Waiver Modification Application
Freeport-McMoRan Tyrone Inc.
Tyrone Mine Permit GR010RE
Open Pits and Interior Stockpile Slopes
July 2010

Table of Contents

Text

References

Attachments

Table of Contents – Continued

Tables

Figures

1.0 INTRODUCTION

1.1 Purpose

Tyrone hereby applies to the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD) to modify the waiver area approved by MMD in a letter dated April 12, 2004 for the Tyrone Mine. This application applies to Permit Number GR010RE and is based on the New Mexico Mining Act rules in Title 19, Chapter 10 of the New Mexico Administrative Code. Additional areas to be included in the waiver upon approval by MMD and justifications for the request are updated in this application based on the most recent Closure/Closeout Plan submittal of October 2007 (FMTI, 2007a) and current discussions with both MMD and New Mexico Environment Department (NMED) concerning mine closure/closeout matters for the Tyrone Mine. The NMED is involved in this process because Tyrone must conduct closure activities in accordance with the Supplemental Discharge Permit for Closure (DP 1341), which is issued by the NMED and in order for a waiver to be granted, NMED must certify that environmental standards will be met.

Tyrone anticipates that NMED will certify that environmental standards will be met by a waiver issued consistent with this application, based on closure requirements proposed by NMED in connection with resolution of Tyrone's outstanding appeal of DP 1341. Tyrone reserves the right to withdraw or modify this request consistent with final resolution of its DP 1341 and the certification made by NMED.

1.2 Governing Regulations

The MMD Director may grant a waiver for open pits and/or waste units at an existing mining operation if the permittee demonstrates that achieving a post-mining land use (PMLU) or self-sustaining ecosystem (SSE) is a) technically infeasible, or b) economically infeasible, or c) environmentally unsound. For the majority of its mine site, Tyrone has selected the approved post-mining land use of wildlife habitat.

Under the Mining Act Rules, Subsection B of 19.10.5.507 NMAC and Paragraph (3) of Subsection J of 19.10.5.506 NMAC discusses the process to apply for a waiver:

> 507 (B) Waivers for Pits and Waste Units
>
> An operator may apply for a waiver for open pits or waste units from the requirement of achieving a post-mining land use or self-sustaining ecosystem. The operator must show

that achieving a post-mining land use or self-sustaining ecosystem is not technically or economically feasible or is environmentally unsound. The Director may grant the waiver for an open pit or waste unit if he finds:

1. measures will be taken to ensure that the open pit or waste unit will meet all applicable federal and state laws, regulations and standards for air, surface water and groundwater protection following closure; and

2. the open pit or waste unit will not pose a current or future hazard to public health or safety.

The Rules also define a self-sustaining ecosystem as follows:

Paragraph (2) of Subsection S of 19.10.1 NMAC: "Self-sustaining ecosystem" means reclaimed land that is self-renewing without augmented seeding, amendments, or other assistance which is capable of supporting communities of living organisms and their environment. A self-sustaining ecosystem includes hydrologic and nutrient cycles functioning at levels of productivity sufficient to support biological diversity.

1.3 Site Overview and Closure/Closeout Plan Status

Mining operations at Tyrone have resulted in the following disturbances in the mine area.

Table 1.3.1 Current Land Use Within Mining Area

Mine Features	Approximate Area, ac	Approximate % of Area
Pits	1371	27
Stockpiles	3021	60
Roads and Miscellaneous	629	13
Total	5021	100

Note that tailing impoundments are not included above because they have been fully reclaimed and no waiver is being requested for them. Similarly, Stockpile 1 located east of Highway 90 has been reclaimed and is not included in the area estimates. The 7A and 1C stockpiles which are currently undergoing reclamation are included in the above acreage value for stockpiles as are the San Salvador Hill and South Rim Pits which will both be backfilled as part of mining operations and

will be reclaimed in the future. The miscellaneous area includes features such as buildings, tanks, remnants of mill equipment and parking areas, which are partially included within the industrial post-mining land use areas.

To address site-wide water management and reclamation of the pertinent disturbed areas, Tyrone submitted an updated Closure/Closeout Plan (CCP) to NMED and MMD on October 11, 2007 in conjunction with its application to renew DP 1341. The CCP was formally submitted to the MMD as an update of the closeout plan for the mine on April 9, 2009.

In the updated CCP Tyrone indicated that a waiver modification would be necessary to implement the updated plan as proposed at that time, but deferred submitting a revised waiver application until responses to the updated plan were received from the agencies and additional discussion could take place.

