and stockpile area. Several of these faults are known to have a significant influence on groundwater flow. The Southern Star, San Salvador, and West-Main faults tend to act as barriers to groundwater flow and tend to direct groundwater flow toward the pits. Groundwater level elevations on opposite sides of these faults differ from a few hundred feet up to 400 feet along the West Main fault (Figure 8). The Sprouse-Copeland and Townsite faults also have an influence on the regional groundwater flow system. The Sprouse-Copeland fault, which is located along the southeast side of the mine and stockpile area, separates groundwater within igneous rocks to the west from groundwater within Gila conglomerate to the east. In 2008, Tyrone conducted a study at the request of NMED to confirm that regional groundwater level elevations immediately east of the Gettysburg pit remained higher than water level elevations of the Gettysburg pit lake as the water level of the pit lake was raised. The study demonstrated that the hydraulic gradient immediately east of the Gettysburg pit remained toward the pit lake as the water level of the pit lake was raised. This study also revealed that a splay, believed to be associated with the Townsite fault, acts as a barrier to groundwater flow east of the Gettysburg pit; groundwater level fluctuations at monitor wells immediately east of the pit (i.e., 455-2007-01, 455-2008-02, and 455-2008-03 [Figure 6]) were synchronized with pit lake water level changes, while the water level at 455-2008-01, located about 600 feet east of the pit lake, was not influenced by water level fluctuations in the pit. The Tyrone Mine Chief Geologist believes that the Townsite is a fault zone rather than a single linear fault, as depicted on the figures presented in this petition (Princehouse, 2010). The fault trace shown on the figures is the best representation the mine has for the location of the Townsite fault. The Townsite fault trends northwest-southeast and extends from the Gettysburg pit to an area just north of the Main pit (Figure 8). The Townsite fault zone may also act as a barrier to groundwater flow in the area east of the Savannah and Main pits.

3.5.2 Hydrogeology and Water Quality in the Vicinity of Savannah Pit

As discussed above, a series of comprehensive groundwater studies and routine water level and water quality monitoring form the basis of the current understanding of the hydrogeology at Tyrone, including the area of the Savannah pit. In addition to this information, two new monitor wells were installed in October and November 2010 to further characterize the hydrogeology and water quality in the immediate vicinity of the Savannah pit. These wells are designated 455-2010-01 and 455-2010-02 (Figure 6) and were installed to support this variance petition. Appendix B contains well completion logs for these two wells.

Groundwater in the vicinity of the Savannah pit flows to and is captured at the Main pit (Figure 9). In order to mine from the Main pit, the pit has to be dewatered. These dewatering activities maintain a lower groundwater level elevation at the Main pit relative to surrounding areas, causing groundwater to flow toward the pit. Water extracted from the Main pit is used as mine process water. One of the reasons monitor wells 455-2010-01 and 455-2010-02 were installed was to further characterize the water levels and direction of groundwater flow (hydraulic gradient) east and north of the Savannah pit. Measured water levels at these two monitor wells, as well as measured water levels at wells 670-2005-01, GLD-3A, 2-7, and 6-5, indicate that groundwater beneath and adjacent to the Savannah pit flows toward, and ultimately ends up within, the Main pit. Because groundwater beneath the Savannah pit flows to the Main pit, any regional groundwater impacted in the future by the proposed leach operation at the Savannah pit will flow toward, and be captured at, the Main pit. This observation is true under both operational and closure conditions, because Tyrone is required to pump and treat any water that accumulates in the Tyrone pits (including the Main pit) during closure as part of DP-1341.

