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1. INTRODUCTION

1.1. DOCUMENT PURPOSE AND ORGANIZATION

Rosemont Copper Company (the Applicant) proposes to develop an open pit copper mine known as the Rosemont Copper Project (Project). Because portions of the Project occur on lands managed by the U.S. Forest Service, Coronado National Forest (CNF), the Applicant submitted a Mine Plan of Operations (MPO) (WestLand, 2007) to the CNF. The CNF deemed the MPO complete for the purpose of initiating review under the National Environmental Policy Act (NEPA) and is in the process of developing an Environmental Impact Statement (EIS). The U.S. Army Corps of Engineers (Corps) is a cooperating agency in the EIS development process due to anticipated impacts to potentially jurisdictional waters of the U.S.

In addition to the development of an EIS by the CNF, an analysis of alternatives to the proposed Project is required by the Corps to demonstrate compliance with guidelines established under the Clean Water Act (CWA), Section 404(b)(1) (40 C.F.R. §230), for avoidance and minimization of impacts to jurisdictional waters of the United States. The alternatives analysis is intended to ensure that no discharge be permitted “if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences” (40 C.F.R. §230.10(a)).

This analysis identifies a number of alternatives to accomplish the Project purpose and evaluates the practicability of each alternative as well as the expected environmental impacts of each. The formulation of alternatives to the proposed Project relies in part on the alternatives developed through the U.S. Forest Service review of the Rosemont Project MPO (WestLand, 2007).

This alternatives analysis is presented in three sections:

Section 1: Introduction. This section includes historical information, a description of the purpose and need for the Project, and a description of the proposed Project area.

Section 2: Formulation of Alternatives. Section 2 provides a description of the general approach taken in formulating alternatives, including the geographic scope of the alternatives, a description of the criteria reviewed in the analysis, the preferred alternative, and other onsite and offsite alternatives considered that could potentially satisfy the Applicant’s overall Project purpose.

Section 3: Alternatives Description. Section 3 provides a description and evaluation of the practicability of each of the alternatives considered and the impact of each alternative on the aquatic ecosystem and on the overall environment.
1.2. PROJECT HISTORY AND BACKGROUND

The Rosemont Copper Property (Property) consists of a group of patented mining claims, unpatented mining claims, and fee land that covers most of the Rosemont Mining District and the adjacent Helvetia Mining District within unincorporated Pima County in southeastern Arizona. Specifically, the Property is located approximately 30 miles southeast of Tucson, west of State Route 83 (SR 83), in portions of Sections 1, 2, 10–15, 22–25, 35, and 36, Township 18 South, Range 15 East, portions of Sections 1 and 2, Township 19 South, Range 15 East, portions of Sections 6–8, 14–23, and 27–33, Township 18 South, Range 16 East, and portions of Sections 4, 5, and 6, Township 19 South, Range 16 East (Figure 1).

Primary access to the Property will be from Interstate 10 (I-10) to SR 83 south, then west on the Project’s main access road. There is a secondary access from the west for utility corridor maintenance and emergency purposes. The access and utility alignment traverses the Santa Rita Experimental Range and private properties that lie northwest of the Project. The utility corridor will contain both a 138 kV powerline and a waterline.

As explained more fully below, current estimates are that the Rosemont deposit consists of 667 million tons of proven and probable mineral reserves. Additional mineralized material has been identified in association with the Broad Top Butte, Copper World, and Peach-Elgin deposits.

The core of the Property consists of 132 patented lode claims\(^1\) that in total encompass an area of 1,969 acres. A contiguous group of 899 unpatented lode claims\(^2\) with a total area of approximately 12,000 acres surrounds the patented claims. There are also 14 parcels of Rosemont-owned fee land grouped into six individual areas that total 911 acres on the east side of the Santa Rita Mountains. These patented claims, unpatented claims, and fee lands cover approximately 14,880 acres and, together, are referred to as the Rosemont Holdings. For the purposes of this 404(b)(1) analysis, the Project “site” is comprised of that portion of the aggregated Rosemont Holdings that was considered for onsite alternatives. This area comprises the entirety of the Barrel Canyon drainage from the Santa Rita Mountain ridgeline on the west, south to the upper Cienega Creek watershed boundary, east to SR 83, and north to Scholefield Canyon.