Tyrone submitted the DP 1341 Condition 89 Feasibility Study in November 2007 (Golder, 2007b). This document is an important complement to this waiver request and the October 2007 updated CCP. The Feasibility Study was intended to evaluate the relative effectiveness and associated costs of selected closure/closeout alternatives. The selection of alternatives was developed in consultation and collaboration with the NMED and MMD.

This waiver application is consistent with the Feasibility Study and the CCP update except that, as part of its resolution of its DP 1341 permit appeal, this waiver application includes additional reclamation within the proposed waiver area that was not included in the CCP update and is not directly addressed by the cost benefit analysis presented in the Feasibility Study. Tyrone is making this proposal as an overall good-faith effort to balance mining business needs at the Tyrone Mine site and the optimal closure requirements as determined by NMED with closeout requirements whose purpose is the establishment of a designated PMLU. Tyrone reserves the right to modify the waiver application depending on resolution of its DP 1341 permit appeal and application of closure/closeout requirements elsewhere in the mine.

1.4 Tyrone Mine Areas Proposed for Waiver

The waiver areas conditionally approved in April 2004 are presented on Figure 1. The areas for which a waiver is requested in this application are also illustrated on Figure 1 (see line labeled “Proposed Waiver Areas”). The proposed waiver boundaries are nearly equivalent to the “surface water catchment zone” in Tyrone’s October 2007 CCP update, except for minor refinements based on the latest available topographic data. This waiver boundary is related physically to the mine surface. Within these waiver boundary lines, it is not feasible for water to drain by gravity to the exterior of the mine. The exterior is the undisturbed land surrounding the disturbed mine land.

Tyrone was granted a waiver from achieving a PMLU or a SSE for the Main, Gettysburg, Savanna, and Copper Mountain Pits as part of Revision 01-1 to Permit GR010RE. Areas covered by the existing waiver include outslopes of stockpiles located within the pit wall boundary and thus are considered part of the open pit consistent with the definition of open pits in GR010RE. After much discussion with MMD at that time, MMD decided to conditionally allow a waiver of the larger pits as they were configured at that time.

Since 2004, when the Permit was issued, mining has resulted in changes in the configuration of the pits. Expansion of the open pit waiver boundary was anticipated to change as mining progressed. The pit waiver area has locally contracted on the north western side of the Copper Mountain pit for this request because Tyrone found it is feasible for this area to be reclaimed and drain by gravity to Deadman Canyon. Otherwise, the pits have become slightly larger.

In addition to the expansion areas of the open pits, Tyrone also is requesting a waiver for the interior slopes of stockpile units shown on Figure 3. Interior means the stockpile outslopes that face towards the open pits. Tyrone requests waivers for the units listed in Table 1.4.1 below. The total requested waiver acreage is 2087 acres out of a total of 5021 disturbed acres in the primary mining area. There are 254 acres of top surface (low gradient areas) within the proposed waiver area that Tyrone will reclaim to a SSE. Therefore, 1833 net acres are in the proposed waiver area. Thus, 3188 acres will either be reclaimed to a SSE or will remain intact for industrial post mining land use. All top surface areas and exterior (perimeter) stockpile outslopes will be reclaimed.

Under this proposal, approximately two-thirds of the primary mining area is subject to formal earthwork reclamation to obtain a designated PMLU of either wildlife habitat or industrial use. About one-third of the area would not be reclaimed, but would be addressed through other measures to protect human safety and health.

Table 1.4.1 Pit Area Comparison and Interior Slope Area

Unit	April 2004 Waiver Area (Acres)	Proposed Waiver Area (Acres)
Open Pit Units		
Main Pit (including West Main and Valencia Pits)	706	809
Gettysburg Pit	231	231
Savanna Pit	167	167
Copper Mountain Pit	132	164
Total Pit Waiver Area	1236	1371
Interior Slope of Stockpile Units		
1A and 1B		46
2A		84
3B		60
2B, 2C, 4A, 7B		177
5A		32
Copper Mountain		32
6B, 6C		31
Total Stockpile Waiver Area		462
Total Proposed Waiver Area		1833

1.5 Reclamation/Stabilization Measures Inside Proposed Waiver Areas

Tyrone proposes to reclaim certain areas within the delineated proposed waiver areas/surface water catchment zone as illustrated on Figure 1. These are relatively flat areas that Tyrone proposes to reclaim based on the following criteria:

- Area graded to not less than 1% slope
- If the surface of the designated area is acid generating mine rock or material impacted by leach operations, construct a cover of non-acid generating material such as Gila Conglomerate to a minimum cover thickness of 36 inches
- Seed and mulch covered surface
- Construct necessary storm water channels on the reclaimed surface to remove runoff water from the reclaimed surface without causing significant erosion
- Construct surface water diversions so that runoff from adjacent un-reclaimed surfaces does not contact the vegetated cover material
- Take measures to limit wildlife access to acidic ponds and sumps.