Regional groundwater in the vicinity of the Savannah pit occurs primarily within igneous rocks. These rocks consist primarily of Tertiary quartz monzonite and Tertiary monzonite porphyries. Hedlund (1978) describes Tertiary intrusive rocks within the mine area as quartz monzonite (Figure 11). Drill cuttings of igneous rocks collected from boreholes for monitor wells 455-2010-01 and 455-2010-02 are described as Tertiary monzonite because cuttings had a low quartz content (Appendix B). The mean hydraulic conductivity of igneous rocks determined by aquifer testing at Tyrone is 2.0 ft/d (DBS&A, 1997b and 2007a). However, this hydraulic conductivity value is believed to be significantly larger than the bulk permeability of the igneous rock body because monitor wells tend to be screened across productive fractures or fracture zones. Furthermore, monitor wells that exhibit low yield are typically not aquifer tested. A better estimate of large-scale bulk permeability of quartz monzonite within the mine and stockpile area determined through numerical groundwater flow modeling is 0.01 to 0.4 ft/d (DBS&A, 2007b).

Figure 11 illustrates the surface geology in the area of the Main, Savannah, and Gettysburg pits. Also provided in Figure 11 are the locations of three hydrogeologic cross sections depicted on Figures 12 through 14. Cross section A-A' (Figure 12), located to the north of the Savannah pit, passes through the Main pit and non-acid generating 5A waste rock stockpile. Regional groundwater discharges at the base and along the lower walls of the Main pit, forming a small pit lake. Tyrone pumps water from the Main pit in order to keep groundwater levels below most of the current pit-bottom surface. Groundwater levels at the Main pit are generally less than 5,000 feet msl and increase with distance from the pit (Figure 9).

The Townsite fault is located to the east of the Main pit and separates regional groundwater within igneous intrusive rocks to the west from regional groundwater within Gila conglomerate to the east. Groundwater levels within Gila conglomerate are higher than those within igneous rocks at the Main pit.

A cross section through the southern portion of the Savannah pit is shown in Figure 13. The lowest land surface elevation in the Savannah pit, 5,600 feet msl, is approximately 1,000 feet north of the B-B' cross section. The B-B' cross section location was selected because of its proximity to monitor wells 6-5, 2-7, and 455-2010-02. Regional groundwater is believed to be below the bottom of the Savannah pit based on water levels at nearby monitor wells and resulting interpolated water level elevation contours. In addition, Tyrone Mine personnel have noted for a number of years that water was present in the bottom of the Savannah pit only after storm events, and a consistent inflow of water was not observed, as would be the case if the bottom of the pit were below the regional water table.

The Townsite and Sprouse-Copeland faults are located to the east and southeast of the Savannah pit, respectively. To the east of the Nos. 1A, 1B, and 1C stockpiles, the Sprouse-Copeland fault separates regional groundwater within igneous intrusive rocks to the west from groundwater primarily within Gila conglomerate to the east (Figure 8). Monitor well 383-2008-01, shown on the B-B' cross section, is located just to the north of the northern extent of the surface trace of the Sprouse-Copeland fault. This well is screened in Gila conglomerate with igneous rock believed to be present at the base of the borehole (Appendix B).

Figure 14 depicts a northwest-southeast trending cross section through the Main, Savannah, and Gettysburg pits. The C-C' cross section illustrates the progressive drop in groundwater level elevations from the Gettysburg pit to the Main pit. This drop occurs due to the significantly greater depth of the Main pit relative to the Gettysburg pit. The hydraulic gradient is relatively flat near the Gettysburg pit and steepens between the Savannah and Main pits.

Constituents that exceeded WQCC water quality standards in groundwater samples recently collected from monitor wells near the Savannah pit are shown on Figure 15. Table 1 summarizes historical water quality data for monitor wells in the vicinity of the Savannah pit; time-series plots for these wells are presented in Figures 16a and 16b. Table 2 presents water quality data for the two new DP-455 monitor wells (455-2010-01 and 455-2010-02) installed to support this variance petition. Additional water quality data are provided in Appendix C.

Analytical results for water samples collected from monitor wells indicate that water quality adjacent to the Savannah pit has been impacted by mining activities (Figure 15). For example, groundwater at monitor wells 2-7, 6-5, GLD-3A, and 455-2010-02 exceed WQCC water quality standards for TDS, sulfate, pH, and multiple metals. Regional groundwater quality north of the Savannah pit at well 455-2010-01 exceeds WQCC water quality standards for fluoride and manganese (Table 2), although these exceedances are possibly due to natural mineralization in the area. The sulfate concentration at 455-2010-01 appears elevated but is below the WQCC water quality standard (Table 2).