Most of the unpatented claims are located on federal land administered by the CNF, but a limited number of claims in the northwest portion of the Property are on federal land administered by the Bureau of Land Management (BLM). The Project does not include any activities on BLM land. The area surrounding the claims and fee properties is generally state and federal lands and undeveloped rangeland, with limited

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1 A "patented lode claim" is a parcel of fee land that was conveyed by the United States government to an individual or company pursuant to the Mining Law of 1872. Generically, a "patent" is a deed issued by the United States—it is the evidence of right, title, and/or interest in a parcel of land, as first granted by the United States.

2 An "unpatented lode claim" is a parcel of land claimed by an individual or company pursuant to the Mining Law of 1872, but which has not been patented. The owner of an unpatented lode claim does not need a patent, or a vested right to issuance of a patent, to possess and use the land for legitimate mining or milling purposes. Further, an unpatented lode claim is property in the fullest sense of the word, and the owner is not required to secure patent from the United States—so long as the owner complies with all the provisions of the Mining Law of 1872, his possessory right, for all practical purposes of ownership, is as good as though secured by a patent. See United States v. Shumway, 199 F.3d 1093, 1105 (9th Cir. 1999).
private property. The area in the vicinity of the Project is used primarily for cattle grazing, with substantial public use for recreational purposes.

The Property is situated mainly on the east side of the Santa Rita Mountains. The existing large-scale mining activities that have been ongoing in the region occur on the west side of the range, along the Interstate 19 corridor south of Tucson. Production from mines in the Helvetia District and to a lesser extent the Rosemont District occurred from the late 1800s until 1951, producing approximately 227,300 tons of ore. Ore production in the area ceased in 1951 and has not been resumed as of 2013, although exploration of the Rosemont deposit and (to a significantly lesser extent) the Broad Top Butte and Peach-Elgin prospects has been carried out over the ensuing years.

1.3. PURPOSE AND NEED FOR THE PROJECT

In accordance with the requirements of the CWA Section 404(b)(1) guidelines, for the purpose of determining a project’s water dependency, the basic Project purpose is copper mining. For the purpose of developing alternatives, the Corps has determined that the overall project purpose is to develop the mineral resources associated with an ore deposit in southeastern Arizona (Pima, Pinal, Gila, Graham, Greenlee, Cochise, and Santa Cruz counties) using conventional open pit mining and processing of copper ores for the purpose of producing copper and/or copper precursors, silver, and molybdenum.

The Applicant’s purpose and need for the Project is to mine and process copper ore from the Rosemont ore deposit for the purpose of producing copper and/or copper precursors, as well as recovering by-product metals such as silver and molybdenum, in a manner that is sensitive to the natural environment and in compliance with applicable regulations, with an economic return adequate to justify the development costs and risks associated with the construction of the mine site and associated facilities.

1.4. PHYSICAL AND NATURAL ENVIRONMENT

The primary drainage in the Project site is Barrel Canyon, with its main tributaries being Wasp Canyon, McCleary Canyon, and Scholefield Canyon. Barrel Canyon drains into Davidson Canyon on the east side of SR 83. Several seeps and springs are present within the Project site, including Scholefield Spring (which supports a potentially jurisdictional wetland) located in the northern portion and Rosemont Spring northwest of Rosemont Camp.

Elevations on the Property range from approximately 6,824 ft above mean sea level (amsl) at Weigles Butte on the west edge of the Project site to approximately 4,500 ft at the lower end of Barrel Canyon. The ridge on the west edge of the Property constitutes the main crest of the Santa Rita Mountains. Topographically, the site consists of mountain front and rolling foothills bisected by ephemeral washes.

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3 As a general rule, the basic purpose of the project must be known to determine if the project is water dependent. Since the proposed Project does not entail discharges to special aquatic sites (see Preliminary Jurisdictional Waters Determination SPL-2008-00816-MB), the presumption that a less damaging, practicable offsite alternative exists does not apply [Army Corps of Engineers Standard Operating Procedures for the Regulatory Program, Section 12, 2009; 40 CFR part 230.10(a)(3)].