Additionally, Tyrone proposed a number of site stabilization and safety measures to be completed within the waiver areas starting on Page 115 of the CCP update. These items are summarized below:

- Construction and maintenance of pit perimeter berms 10 feet wide and 5 feet high
- Construction and maintenance of 6-foot-high, chain link security fence around pit perimeters
- Operation and maintenance of pit dewatering systems
- Operation and maintenance of pipelines and systems to transfer impacted water to the water treatment plant.

1.6 Application Organization

The application and supporting information are organized as follows.

Information concerning the justifications for waivers of stockpile interior slopes is provided in Section 2. Reclamation cost estimate information supporting this section is provided in Attachment A. Mine life cost analysis information supporting Section 2 is provided in Attachment B.

Information concerning the justifications for waivers of open pits is provided in Section 3. Reclamation cost estimate information supporting this section is provided in Attachment C.

A summary of the waiver request is provided in Section 4.

2.0 STOCKPILE INTERIOR SLOPE WAIVER JUSTIFICATIONS

2.1 Stockpile Construction and Waiver Proposal

Mine rock is blasted, shovel excavated, and truck hauled to waste stockpiles and leach stockpiles.

Typical mining best practice is to construct stockpiles close to the pit without covering future ore bodies (if possible) to

i) minimize haul distances,
ii) minimize the area of mining impact, and
iii) maintain proximity to the pit hydraulic sink capture zone if possible.

The stockpiles as constructed are economically and environmentally sound in that they are constructed at angle of repose, the steepest stable configuration which minimizes the footprint of the mine-impacted area. For a given stockpile, this

also maximizes the economic life of the stockpile because with steep slopes, more mined material can be stored in the most efficient space, instead of expanding the footprint to other areas.

At Tyrone, the Open Pit and Stockpile Unit currently include leach and waste stockpiles. After the cessation of leaching operations, leach stockpiles will become waste stockpiles (i.e. waste units).

As constructed, some stockpiles at Tyrone are totally within the hydraulic pit groundwater capture zone and surface water catchment zone (e.g., 4C, 2A, 2B, 2C, 4A, and 8C). Stockpile 1 is completely outside these capture/catchment zones and it has been completely reclaimed. Other stockpiles straddle the surface water catchment zone (e.g., 3A Leach). A waiver is being requested only for the portions of slopes of stockpiles that are inside the surface water catchment zone (or proposed waiver area boundary - see Figure 3). Water that runs off or infiltrates these stockpile surfaces will ultimately report to the pit and be collected for water treatment.

Figure 3 illustrates the interior slopes for which Tyrone is requesting a waiver. These stockpile slopes are listed Table 1.4.1 along with their areas in acres. Barring future changes in the mine plan for Tyrone, these areas would remain much as they are today. Runoff from interior slopes that could impact areas that are to be reclaimed would be captured and routed so as not to impact reclaimed surfaces. This impacted water would be routed to the pit bottoms and so would ultimately be collected for water treatment prior to discharge. An example is the runoff from the interior (east facing) slope of the 2A stockpile which would be collected in a diversion channel near the base of the slope and routed around the reclaimed flat area to the bottom of the pit (see Figure 3).

Of the total stockpile area of approximately 3021 acres within the primary mining area, a waiver of some reclamation requirements is being requested for approximately 462 acres or 15%. The other 85% of stockpile plan projection area would be reclaimed in the future or is currently being reclaimed. The stockpiles that are currently being reclaimed are the 7A and 1C. Future stockpile reclamation would include the continuation of the reclamation of the 1A and 1B Stockpile exterior slopes as well as reclamation of the perimeter slopes and top surfaces of 5A, 3B, 2A, 2B and 4C Stockpiles. San Salvador Hill and South Rim Pits are currently being backfilled as part of mine operations and will be reclaimed some time after these pits are completely backfilled. Thus, all the exterior slopes around the entire perimeter of the primary mining area will be reclaimed. Storm water that flows from the reclaimed stockpiles to the natural areas outside of the perimeter of mine disturbance will not contribute to degradation of ground or surface waters. Impacted runoff from the interior of the mine area will ultimately flow through the water treatment system before discharge.

Tyrone is proposing to reclaim 254 acres of stockpile top surface and other relatively flat areas that lie within the proposed waiver area. The flat areas are parts of the 2A, 5A, 6B and 8C stockpiles (see Figure 1).