Open-pit mining activities at Tyrone began in the late 1960s, before present day environmental regulations and standard best management practices. The waste and leach stockpiles surrounding the Savannah pit are not lined. Seepage from these stockpiles (PLS from leach stockpiles and leachate from infiltrating rainfall at waste rock piles) is a potential source of groundwater impacts. Water quality impacts also occur from the interaction of precipitation and surface water runoff with exposed sulfide minerals in the pit walls, creating acid rock drainage. The earliest water quality data collected by Tyrone near the Savannah pit are from the early 1980s. At that time, monitor wells 2-7 and 6-5 exceeded current WQCC standards for fluoride, manganese, sulfate, and TDS (Table 1 and Appendix C). In addition, monitor well 6-5 had exceedances for aluminum, cadmium, cobalt, copper, iron, zinc, and pH. These data represent groundwater quality before Tyrone began leaching operations to support the SX/EW plant constructed in 1984. These groundwater impacts were likely caused by natural sulfide mineralization associated with the copper ore body and/or early mining activities.

As discussed above, groundwater beneath the area of the Savannah pit flows toward and is then captured at the Main pit. Mine-related impacts to groundwater in the vicinity of the Savannah pit are and will continue to be intercepted at the Main pit. In accordance with DP-1341, following closure groundwater will continue to be captured at the Main pit, and impacted water will be treated to meet WQCC water quality standards.

3.5.3 Surface Watercourses

Surface watercourses will not be affected by the Savannah in-pit leach stockpile. Before surface mining began, a surface water drainage divide passed through the mine and stockpile area (Figure 1). The drainage divide separated water flowing to the north/northwest toward Mangas Wash from water flowing to the south/southeast toward Oak Grove Wash. Small tributary drainages in the mine area that once drained to the Mangas and Oak Grove washes have either been mined out or covered with stockpile material. Storm water that comes into contact with stock material is contained within berms, and the runoff water is directed to mine facilities. Storm water that comes in contact with the Savannah in-pit leach stockpile will flow to the base of the Savannah pit and be collected at a PLS collection pond. Storm water in the mine area is managed in accordance with an NPDES multi-section general storm water permit.

3.5.4 Waters in Pit Bottoms and Process Collection Sumps

One method of PLS collection from the No. 6B stockpile is to collect it at the stockpile toe, located at an elevation of 5,750 feet msl at the southwest end of the Savannah pit (Figure 6). The chemistry of this fluid is typical of PLS, with elevated metal concentrations, low pH values, and sulfate and TDS concentrations of around 50,000 and 80,000 mg/L, respectively (Table 3). This collection facility, along with three deep wells installed through the 6B leach stockpile designed to collect PLS, will be abandoned and replaced by a single PLS collection pond if a Savannah in-pit stockpile is constructed.

The northern portion (deepest part) of the Savannah pit, at a land surface elevation of 5,600 feet msl, is currently used to manage and store mine water. Beginning in about March 2010, Tyrone began to pump mine water, primarily from the Main pit, to temporarily store it in the Savannah pit. Currently, the water level elevation is at approximately 5,700 feet msl (Figure 7). Water currently stored in the Savannah pit exceeds WQCC groundwater standards for sulfate (4,660 mg/L), TDS (7,430 mg/L), pH (4.95 standard units), and multiple metals (Figure 15). Prior to the recent period of water storage in the pit, water that collected in the pit bottom (believed to be storm water) had sulfate and TDS concentrations as high as 62,000 and 43,900 mg/L, respectively (Table 3). Water currently stored in the Savannah pit must be removed prior to in-pit stockpile construction.

The observed water level in the Savannah pit (Figure 7) was used in conjunction with observed precipitation and evaporation in an attempt to estimate the amount of seepage of stored water that may be occurring. Based on the existing data and the limited fluctuation of water levels in the Savannah pit, a good correlation could not be identified between pit water and known inflows (precipitation and storm water) and outflows (evaporation) that would have allowed the residual (seepage) to be calculated. However, because the pit water elevations are relatively constant, one conclusion that can be drawn is that the bottoms and sides of the Savannah pit are composed of low-permeability rocks, given that seepage is small even under the condition of about 100 feet of head. This conclusion is supported by observed water levels in wells 455-2010-01, 455-2010-02, and 670-2005-01, which to date show no apparent influence of seepage from the water stored in the Savannah pit.