4 See Army Corps of Engineers Standard Operating Procedures (SOP) for the Regulatory Program (2009). The Corps SOP state “the overall project purpose is used to evaluate less environmentally damaging practicable alternatives” and “must be specific enough to define the applicant’s needs, but not so restrictive as to constrain the range of alternatives that must be considered under the 404(b)(1) guidelines.”
Vegetation cover types within the Project site are consistent with the mapping by Brown and Lowe (1980). The two biomes present within the Project site are Madrean evergreen woodland and semidesert grassland, as described by Brown (1982). Madrean evergreen woodland covers the higher elevation parts of the Project site, generally in the western and southern areas. This community is characterized by open woodlands or savanna, with trees interspersed with grasses and forbs. Semidesert grassland covers the lower elevation parts of the Project site, primarily in the northern and eastern areas. This community is characterized by open grasslands with widely scattered shrubs and cactus. At middle elevations within the Project site, the semidesert grassland grades into the Madrean evergreen woodland in a wide transition zone. Riparian areas are present along some of the major washes within the Project site and in small patches at some of the more reliable springs (WestLand, 2010). Ephemeral flow in Barrel, McCleary, and Wasp Canyons (with occasional spring flow in short reaches of McCleary Canyon and other drainages) supports areas with tree and shrub species not present on the drier upland ridges. Several springs in the Project vicinity, including Rosemont Spring, Scholefield Spring, and Figtree Spring, support a variety of trees, shrubs, and herbaceous plants not found elsewhere within the Project site.

An analysis by WestLand (2010) delineated five different classes of riparian habitat within the Rosemont Project area based on Normalized Difference Vegetation Index (NDVI) Display Values developed from satellite imagery, with higher NDVI Display Values indicating the presence of increased vegetation. Based on this classification system, the highest quality (read “highest vegetation density”) riparian habitat was found in a relatively short, moister reach in upper McCleary Canyon and in association with Scholefield and Fig Tree Springs.

### 1.5. Jurisdictional Waters of the United States

Per the provisions of Corps RGL 08-02 (dated June 26, 2008), the Applicant submitted a preliminary jurisdictional waters determination (PJD) to the Corps on May 29, 2009. Additional information was submitted per Corps request on July 31, 2009. Supplemental information related to Sycamore Canyon and the offsite waterline alignment was provided to the Corps on January 5, 2010, and March 1, 2010, respectively. Approval of the PJD by the Corps was provided in November 2010. Although an approved PJD does not provide a legally binding determination of jurisdiction over particular water bodies or wetlands, it is suitable for the purpose of permitting under CWA Section 404 (Corps RGL 08-02).

The total estimated area of potentially jurisdictional waters within the analyzed portion of the Project site is approximately 101.6 acres (Figure 2). Additional potential waters of the U.S. occur along the proposed utility alignments west of the Project site. The majority of the onsite potential waters of the U.S. are ephemeral, flowing only in response to storm events. Springs located within McCleary Canyon and
Rosemont Spring will occasionally discharge for an extended period after storm events, resulting in minor surface water flow before the spring water infiltrates back into the ground.

Two potential special aquatic sites, as defined by the 404(b)(1) guidelines (40 CFR §230.3(q-1)), were identified on the Property. The potential special aquatic sites consist of wetlands associated with Scholefield and Fig Tree Springs. These wetlands will not be directly impacted by the proposed Project, but may be impacted by one or more alternatives.
2. FORMULATION OF ALTERNATIVES

This section defines the range of the alternatives in this analysis and describes the criteria used to determine the practicability of the alternatives for the Rosemont Project. Alternatives are influenced by the distribution, function, and value of the jurisdictional waters found at the site, the nature of the project purpose, and other environmental factors. Specific criteria are described that are used to identify the least environmentally damaging practicable alternative that fulfills the Project’s overall purpose.

2.1. CRITERIA FOR DETAILED ANALYSIS OF ALTERNATIVES

The following criteria have been established to determine whether an alternative is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall Project purpose, and whether it has the potential to reduce impacts to the aquatic ecosystem without causing other significant adverse environmental consequences.

2.1.1. Practicability

The 404(b)(1) guidelines provide that “an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” (40 CFR 230.10). In order to determine whether an alternative to the Rosemont Project could be considered practicable, a brief discussion of the geology of copper deposits and the stages of a mine project is in order.

Although copper is a relatively common constituent of the earth’s crust, concentrations of copper minerals that can be economically recovered are rare. This contrasts markedly with other types of more common mineral resources, such as coal, sand and gravel, or limestone deposits, which are considerably more abundant and widespread. To justify the substantial investment necessary to develop a copper deposit, the deposit must be of sufficient quality (grade), size (tons), and geometric configuration (e.g., depth, etc.) to allow for a sufficient financial margin after meeting operating costs to amortize the initial investment and provide a reasonable return on investment. Financing of mine development is heavily dependent on accurate reporting of the known nature of the mineral deposits, and, as a consequence, the terminology used must follow generally accepted industry standards and securities regulatory agency requirements. (The letters from Augusta Resource’s Vice President of Exploration, provided in Appendix A, explain this in detail.)