The top surface located just south of the Main Pit (8C) has been designated in the updated CCP as the water treatment plant sludge disposal site. The preliminary design is described in the CCP. Individual sludge disposal cells will be reclaimed as they are filled and then allowed to dry. The reclamation of the area would occur over the time that the water treatment plant is in operation.

2.2 Economic Infeasibility of Interior Stockpile Slopes

The stockpile unit areas, reclamation capital and O&M costs and cost per acre are presented in Table 2.2.1. The location of each stockpile unit listed in the table is shown on Figure 3.

Table 2.2.1 Estimated Reclamation Costs for Interior Stockpile Slopes

Stockpile Unit	Area (Acres)	Total Reclamation Cost	Cost per Acre
1A and 1B	46	$4,200,000	$91,300
2A	84	$10,300,000	$122,600
3B	60	$5,100,000	$85,000
4A, 2B, 2C,7B	177	$20,000,000	$113,000
5A	32	$3,200,000	$100,000
Copper Mountain	32	$4,600,000	$143,800
6B, 6C	31	$16,600,000	$535,500
Combined Total	**462**	**$64,000,000**	**$138,500**

Cost estimate information for each of these units is presented in Attachment A. Tyrone maintains that the cost for this work is economically infeasible, and that the benefit gained does not justify the cost. The cost per acre for these slopes is substantially higher than costs previously judged by MMD to be uneconomical. For instance, reclamation of the stockpile outslopes in the open pit capture zone at Chino were deemed economically infeasible at an average cost of $66,000 per acre (see Chino Waiver Approval dated December 18, 2003). The average cost for reclamation of the proposed interior stockpiles at Tyrone is about $139,000 per acre. Even if the interior slopes of 6B and 6C Stockpiles are excluded, since they are exceptionally expensive, the average cost per acre is still high at about $110,000 per acre. Tyrone estimates that if these same slopes were on the perimeter, if they were exterior slopes, the average cost would be 25 to 30% less. The reduction in unit cost for exterior slopes compared to interior slopes could even be higher depending on the individual stockpile. The comparable average

cost for a typical exterior slope using the same cost estimating approach is approximately $80,000 per acre. The reasons that interior slopes are generally more expensive than similar slopes on the perimeter can vary, but a common thread is that in order to achieve the same environmental benefit, runoff from an interior slope would have to be collected and pumped outside the disturbed mine area. Water management costs for interior slopes have been included above to account for this fact (see Attachment A).

The analysis of economic feasibility is more complex than simply comparing cost per acre values. Reclamation and closure requirements affect local mine planning decisions from both a short-term and long-term perspective. Tyrone is committed to complying with all State and Federal laws while maintaining a viable operation that supports the economy of the region.

The evaluation of technical and economic feasibility must weigh the benefit gained against the cost of reclamation. The November 2007 Feasibility Study concluded that relatively little groundwater quality benefit is gained by covering interior stockpile tops and slopes. Nonetheless, Tyrone is proposing to cover the relatively flat surface areas within the surface water catchment zone even though this water will ultimately drain to the pit and require water treatment. The purpose of the compromise is to provide some level of reclamation within this area where the cost of working on relatively flat surfaces is more moderate. However, the benefit of this reclamation is still questionable.

The economic impact of reclaiming the interior slopes is far higher than the $64 million in reclamation costs shown in Table 2.2.1. The economic impact must also consider a more significant economic loss caused by the requirement to reclaim interior slopes that dwarfs the numbers above.

Tyrone has been aggressive in integrating mine reclamation with active mine operations. Tyrone has clearly demonstrated commitment to reclamation of exterior perimeter stockpile surfaces wherever it is physically feasible to drain the clean runoff from those surfaces by gravity to the natural drainages surrounding the mine area. Tyrone has agreed to this reclamation, in part, because it has direct environmental and economic benefit of reducing water treatment costs by allowing stormwater runoff to flow over reclaimed areas and out of the mine. However, the agreement to regrade and reclaim these perimeter slopes has greatly reduced the available stockpile storage volume or capacity. This is true because in order to accommodate plans to regrade these slopes, Tyrone has begun during operations to configure current and future stockpile lifts so that they can be regraded more readily to a 3:1 slope. If Tyrone is required to do the same thing on interior slopes facing or within pits, then this precious remaining stockpile capacity is drastically reduced. Tyrone has no flexibility to place this material elsewhere in its life of mine plan unless additional leach and waste stockpile capacity is permitted elsewhere (likely outside the current mining disturbance footprint). This is neither economically nor environmentally sound. The cost

impacts are summarized in the table below and are discussed in greater detail in Attachment B.