3.5.5 Post-Closure Conditions and Requirements

On April 8, 2003, the NMED issued Supplemental Discharge Permit for Closure, DP-1341, to Tyrone pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§ 74-6-1 through 74-6-17 (1993), and the WQCC Regulations, 20.6.2 NMAC (NMED, 2003). This permit contains closure requirements addressing Tyrone's discharges of contaminants that may move directly or indirectly into groundwater. Conditions 36 and 37 of DP-1341 require Tyrone to construct, operate, and maintain a water treatment system and manage a pit interceptor well system. Condition 36 requires treatment of impacted water exceeding 20.6.2.3103 NMAC water quality standards and a useful operating life of at least 100 years for the treatment plant.

After closure, Tyrone will continue to dewater at the Main pit. The pit will serve as a hydrologic sink to contain and remove impacted groundwater, and prior to discharge, the extracted water will be treated to comply with WQCC water quality standards. The NMED has recognized that the water quality that enters the Main pit is impaired and has imposed abatement requirements under the operational discharge permits and under the closure requirements of DP-1341, including associated financial assurance for closure and post-closure.

3.6 Regulations of the Commission for which the Variance is Sought

The NMED has determined that the proposed Savannah pit leach stockpile will not meet specific WQCC regulations. Therefore, Tyrone is seeking variance from WQCC regulations 20.6.2.3109(C)(1) and (2) and 20.6.2.3109(H)(3) NMAC. Variance from these regulations will allow NMED to modify DP-455 and permit leaching operations at the Savannah pit.

Section 20.6.2.3109 NMAC stipulates conditions for the approval, disapproval, modification, or termination of discharge permits and abatement plans. Tyrone is seeking variance from requirements (1) and (2) under subpart C of this section. These requirements are as follows:

> Provided that the other requirements of this part are met and the proposed discharge plan, modification or renewal demonstrates that neither a hazard to public health nor undue risk to property will result, the secretary shall approve the proposed discharge plan, modification or renewal if the following requirements are met:

Tyrone is seeking variance from WQCC regulations to the extent that the approval criteria of 20.6.2.3109(C)(1) and (2) and 20.6.2.3109(H)(3) NMAC will not be met. Variance from these regulations will allow NMED to modify DP-455 and permit leaching operations at the Savannah pit. Under the variance, Tyrone would be authorized to exceed groundwater quality standards through discharge to groundwater that may occur from a Savannah in-pit leach stockpile, and would not be required to implement pollution prevention measures or perform monitoring and reporting to prevent an exceedance of WQCC water quality standards resulting from this discharge.

Tyrone would, however, still be required to comply with requirements stipulated in a discharge permit. These requirements are expected to include the following:

- Compliance with specified stockpile boundary limits and maximum allowable raffinate application rates
- Conducting operational measures to limit contamination to the extent practicable (e.g., following proper pipeline operational procedures)
- Performing routine process fluid and groundwater level and quality monitoring
- Submitting reports to the NMED that document activities performed and data collected
- Implementing contingency plan requirements, such as spill reporting and containment
- Meeting abatement requirements to the extent required by 20.6.2.4000 through 4115 NMAC
- Complying with closure and financial assurance requirements, as required by Supplemental Discharge Permit for Closure, DP-1341

Tyrone wishes to vary from the WQCC regulations to the extent that the NMED may modify DP-455 and issue a discharge permit for a leach stockpile within the Savannah pit without a finding by the NMED that the approval criteria in Section 20.6.2.31 09(C) NMAC are met. Furthermore, to the extent that Section 20.6.2.3109(H)(3) would prohibit the Secretary from approving a discharge permit for a Savannah in-pit leach stockpile, Tyrone requests a variance from application of that prohibition to discharges from any of the Savannah in-pit leach stockpile facilities located within the area described in Section 3.3.