Determining the quality, size, and geometric configuration of a deposit is an expensive and time-consuming process. A mining project begins with an exploration campaign of a geologically favorable region. As the results of more and more exploration and evaluation become available for the region, certain areas, called prospects, are targeted as being more favorable, i.e., as having the quality, size, and configuration conducive to profitable extraction. Increasingly detailed work will show what the relative potential of each targeted area is and typically identify the highest potential target area. Continued exploration is then focused on the area with the highest potential for profitable mineral extraction because the significant time and expense involved in the exploration process for any one operator make simultaneous evaluation of all potential mineralized areas impracticable.
The advancement of a prospect during mineral exploration may then result in the identification of an initial Mineral Resource estimate. Mineral Resources are officially defined as: “A concentration or occurrence of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth’s crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.” Mineral Resources are subdivided in order of increasing geological confidence into inferred, indicated, and measured categories, the definitions of which are provided below.

**Inferred Mineral Resource** – “that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.” Due to the uncertainty that may be attached to Inferred Mineral Resources, it cannot be assumed that all or any part of an Inferred Mineral Resource will be upgraded to an Indicated or Measured Mineral Resource (see below) as a result of continued exploration.

**Indicated Mineral Resource** – “that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics, can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.” An Indicated Mineral Resource estimate is of sufficient quality to support a preliminary feasibility study which can serve as the basis for major development decisions.

**Measured Mineral Resource** – “that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit (i.e., feasibility [see below] can be completed). The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.

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5 The definitions provided in this section were all obtained from CIM DEFINITION STANDARDS – For Mineral Resources and Mineral Reserves, prepared by the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Standing Committee on Reserve Definitions and adopted by the CIM Council on December 11, 2005. Augusta Resource Corporation, parent company of Rosemont Copper Company, is traded on the Toronto Stock Exchange and is bound by these standards.
The next major stage of a mineral exploration project is a feasibility analysis, which incorporates mine, metallurgical, and environmental engineering to determine what part of the Mineral Resource is economically extractable, and that part is referred to as the Mineral Reserve. Mineral Reserves have been officially defined as: “The economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when the material is mined.” Material that cannot be considered as part of the economic Mineral Reserve must remain as Mineral Resource for reporting purposes. Mineral Reserves are subdivided in order of increasing economic confidence into probable and proven categories, as defined below.

**Probable Mineral Reserve** – “the economically mineable part of an Indicated and, in some circumstances, a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.”

**Proven Mineral Reserve** – “the economically mineable part of a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.” Application of the Proven Mineral Reserve category implies that the person performing the evaluation (the “Qualified Person”) has the highest degree of confidence in the estimate with the consequent expectation in the minds of the readers of the report.

Once the economic feasibility study has demonstrated a given mineral project to be economically viable (that is, a Mineral Reserve has been identified), the next steps include detailed engineering, environmental impact analysis, and procurement of project financing. The geological Mineral Resource and economic Mineral Reserve are largely fixed at this point, but may be updated if additional information becomes available. In such circumstances, the additional information is usually incorporated into an economic feasibility study update.

It is conceivable, however, that a feasibility study may determine that no part of a Mineral Resource is economically extractable (given existing technologies), and in that case no Mineral Reserve would be identified. Development of such an ore deposit would therefore not be “practicable” under the 404(b)(1) guidelines.

If an offsite alternative consists solely of Mineral Resources, by definition there is insufficient information to determine if extraction is feasible (the industry’s term) or practicable (the 404(b)(1) guidelines’ term). It is not until the feasibility study is complete, and the Mineral Reserve identified, that it can be determined whether or not a given project is “capable of being done” in light of cost, technology, and logistics. As such, offsite projects or properties for which only a Mineral Resource has been identified
cannot be considered “practicable” alternatives until a feasibility study has been completed that determines them so. It is not simply that these offsite alternatives are not “practicable”; their practicability is unknown and unknowable absent a significant (i.e., expensive and time-intensive) exploration campaign and subsequent feasibility analysis.

With this as background, we move to discussion of the specific elements of practicability identified in the guidelines: availability, cost, and logistics and technology.