Table 2.2.2 Economic Loss Due to Reduction in Storage Volume

Leach Stockpile	Stockpile Volume Lost Due to Interior Slope Requirements (tons)	% Reduction in Stockpile Capacity Due to Interior Slope Requirements	Revenue Lost Due to Reduction in Stockpile Capacity
2A	7,342,738	62	$76,100,000
4A, 2B, 2C,7B, Copper Mountain	47,924,167	24	$496,800,000
Total	55,266,905		$572,900,000

This table was developed based on a simplified analysis for leach stockpiles only, but the same principle applies to active waste stockpile capacity. Both waste and leach stockpile space are critical to Tyrone's mining operation viability. Tyrone has sacrificed flexibility in stockpile capacity in order to aggressively pursue reclamation of the perimeter stockpiles during mining operations. Since the lost revenues to the operations can be as much as $573 million as shown in the table, it is very clear that the cost of imposing this requirement is much more significant than the reclamation cost of $64 million. Furthermore, this analysis does not account for the impact to the local and regional economy if the mine economics and or the life of mine are reduced in this way.

It is clearly economically infeasible for Tyrone to reclaim the interior stockpile slopes. A waiver should be granted that allows Tyrone's mining operations to continue within the disturbed interior of the mine, particularly where there is no apparent environmental benefit to reclaiming the interior stockpile slopes, as is the case here.

2.3 Environmental Unsoundness of Stockpile Sloping

The feasibility study that evaluated alternative reclamation designs concluded that regrading, covering and revegetating interior slopes provided only a marginal rather than a significant improvement in the quality and quantity of impacted water that must be treated. The expenditure of resources required to achieve this marginal improvement is not justified.

As applied at the Tyrone Mine, it is environmentally unsound policy for the state to require regrading and reclamation of these interior slopes. The reason is that by agreeing to regrade and reclaim the perimeter stockpiles, Tyrone has lost its flexibility to place ore and waste in these stockpiles as explained above. If the interior stockpiles must also be regraded, then the ore must be processed in a new

stockpile – likely outside the current mine-impacted footprint. Tyrone believes that it is environmentally unsound to either require the Tyrone Mine to choose between substantially reducing the mine life (by not processing this material) or disturbing new acres (outside the current mine disturbance) in order to process the material there.

2.4 Meeting Environmental Standards for Stockpile Units

If the waiver were granted, environmental standards would be met using the methods outlined in Section 1.5. Runon from stormwater will be controlled with berms to prevent water from the top of the stockpiles running down the interior slopes. Sedimentation and runoff containment structures will also be constructed around the bases of the stockpiles. The top surfaces of the stockpiles will be covered and revegetated to reduce seepage and surface water impacts. Tyrone will continue to operate and maintain systems to collect and treat water that does not meet standards. Tyrone will continue to be subject to the requirements of DP 1341 which ensures that applicable New Mexico water quality standards and goals are met.

Air quality standards are currently being met at the Tyrone Mine. Mining operations result in particulate emissions from haul road traffic, blasting, loading and unloading, and wind. Since only minor O&M activities are expected within the mine area after mining ceases, all air standards within the mine area will be met.

In summary, for the interior of the mine area impacted runoff is captured and treated, infiltrated water is reduced and also captured by pit bottom pumping; and air quality standards are met as they are today with much less dust emissions.

2.5 Safety Measures for Stockpile Sloping

To address human health and safety concerns with regard to the stockpile outslopes, Tyrone will take measures to limit future access to these areas to authorized personnel only. Warning signs will be posted, as necessary, around the perimeters of these facilities. Access will be controlled by maintaining the existing or replacement perimeter fencing and security measures will also be used to prevent trespassing.

The conversion of the building, tankage and parking areas to an industrial PMLU would provide the benefit of continued human presence in the area and, to an extent, would deter more blatant forms of trespass and vandalism.

3.0 OPEN PIT WAIVER JUSTIFICATIONS

3.1 Open Pits Development and Waiver Proposal

The open pits were constructed by blasting hard rock and excavating the blasted rock with a power shovel. To minimize the amount of non-economic material to be moved, the pit walls are left in the steepest configuration possible consistent with stability and safety considerations. This configuration minimizes the size of the open pit as well as the amount of material that must be removed and hauled as waste in order to reach the ore. By minimizing the amount of excavated materials, this method of mining also minimizes the area disturbed for the placement of material stockpiles.