Granting of a variance would not eliminate the requirement for Tyrone to obtain approval of a discharge plan and to obtain and comply with a discharge permit for discharges of water contaminants within the area affected by the variance. Renewal of existing discharge permits for existing discharges and approval of discharge plans for any new discharges would be required. Significant modifications to the Savannah in-pit leach stockpile system may require that a revised variance petition be approved by the WQCC. If a variance is granted, the NMED could approve a discharge plan and issue a discharge permit for a Savannah in-pit leach stockpile and associated facilities without making the findings required by 20.6.2.3109(C)(1) and (2) NMAC and without addressing the prohibition in 20.6.2.3109(H)(3) NMAC. If the variance is granted, Tyrone will be required to comply with the requirements of the discharge permit proposed to be issued for the Savannah in-pit leach operations.

3.8 Reasons Why Compliance with the Regulations Will Impose an Unreasonable Burden

Tyrone does not have sufficient permitted leach stockpile capacity to accommodate remaining ore reserves. Tyrone is proposing to create a leach stockpile within the Savannah pit because the pit is immediately adjacent to actively mined areas and has already been disturbed. The following comparison of ore reserves to leach stockpile capacities and alternatives analysis is presented to demonstrate why compliance with the regulations will impose an unreasonable burden on Tyrone. Without enough leach stockpile capacity, Tyrone will need to reevaluate the feasibility of continued operations.

3.8.1 Ore Reserves and Stockpile Capacities

Ore reserves are the estimated quantities of proven and probable materials that may be economically and legally mined and processed for extraction of their constituent values at the time of reserve determination (FCX, 2009). Tyrone determines ore reserves from mapping, drilling, sampling, assaying, and evaluation methods generally applied in the mining industry. Estimates also consider projected long-term copper prices and future cost trends, as well as economic, marketing, legal, environmental, social, and governmental factors. Tyrone's calculation of ore reserves also includes an evaluation of mine design. This can limit the amount of material classified as reserves, but is intended to maximize the value of future cash flows by eliminating the mining of material that does not add to the net present value of the mine. Several factors are considered, as follows: (1) time-value concepts that account for the time that elapses between the removal of overburden and mining of ore, (2) design concepts that recognize the amount of capital and other expenditures required to extract ore reserves over the life of the mine, and (3) cutoff-grade strategies that maximize time-valued cash flow. Tyrone contracts with third-party consultants to audit their ore reserve estimates and believes its ore reserve estimation methodology is prudent and consistent with industrial standards.

As discussed in Section 2.3, Tyrone currently uses one method of beneficiation: leaching of ores to recover PLS that is processed at the SX/EW facility to produce pure copper cathodes. Leaching of copper ore is performed at several stockpiles at Tyrone (Figure 2) that have NMED-approved discharge plans and permits (Figure 4). Tyrone estimates its 2011 ore reserves at 180 million tons, while the total remaining capacity of these stockpiles is only about 150 million tons, about 83 percent of the remaining reserves (i.e., 30 million ton deficit in stockpile capacity). In addition, the estimate of remaining stockpile capacity assumes that each stockpile is built up and used to its full capacity. In practice, stockpiles are typically not completed to their full capacity due to the diminishing returns related to haul costs and other operational factors. Consequently, unless additional leach stockpile capacity is permitted and developed, mining of leachable ores would have to stop, resulting in premature closure of the Tyrone Mine.

3.8.2 Alternative Analysis

At least 30 million tons of new leach stockpile capacity is needed at Tyrone to support mining of the remaining ore reserves (2011 estimate) and prevent premature closure of the mine. In addition, significant additional capacity greater than the 30-million ton projected deficit is highly desirable for mine planning so that operational constraints and costs such as haul distances and grades can be optimized. Sections 3.8.2.1 and 3.8.2.2 present two possible alternatives for the development of a significant volume of additional leach stockpile capacity. The first alternative is the Savannah in-pit leach stockpile, which is the subject of this variance petition. The second alternative is a new leach stockpile constructed in the vicinity of the Tyrone Mine shops and General Office (GO), referred to as the 5B leach stockpile. If the Savannah in-pit stockpile cannot be constructed, the 5B stockpile is the next best alternative location. Both of these alternatives would accommodate the current ore reserves and provide additional needed capacity in excess of the remaining capacity of permitted leach stockpiles.