2.1.1.1. Availability

In order for development on a particular site to be practicable, the subject property must be under the Applicant’s control or ownership, or available for acquisition. The Corps has directed the Applicant to evaluate availability as of the date of acquisition of the Rosemont Project, in 2005.

2.1.1.2. Cost

As a publicly held corporation, the Applicant has a fiduciary duty to stockholders to provide a reasonable rate of return on investment, commensurate with the risks associated with achieving those returns. Project costs affect the practicability of alternatives, especially with respect to costs that are substantially greater than the costs normally associated with the particular type of project. The relevance to practicability determination rests not in the Applicant’s individual financial standing, but primarily in the characteristics of the project and what constitutes a reasonable expense for these types of projects for the industry as a whole. The alternatives were reviewed with respect to the effect of the alternative on Project cost when compared to other alternatives or the cost of similar projects.

Offsite alternatives present a particular challenge from the standpoint of cost. In order to determine if a particular alternative is feasible, it is necessary to estimate the costs of developing the resource and measure those costs against industry standards, which typically means cost per pound of copper produced. The challenge with many offsite mineral resources is that the extent and configuration of the resource has not been adequately defined and so there is inadequate information on the amount of copper generated or the cost to construct the project.

2.1.1.3. Logistics

Development of an MPO includes several logistical considerations, including mine stability—waste rock and tailings piles must be designed so as to be stable and to meet basic safety standards. Similarly, development of an open pit is done in an incremental way that ensures that the walls of the pit remain stable so as to allow continued mining.

2.1.1.4. Existing Technology

All of the alternatives considered in this analysis were developed based on existing copper mining technology. That is, none of the alternatives considered here are dependent on development of new technology to be practicable. For example, dry stack tailings disposal was contemplated for all alternatives; this technology is more expensive but uses much less water than conventional tailings
disposal with slurry pipeline and impoundments. Technological considerations, therefore, were not determinative in the evaluation of any of the alternatives.

2.1.2. Impacts to Aquatic Ecosystem

Specific criteria used to determine whether the development of an alternative mineral resource would result in less impact to the aquatic ecosystem include estimated impacts to waters of the U.S., including wetlands. Because offsite alternatives are effectively eliminated by issues related to Project purpose, availability, or cost (see below), analysis of impacts to aquatic ecosystems is not discussed here. In general, the Rosemont site itself is located at the top of the watershed and is characterized by ephemeral watercourses, with a few isolated springs and occasional spring flow within short reaches in McCleary Canyon and others. There are no wetlands within the footprint of the proposed Project. As a general matter then, the presumption of available alternative sites found in the 404(b)(1) guidelines is not applicable here.

2.1.3. Other Environmental Impacts

Because offsite alternatives are effectively eliminated by issues related to Project purpose, availability, or cost (see below), a detailed analysis of other environmental impacts associated with alternative mineral resources is not discussed here.

With regard to onsite alternatives, in addition to potential waters of the U.S., the Rosemont Project site supports sensitive species and habitats that may be affected by one or more of the evaluated alternatives. Sensitive habitats include the five classes of riparian habitats referenced above and described in WestLand (2010). The Rosemont Project site also supports habitat features for sensitive species, including roost sites for the federally listed lesser long-nosed bat and stock tanks in which the federally listed Chiricahua leopard frog has been observed. A number of area springs, including both Scholefield and Fig Tree Springs, support the giant sedge, which is listed as “sensitive” by the U.S. Forest Service. A complete analysis of a broad suite of environmental resources is provided in the CNF EIS.

2.2. Offsite Alternatives

The 404(b)(1) guidelines provide that “an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant, which could reasonably be obtained, utilized, expanded or managed in order to fulfill the basic purpose of the proposed activity may be considered” (40 C.F.R. §230.10).