The resulting configuration of the open pit leaves a series of steep rock walls with flat benches at intervals of 50 feet. Due to the steepness of the rock walls and the nature of the rock material, substantial modifications would be required in order to reestablish vegetation within a reasonable time frame.

As a result of mining, the bottom of the pit has advanced below the water table. Concurrently, to maintain dry working conditions, groundwater that flows into the pit is collected in sumps and is removed and used in Tyrone's operations. The collection and pumping of groundwater that enters the pit lowers the water table surrounding the pit creating a localized cone of depression or drawdown within the groundwater system. This response is similar to that of a well. Under these circumstances, the term given to the pit is a "hydraulic sink" since the pit bottom represents the lowest groundwater elevation. Measurements of the groundwater elevation in piezometers and wells indicate the configuration of the water table around the pit (hydraulic sink). Within the hydraulic sink, groundwater flows into the pit. This area is also referred to as the pit capture zone. Tyrone's operational discharge permits and the closure permit (DP 1341) require Tyrone to continue pump the pit water and maintain the hydraulic sink.

In the conditional approval for the Tyrone waiver granted April 12, 2004, the physical limits of the pits were as they existed at that time. Table 1.4.1 lists the pits and their areas as approved for waiver at that time. Tyrone requests that the existing waiver for the same pits be expanded by 135 acres to encompass the physical limits of the pits as they exist today. Table 1.4.1 provides a list of the pits along with the plan view areas.

3.2 Technical Infeasibility in Revegetating Open Pits

For the purposes of this analysis it is assumed that there are three methods to reclaim an open pit. These methods include 1) direct reclamation of flat

catchment benches, 2) regrading of pit walls and revegetating the resulting surface, and 3) partial or complete backfill.

At Tyrone, pit walls range in overall toe to crest interbench angles of 40 to 55 degrees. Therefore, given the steep pit wall angles, direct reclamation of pit walls is not technically feasible without regrading pit walls or backfilling the pit. The exposed rock walls are also not suitable for direct revegetation without soil placement.

Reclamation of flat areas may be feasible in very limited areas dependent on access, bench stability, and construction safety. The flat surfaces that Tyrone proposes to reclaim within or near the pit areas are shown on Figure 1.

Inherently, reclaiming a catchment bench poses safety risk. The advantages of reclaiming 10 or even one hundred acres for the sole purpose of creating wildlife habitat may be unreasonable compared to the safety risks present while working on these catchment areas.

Reclamation of large open pits at hard rock mines generally involves the use of safety features such as berms, fencing, and signs and water management practices such as sediment control, perimeter berms and water treatment. Large open-pits associated with hard rock mining operations are rarely revegetated. Backfilling and revegetation depend on complex set of conditions relative to ore distribution and economics. Surface coal mines with shallow mineral deposits are commonly backfilled as mining progresses and revegetated. Because the materials are inert and the pits are shallow, the pit walls of gravel mining operations are sometimes flattened and revegetated.

The National Research Council (NRC) initially investigated the issue of pit backfilling in 1979, and revisited the issue in 1999 (NRC, 1999). The NRC concluded that pit backfilling is:

> "generally not technically feasible for non-coal minerals, or has limited value because it is impractical, inappropriate, or environmentally unsound…."
>
> Further, to restore the original contour where massive ore bodies have been mined by the open pit method could incur costs roughly equal to the original cost of mining. Although technically possible, such backfilling of a large open pit would be of uncertain environmental and social benefit, and it would be economically impractical to some deposits under the current cost structures".

The NRC recommended that pit backfilling be evaluated on site specific basis and that backfilling may be viable under the following conditions:

1) mining areas where multiple ore bodies allow mining and backfilling to proceed without double handling of backfill materials;
2) location where backfilling will eliminate negative environmental impacts, such as acid mine drainage, and;
3) sites where backfilling provides an economically viable means of achieving reclamation goals or protecting other specified resource values.

The NRC discouraged backfilling where the backfill material has been leached or chemically transformed as a result of geochemical conditions because groundwater quality degradation would ensue.

Revegetation of the open pit portion of large open pit mining operations is contrary to current industry standards and practices, and is generally considered impractical. Conditional exemptions for the revegetation of open pits and rock faces are included in several state mine reclamation laws (e.g., Arizona, Idaho, Montana, and Nevada) (ELI, 1996). The conditions for exclusion of the revegetation requirement involve economic considerations, geologic stability, and topographic constraints. Federal mine reclamation regulations such as those administered by the United States Bureau of Land Management do not require the revegetation of some or all portions of open pits depending on the ore configuration and nature of the waste rock. Partial pit backfilling with revegetation of the backfill surface is sometimes required for certain pits but it is motivated by potential water quality issues associated with pit lakes rather than by post-mining land use considerations. Thus, the request for an open pit waiver at Tyrone is consistent with the regulatory requirements in other states, and with the federal requirements for large open pit mining operations.