As demonstrated in the following subsections, given the financial, environmental, and permitting constraints of a new leach stockpile in the shop and GO areas, the most logical and viable solution is in-pit placement of leach stockpile material at the Savannah pit.

3.8.2.1 Savannah In-Pit Leach Stockpile

Under this alternative, Tyrone would obtain a permit to construct and operate a leach stockpile within the Savannah pit. Leach ore reserves would be transported from active pits, such as the Main and West Main pits. The in-pit stockpile would be built on the north side of, and would be contiguous with, the existing 6B leach stockpile (Figure 17), eventually covering the 6B leach stockpile as the Savannah in-pit stockpile is raised. PLS would be collected at a pond located at the bottom of the Savannah pit. PLS would be directed to this pond by flowing, under the influence of gravity, along the under-dump topography. Mining activities have shaped the under-dump topography within the Savannah pit, leaving behind high vertical walls, haul and access roads, and a bedrock pit bottom composed of igneous intrusive rocks. PLS would flow primarily along the existing pit bottom. Tyrone would grade and remove any obstructions along the bottom of the pit that could hinder the flow of PLS to the collection pond. A channel would be blasted through the 50-foot bench north of the existing Savannah PLS well to allow for the flow of PLS through the fractured rock to the proposed Savannah PLS pond (Figure 10). These efforts would be taken to prevent PLS from mounding beneath the stockpile behind obstructions along the pit bottom. Due to the low permeability and slope of the bedrock, PLS will flow along the stockpile/bedrock contact toward the PLS collection pond located at the base of the Savannah pit.

3.8.2.1.1 Capacity. The in-pit portion of the Savannah stockpile would have a capacity of approximately 50 million tons. However, placement of stockpile material in the Savannah pit would allow the No. 6B stockpile to be extended to the northeast, eventually creating one continuous stockpile with a total increased capacity of 181 million tons, which easily covers the projected leach stockpile capacity deficit and would provide Tyrone with significant operational flexibility well into the future. In addition, with the increased capacity made possible by construction of the Savannah in-pit stockpile, the likelihood is reduced that Tyrone will need to build a new leach stockpile outside the existing mine and stockpile area in the future.

3.8.2.1.2 Environmental Protection. The Savannah in-pit leach stockpile would be placed within the existing mine and stockpile area. Topography in this area has already been substantially altered by surface mining activities, which have been ongoing since 1967. Locating the stockpile within the existing mine and stockpile area avoids additional land disturbance in areas that have been unaffected or significantly less affected by historical mining activities. Regional groundwater flow in the mine and stockpile area is controlled by faults that act as hydraulic barriers and by dewatering at the Main, Gettysburg, and Copper Mountain pits. The Savannah pit is located between the Main and Gettysburg pits. Groundwater beneath and adjacent to the Savannah pit flows to and is captured at the Main pit due to dewatering activities at this pit. The Main pit is the deepest pit at Tyrone. Therefore, dewatering at this pit causes this pit bottom to be the region of lowest groundwater level elevation within the entire mine area. Because groundwater flows from areas of high water level elevation to areas of low water level elevation, much of the groundwater within the mine and stockpile area is captured at the Main pit, and will continue to be captured at this pit in the future. Because groundwater in the vicinity of the Savannah pit flows to the Main pit, any groundwater that were to become impacted by the proposed leach operation at the Savannah pit would be captured at the Main pit.

The Savannah in-pit leach stockpile would also be located closer to mining reserves than the 5B leach stockpile (Section 3.8.2.2), resulting in shorter haulage distances. Therefore, significantly less fuel and other resources (e.g., water for dust suppression on haul roads) would be consumed. Additionally, shorter haulage distance would help to minimize fugitive air emissions and combustion byproducts.