The following sections provide a discussion regarding the state of the copper mining industry in Arizona in 2005, as well as an analysis of the copper mining projects that were either underway or in the planning stage at that time.
2.2.1. Status of Copper Industry in 2005

The copper industry is very important in Arizona, with an estimated direct and indirect contribution to the Arizona economy of approximately $12.1 billion in 2010, the most current year for which this information is available (Niemuth, 2011). At the time that Augusta bought the Rosemont Property, in 2005, Arizona produced over 60 percent of the nation’s copper; however, nearly 100 percent of that copper came from just 10 large mines owned by four companies (Table 1; Niemuth, 2006). Figure 3 shows these facilities as they occur within the geographic range of the alternatives.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Ownership</th>
<th>% of Arizona Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morenci</td>
<td>Phelps Dodge and Sumitomo (now Freeport-McMoRan and Sumitomo)</td>
<td>51.9</td>
</tr>
<tr>
<td>Ray</td>
<td>ASARCO</td>
<td>14.8</td>
</tr>
<tr>
<td>Bagdad</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
<td>10.5</td>
</tr>
<tr>
<td>Sierrita</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
<td>10.3</td>
</tr>
<tr>
<td>Mission</td>
<td>ASARCO</td>
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<tr>
<td>Silver Bell</td>
<td>ASARCO and Mitsui</td>
<td>3.0</td>
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<td>Pinto Valley</td>
<td>BHP</td>
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<tr>
<td>Miami</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
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<td>Mercator</td>
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<tr>
<td>Tohono</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
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</tbody>
</table>

In 2005, the price of copper had increased 29.5 percent over the previous year due to increased domestic and international demand, and was continuing to rise (Niemuth, 2006). In that environment, the companies listed in Table 1 were evaluating opportunities for expanding and rehabilitating their operations or otherwise increasing production to take advantage of this significant increase in copper price. As such, none of the sites listed in Table 1 were available for sale at the time that Augusta purchased the Rosemont Property. None of these sites therefore offered the possibility of being an available, practicable alternative within the scope of the Rosemont Project.

2.2.2. Offsite Alternatives

A number of other Arizona copper mining projects and potential projects were in various stages of exploration or development in 2005 (Table 2; Niemuth, 2006). The locations of these projects are shown in Figure 4, and the projects themselves are described further below. Much of the information regarding the status of these projects was derived from their respective filings with the U.S. Securities and Exchange Commission and the Canadian Securities Administrators (CSA), all of which are publicly available online. In addition to the formal filings, these companies issued news releases marking significant milestones, which were also reviewed as part of this alternatives analysis.
Table 2. Arizona Copper Projects, 2005 (Niemuth, 2006)

<table>
<thead>
<tr>
<th>Project</th>
<th>Ownership</th>
<th>Size and Confidence Level</th>
<th>Status Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safford (Dos Pobres/San Juan)</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
<td>538 million tons proven and probable mineral reserves</td>
<td>In production as of December 2007</td>
</tr>
<tr>
<td>Lone Star</td>
<td>Phelps Dodge (now Freeport-McMoRan)</td>
<td>1,600 million tons inferred mineral resources</td>
<td>Continuing exploration by Freeport-McMoRan</td>
</tr>
<tr>
<td>Johnson Camp</td>
<td>Nord</td>
<td>35 million tons proven and probable mineral reserves</td>
<td>Active leaching, no production</td>
</tr>
<tr>
<td>Carlota</td>
<td>Quadra (now KGHM International Ltd.)</td>
<td>105.7 million tons proven and probable mineral reserves 13 million tons inferred mineral resources</td>
<td>In production as of December 2008. Announced mine-for-closure in fall 2011 due to inefficiencies in leaching process.</td>
</tr>
<tr>
<td>Dragoon</td>
<td>BHP-Billiton</td>
<td>Unknown</td>
<td>BHP terminated agreement after exploration effort. Sporadic exploration in area by others.</td>
</tr>
<tr>
<td>Copper Creek</td>
<td>Redhawk Copper</td>
<td>Not reported in 2005. Currently estimated 27.4 million tons measured and indicated mineral resources; 158.4 million tons inferred mineral resources</td>
<td>Continuing exploration by Redhawk Copper</td>
</tr>
<tr>
<td>Resolution</td>
<td>Rio Tinto and BHP-Billiton</td>
<td>Not reported in 2005. Currently estimated 1.64 billion tons inferred mineral resources</td>
<td>Continuing exploration by Resolution Copper Mining</td>
</tr>
<tr>
<td>Oracle Ridge</td>
<td>Oracle Ridge Mining, LLC</td>
<td>8.14 million tons proven and probable mineral reserves 16.57 million tons inferred mineral resources</td>
<td>Inactive. Exploration drilling initiated to investigate potential for mine restart.</td>
</tr>
<tr>
<td>Bear Canyon</td>
<td>Arizona Copper Corporation</td>
<td>Unknown</td>
<td>Proposed exploration by Arizona Copper Corp.</td>
</tr>
</tbody>
</table>
2.2.2.1. **Safford (formerly Dos Pobres/San Juan)**