The steepness of the pit walls prohibits the placement of cover materials and access to the benches is restricted by safety considerations. The technical infeasibility of covering the pit walls and accessing the benches with planting equipment prevents active revegetation. Because of the volume required and the nature of the waste at Tyrone, backfilling is considered to be economically infeasible and environmentally unsound. Thus, reclamation of the Tyrone pits will be restricted to sediment and water management and safety considerations.

3.3 Economic Infeasibility of Reclaiming Open Pits

Reclamation methods such as direct reclamation of flat catchment benches and regarding of pit walls have been previously discounted due to safety concerns and economic infeasibility. Therefore, for the purposes of this analysis it is assumed that there are two methods to reclaim an open pit. These methods include 1) complete backfill of the open pit, and 2) partial backfill of the open pit.

3.3.1 Complete Pit Backfill

In the complete backfill scenario, the reclamation costs range from a minimum of $639,000 per acre for Copper Mountain to a maximum of $1,416,000 per acre for the Main Pit. The high cost of $1.6 billion for completely backfilling the Main, Gettysburg, Savanna and Copper Mountain pits is in excess of what Tyrone could economically complete. Therefore, Tyrone maintains that the cost for this work is economically infeasible, and that the benefit gained does not justify the cost.

The complete backfill scenario is based on backfilling up to the pit rim. The main activities that would occur include: hauling and grading backfill material from the closest stockpile source; hauling and grading cover material; ripping and revegetation of covered areas; installation and periodic replacement of three pit dewatering wells; water sampling and monitoring; and completing surface water channels to route storm water.

The average cost of $1,150,000 per acre for complete backfill includes using backfill material from the closest stockpiles and does not take into consideration that the borrow material may contain sulfide material (acid generating). If segregation of material is required, or if other sources of non-acid generating material are required, costs could increase dramatically. Additionally, land disturbance would increase due to the new borrow sources that would potentially be required.

3.3.2 Partial Pit Backfill

In the partial backfill scenario, the reclamation costs range from a minimum of $293,000 per acre for Copper Mountain to a maximum of $744,000 per acre for the Main Pit. The high cost of $784 million for partial backfilling the Main, Gettysburg, Savanna and Copper Mountain pits is in excess of what Tyrone could economically complete. Therefore, Tyrone maintains that the cost for this work is economically infeasible, and that the benefit gained does not justify the cost.

The conceptual designs and associated earthwork cost estimate for the partial backfill scenario are based on an interbench outslope gradient of 2.5H:1V, approximate 25-foot wide terrace benches, and maximum 175-foot inter-bench slope lengths (overall outslope gradient of 2.88H:1V). The main activities that would occur include: hauling and grading backfill material from the closest stockpile source; hauling and grading cover material; constructing top, terrace/outslope channels, and downdrains/spillways; ripping and revegetation of covered areas; installation and periodic replacement of three pit dewatering wells; installation and periodic replacement of pit sumps, pumps, pipelines, and electrical infrastructure; and water sampling and monitoring.

The average cost of $570,000 per acre for partial backfill includes using backfill material from the closest stockpiles and does not take into consideration that the borrow material may contain sulfide material (acid generating). Similar to the complete backfill scenario, segregation of material and utilization of other borrow sources could increase costs and land disturbance dramatically.

3.3.2.1 Pit Backfill Cost Estimate Synopsis Table

Description	Area (acres)	Cost Complete Pit Backfill ($)	Unit Cost Complete Pit Backfill ($/acre)	Cost Partial Pit Backfill ($)	Unit Cost Partial Pit Backfill ($/acre)
Main Pit (including West Main and Valencia)	809	$1,145,900,000	$1,416,000	$602,100,000	$744,000
Savanna Pit	167	$140,800,000	$843,000	$64,600,000	$387,000
Gettysburg Pit	231	$186,900,000	$809,000	$68,900,000	$298,000
Copper Mountain Pit	164	$104,700,000	$639,000	$48,100,000	$293,000
Total ($)	1,371	$1,578,300,000		$783,800,000	
Total ($/acre)			$1,150,000		$570,000

Additional cost information on pit backfilling is provided in Attachment C.

3.4 Environmental Unsoundness of Open Pit Reclamation

Backfilling the pits may adversely affect groundwater quality, whether the backfilling is to a flat plane or shallow bowl configuration (NRC, 1999). At the very least there is a strong possibility that backfilling the entire bottom of the pit would compromise water handling and groundwater quality.