3.8.2.1.3 Construction. Tyrone estimates that the Savannah in-pit leach stockpile will have a construction cost of about 7.5 million dollars. This construction cost estimate includes the required PLS pipeline, various pumps, manifolds, piping and electrical requirements, piping the leach pad for distribution of raffinate, and costs for outside engineering designs and support.

3.8.2.2 5B Leach Stockpile

Under this alternative, a new leach stockpile would be placed in the area now occupied by the shops and main gate, close to the GO (Figure 18). The stockpile would cover approximately 278 acres and would be constructed to a height of about 700 feet. PLS collection and overflow ponds would be constructed at the current location of the Tyrone main gate, and the stockpile would buttress against the existing No. 5A waste rock stockpile, covering the current entrance to the mine and a section of the Mangas Valley Road (Figure 18).

3.8.2.2.1 Capacity. The capacity of this stockpile would be approximately 256 million tons, exceeding the current deficit by a significant amount.

3.8.2.2.2 Environmental Protection. A 5B leach stockpile would be outside of both the current mine and stockpile area and most, if not all, of the Main pit capture zone. Aside from the immediate vicinity of the shop facilities and the main gate area, much of the area that would be covered by this stockpile is undisturbed and supports tree (e.g., oak and juniper) and grass species. Mule deer are often seen foraging on grasses in this area. Construction of the stockpile would require that vegetation be cleared and the existing land surface regraded.

Although the stockpile would be lined and collection ponds double lined, if any seepage from leach operations were to occur, regional groundwater that is currently unimpaired and of excellent quality could be impaired. Monitor well 286-2005-03 is located in the area, about 700 feet southeast of the main gate (Figure 18). Routine water quality samples have been collected at this well since 2005 in accordance with DP-286. Water quality at this well meets WQCC water quality standards and contains sulfate and TDS at average concentrations 60 and 300 mg/L, respectively (Appendix C). Thus impacts to groundwater in this area pose a greater potential threat to public health and the environment than impacts beneath the Savannah pit, where impacted water already exists and is contained by dewatering at the Main pit.

The area of a 5B leach stockpile would straddle the current surface water divide and therefore be located at the top of drainages for both Brick Kiln Gulch and Mangas Wash. Tyrone would implement standard best management practices to prevent spills from entering these drainages. Nonetheless, a 5B leach stockpile poses a greater risk to surface watercourses than a stockpile placed in the existing mine and stockpile area. In addition, this stockpile alternative results in greater pipeline distances to transfer solutions between the leach pad and SX/EW plant. Consequently, the risk to the environment from potential pipeline ruptures and spills is greater.

3.8.2.2.3 Construction Costs. Tyrone estimates that the 5B leach stockpile has an estimated construction cost of 75 million dollars. This construction cost estimate includes:

- Relocation of numerous mine operational features such as the access road, gas line, the TNMP power line, the Oak Grove sub line, and mine support buildings
- Construction of a stockpile pad with HDPE lining
- Storm water diversion
- Piping of the leach pad
- A new PLS collection pond and overflow pond with HDPE lining and necessary pumps, manifolds, piping, and electrical components
- A PLS transmission pipeline and costs for outside engineering designs and support

3.8.3 Comparison of Operational Costs

A comparison of operational costs between the two alternatives was conducted for one of the most costly aspects of the Tyrone mining operation: the hauling of ore. The comparison was made for the first 50 million tons of ore hauled for each new leach stockpile alternative. Total truck miles are estimated to be nearly 784,000 for the Savannah in-pit leach stockpile and nearly 2,210,000 miles for the 5B leach stockpile alternative. The corresponding difference in hauling costs is about 20 million dollars greater for the 5B leach stockpile option than for the Savannah in-pit option, again for only the first 50 million tons of material moved.

3.9 Period for which the Variance is Desired

Tyrone requests that the variance be granted for a period of 5 years, the maximum time allowed under Section 20.6.2.1210(C) NMAC. The variance may be extended or renewed by filing a new petition as provided under Section 20.6.2.1210(D) NMAC.