The Safford Mine, a combination of the previous Dos Pobres and San Juan projects, is an open pit copper mine located approximately 6 miles north of Safford, Arizona. The facility is owned by Freeport-McMoRan Copper & Gold and is a mine-for-leach project, producing copper cathodes. In 2005, the Safford Mine (then owned by Phelps Dodge Corporation, which has since been acquired by Freeport-McMoRan) was still in the process of acquiring state operating permits, including the state air permit. Phelps Dodge had expended considerable effort in permitting the Safford Mine, having initiated permitting in the early 1990s and finally achieving a Record of Decision and completed land exchange with the BLM in September 2005.

**Availability:** As described above, in 2005 Phelps Dodge Corporation had spent over 10 years and millions of dollars to complete permitting and a land exchange for the Safford Project, the ROD for which was only signed in September 2005. In addition, copper prices were rising well above historic norms in 2005, and large mining companies like Phelps Dodge were looking for opportunities to expand existing operations and projects, not sell them. As such, the Safford Project would not be considered available for purchase by Augusta in 2005.

**Cost:** Given the efforts of the current owner to develop the mine, this project is assumed to be practicable from a cost standpoint.

**Logistics and Technology:** Given the efforts of the current owner to develop the mine, this project is assumed to be practicable from a logistics and technology standpoint.

**Summary of Practicability:** The Safford Project was not available for purchase by Augusta in 2005 so it could not be considered a practicable alternative to the Rosemont Project.

2.2.2.2. **Lone Star**

The Lone Star deposit is a preliminarily large deposit (1.6 billion tons inferred mineral resources) located in the same mining district as the Safford Mine and is likewise owned by Freeport-McMoRan. The public lands that may be used for the development of this potential ore body were acquired as part of the same BLM land exchange that was completed for the Safford Mine. In 2005, feasibility level analysis had not yet been completed on the Lone Star deposit, and exploratory drilling was ongoing.

The Lone Star deposit was considered as an alternative to the Dos Pobres/San Juan (now Safford) project in that project’s Section 404 permitting effort. Because exploration and feasibility level analysis had not yet been completed at the Lone Star deposit at the time of the Dos Pobres/San Juan alternatives analysis (1997), development of the Lone Star deposit was determined to be logistically impracticable.
Availability: In conjunction with the Safford Mine, Phelps Dodge Corporation had spent over 10 years and millions of dollars to complete a land exchange for the Lone Star deposit, the ROD for which was only signed in September 2005. In addition, copper prices were rising well above historic norms in 2005, and large mining companies like Phelps Dodge were looking for opportunities to expand existing operations and projects, not sell them. As such, the Lone Star deposit was not available for purchase by Augusta in 2005.

Cost: Unknown. However, it is reasonable to conclude that the proximity of the Lone Star deposit to the existing Safford Mine and its associated infrastructure will allow Freeport-McMoRan to mine this deposit (once feasibility is completed) far more economically than would a separate entity such as Augusta.

Logistics and Technology: Unknown, although, again, it is anticipated that development of this mineral resource (once feasibility is completed) would be considerably more logistically feasible for Freeport-McMoRan than for a separate entity such as the Applicant.

Summary of Practicability: The Lone Star project was not available for purchase by Augusta in 2005 and so it could not be considered a practicable alternative to the Rosemont Project.

2.2.2.3. Johnson Camp

The Johnson Camp Mine is an existing open pit copper mine located approximately 65 miles east of Tucson, in Cochise County, Arizona, with an estimated 35 million tons of proven and probable reserves (or approximately five percent the size of the Rosemont ore body). The facility represents the principal holding of the Nord Resources Corporation (Nord) and was placed into care and maintenance in 2003 due to weak market conditions. Despite financial and legal troubles, Nord commissioned several feasibility studies between 2000 and 2005 for resuming operations at the Johnson Camp Mine. The results of these studies suggested that the initial capital costs for restarting operations were expected to exceed 30 million dollars, necessary for the rehabilitation of solution ponds, the construction of new leach pads, the purchase and installation of crushing and conveying equipment, and the installation of infrastructure required by these modifications. Nord was seeking financing during this period in order to initiate these efforts. As of 2005, Nord was the owner of the entirety of the Johnson Camp property and the owner or holder of all associated claims. Nord suspended mining new ore at Johnson Camp in July 2010 in an effort to restructure its debt, but continues to leach existing ore leach pads.