If the waiver to reclaim the pits is granted, environmental standards would be met using the methods outlined in Tyrone's proposed CCP. Tyrone will continue to operate and maintain systems to collect and treat water that does not meet standards. As described in the CCP, Tyrone is proposing nanofiltration and lime precipitation water treatment for impacted water.

Air quality standards are currently being met at the Tyrone mine. Mining operations result in particulate emissions from haul road traffic, blasting, loading and unloading, and wind. The rock in stockpiles and pit walls has limited potential to generate dust because of the large size of the rock fragments. Since few activities within the pits are expected after mining ceases, all air standards within the pits will be met.

3.5 Safety Measures for Pit

In order to address human health and safety concerns with regard to the open pit/mine area, Tyrone will take measures to limit future access to these areas to authorized personnel only. Public access will be prevented. This will be accomplished by two means; a certain portion of the mine site will have a berm and chain link fence placed at the perimeter of otherwise accessible portions of the pit. This berm/fence combination will tie into existing geographic features that will help limit access to the pit area. To allow pit access for maintenance activities by authorized personnel, locked gates will be strategically placed in this berm/fence combination.

4.0 SUMMARY AND CONCLUSIONS

4.1 Waiver Application

Tyrone requests a waiver from establishing a SSE for 1833 acres. The total disturbed area within the primary mining area is 5021 so 3188 or 63% of the area would be either reclaimed to an SSE or be used for industrial purposes.

4.2 Amount of Disturbances

The majority of the land areas within the mine area will be revegetated. The portion of the stockpiles for which the waiver would apply account for 462 acres out of the total 3021 acres covered by stockpiles. For the area occupied by the open pit, 1371 acres will not be revegetated to a SSE. The areas that have not been proposed for revegetation are the pit walls and the stockpiles that are within the pit's hydraulic capture zone. In the areas designated for an industrial PMLU the features are either preserved for future use or are demolished and reclaimed. Overall, only 1833 acres out of the total 5021 primary mine area disturbed acres or 37% would not be revegetated if the requested additional waivers are granted. The open pits occupy 75% of the requested waiver area.

4.3 Negative Impacts of Further Reclamation

Backfilling the pits will prevent installation of accessible systems needed to maintain required water levels. Well systems placed in backfill would be at significantly greater costs and at reduced reliability for pumping impacted waters to a treatment facility. Complete and partial backfill of pits are environmentally unsound.

Requirements to regrade and reclaim interior stockpile slopes are not environmentally sound. Tyrone is aggressively integrating reclamation activities

with mine operations. This has limited Tyrone's capacity to place leach and waste materials for business purposes. If Tyrone is required to regrade the interior slopes also, then Tyrone may then have to consider constructing new facilities outside the impacted/disturbed mine area to process ore and/or place waste that otherwise could have been processed inside the hydraulic containment area of the pits.

4.4 Cost Impacts

The cost to reclaim interior stockpile slopes is approximately $64 million. The cost of reclamation of the interior stockpile slopes is generally more expensive and economically infeasible based on reclamation costs alone. But there is a much more significant economic cost or loss if the waiver of these interior slopes is not granted. Tyrone will lose the capacity to process over 55 million tons of leach ore that indicates lost revenues of approximately $573 million. This is clearly not economically feasible for Tyrone and the communities that are economically benefited by Tyrone's mining business. The feasibility study indicates that the environmental benefit that would be achieved by interior slope reclamation is not justified considering these significant costs.

The estimated cost to fully backfill the pits is $1.5 billion and the estimated cost to partially backfill the pits is $800 million. Attempting to reclaim intermediate flat benches on the pit wall poses construction safety issues. Incremental bonding requirements for these activities further erode the global and regional competitive position of the New Mexico mines. The reclamation of open pits is clearly shown as economically infeasible.

For these reasons Tyrone is requesting a waiver from achieving a SSE in the areas described in this application.

References

ELI, 1996. Hard Rock Mining, State Approaches to Environmental Protection, Environmental Law Institute, James McElfish, January 1, 1996.

Golder, 2007a. Tyrone Mine Closure/Closeout Plan Update, Phelps Dodge Tyrone Inc., Tyrone, New Mexico, October 11, 2007.

Golder, 2007b. DP-1341 Condition 89 Feasibility Study, Phelps Dodge Tyrone Inc., Tyrone, New Mexico, November 12, 2007.

NRC, 1999. Hardrock Mining on Public Lands, National Research Council.