3.10 Abatement of Water Pollution

The Water Quality Act, Section 74-6-4(G) NMSA 1978, states that the WQCC "may only grant a variance conditioned upon a person effecting a particular abatement of water pollution within a reasonable period of time." Any groundwater impacts due to the variance sought in this petition will be abated to the extent required by and consistent with Sections 20.6.2.4000 through 4116 NMAC. This abatement requirement is already addressed under the site-wide closure plan (DP-1341).

3.11 Conditions of DP-455 Permit Modification

If this petition is granted by the WQCC, the NMED will modify DP-455 with a provision to allow leaching operations in the Savannah pit. The permit will contain conditions deemed necessary to fulfill the requirements of the Water Quality Act and the requirements for approval of discharge plans and issuance of discharge permits under 20.6.2 NMAC, except for those regulations addressed by the variance to permit leaching operations in the Savannah pit. As indicated above, closure of the proposed leaching operation and abatement of water pollution are addressed by the requirements of DP-1341.

4. Conclusion

The WQCC may grant an individual variance from any regulation of the commission whenever it is found that compliance with the regulation will impose an unreasonable burden upon any lawful business, occupation, or activity (Section 74-6-4(G) NMSA 1978). The NMED has determined that a Savannah in-pit leach stockpile will not meet requirements of 20.6.2.3109(C)(1) and (2) and 20.6.2.3109(H)(3) NMAC for the approval of a discharge permit. Therefore, Tyrone is seeking variance from these WQCC regulations. Variance from these regulations will allow NMED to modify DP-455 to permit leaching operations at the Savannah pit. If a variance is granted, the NMED could approve the discharge plan and issue a discharge permit for a Savannah in-pit leach stockpile and associated facilities without making the findings required by 20.6.2.3109(C)(1) and (2) NMAC and without addressing the prohibition in 20.6.2.3109(H)(3) NMAC.

Successful acquisition of the variance will provide much needed volume for the placement of leach stockpile material. The development of additional leach stockpile capacity at Tyrone is critical to continued operation of the mine. Tyrone has considered the most likely alternative to be a Savannah in-pit leach stockpile. While a new leach stockpile located outside of the existing mine and stockpile area in the current location of the shops and GO (5B leach stockpile) would provide sufficient leach stockpile capacity, an alternatives analysis shows that a Savannah in-pit leach stockpile is the more environmentally practical and technically feasible solution. A Savannah in-pit leach stockpile offers lower operational costs due to shorter haul distances, reduced associated environmental effects (i.e., fewer emissions), reduced potential for impacts to good quality groundwater, and substantially lower construction costs as compared to the 5B alternative.

Regional groundwater quality in the vicinity of the Savannah pit is already impacted from both historical mining activities and existing leach operations. Groundwater quality at nearby monitor wells exceeds multiple WQCC water quality standards, including those for TDS, sulfate, pH, and multiple metals. Because groundwater beneath and adjacent to the Savannah pit flows to and is captured at the Main pit, any mine impacts from the proposed leach operation at the Savannah pit that reach regional groundwater will be captured at the Main pit. Supplemental

Discharge Permit for Closure (DP-1341) requires Tyrone to construct, operate, and maintain a water treatment system and manage a pit interceptor well system with a useful operating life of at least 100 years after closure. This system will contain and remediate any residual impacts to regional groundwater caused by leach operations at the Savannah pit. After closure, Tyrone will continue to dewater at the Main pit and treat impacted groundwater to comply with WQCC water quality standards.

Locating leaching and stockpiling operations at the Savannah pit will limit the extent of mining operations to an area where the ground surface is already disturbed and underlying groundwater is already impacted. Establishing a new leaching and stockpile operation in an undisturbed area would present a greater risk to groundwater than locating it in an area already impacted.

Finally, due to the location of the Savannah pit, the Savannah in-pit leach stockpile has significant additional environmental benefits, as well as cost benefits to Tyrone. Specifically, haul distances and associated operational costs are substantially lower for the Savannah in-pit leach option compared to the 5B leach stockpile option.

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