Availability: As stated above, the mine was the principal asset of the company and there was no indication that the mine was for sale in 2005.

Cost: Unknown. Preparation of feasibility studies suggests it is practicable though current financial difficulties suggest that cost may not be practicable.

Logistics and Technology: Unknown.

Summary of Practicability: Given that the Johnson Camp Mine was not available for purchase by Augusta in 2005, it could not be considered a practicable alternative to the Rosemont Project.
2.2.2.4. Carlota

The Carlota Copper project is an open pit copper mine located approximately 6 miles west of Miami, on the border of Gila and Pinal Counties, Arizona. Construction on the project had not yet commenced in 2005. Quadra Mining Ltd. (Quadra) purchased the property from Cambior Inc. (Cambior) in December 2005 for approximately 39.7 million dollars. Cambior had previously completed a feasibility study for the operation in October 2005 and obtained all the permits necessary for the mine’s operation when it opted to sell the operation to Quadra. At the time of the sale, two of the previously approved permits for the project (the state air permit and the Environmental Protection Agency National Pollutant Discharge Elimination System permit) were the subject of litigation that had the potential to affect the construction or operation of the Carlota project.

A significant portion of the Carlota ore body lies beneath Pinto Creek, a relatively large intermittent drainage on the Tonto National Forest. Development of the project entailed rerouting a portion of Pinto Creek around the open pit on an established pit bench. In January 2010 a significant rainfall event resulted in the Cactus Pit at the Carlota Mine being inundated with water, preventing any mining in that pit until the water could be removed in March 2010.

In the fall of 2011, Quadra announced that it would be ceasing mining operations at the Carlota Mine due to inefficiencies in the leaching process resulting from the presence of excess fines in the leach material. Carlota is now operating under a mine-for-closure plan and will be initiating reclamation in the relatively near future. In February 2012, Quadra entered into an agreement with KGHM, a Polish company, in which a subsidiary of KGHM would acquire all outstanding Quadra securities and Quadra would operate under the name KGHM International Ltd.

Availability: The Carlota Project was purchased by Quadra in 2005, though it was encumbered at that time by litigation related to two environmental permits.

Cost: Given the fact that the Carlota project is now in closure, it cannot be considered a practicable alternative to the Rosemont Project.

Logistics and Technology: As with costs, given the fact that the Carlota project is now in closure, it cannot be considered a practicable alternative to the Rosemont Project.

Summary of Practicability: In 2005, the Carlota Copper project was encumbered by litigation related to two environmental permits that had the potential to adversely affect the implementation of the project. In addition, the challenging project design (i.e. developing a mine pit below a significant intermittent mountain drainage) has proved difficult to manage in terms of stream hydrology. Due to inefficiencies in the leach system, Quadra (now KGHM International Ltd.) has announced that it is winding down the mine operation. Given the above, the Carlota Project does not provide a practicable alternative to the Rosemont Project.
2.2.2.5. Dragoon

The Dragoon property is a copper exploration prospect near Benson, in Cochise County, Arizona. General Minerals Corporation (GMC) announced the acquisition of the rights to the Dragoon copper prospect in November 2002. In that announcement, GMC characterized the property as an exploration “prospect” and a “drill target,” and indicated that a certain highly prospective portion of the property had “never been drilled.” In a subsequent announcement (dated April 10, 2003) relating to the completion of geophysical studies, GMC stated that earlier drilling on the Dragoon property “indicated the presence of weak sulphide mineralization” and that its goal was a “further refinement of the target.” About one year later, GMC issued a press release (dated March 5, 2004) relating to an update of its world-wide exploration activities in which it described itself as an “early stage exploration[ist]” with the ultimate goal of “identify[ing] properties with discovery potential.” Interestingly, although GMC provided significant information relating to certain of its properties, it only mentioned Dragoon in passing, indicating that the property is “attracting interest from potential joint venture partners.” Shortly thereafter (May 2004), GMC announced the completion of four technical reports, none of which related to Dragoon. Notwithstanding, GMC did strongly indicate at that time its strategy: “wealth creation through mineral exploration discovery and success.”

In April 2005, GMC announced that it had entered into an exploration earn-in with BHP Billiton (BHP) whereby BHP agreed to make certain exploration expenditures to earn up to a 70 percent joint venture interest in the property. In this announcement, GMC continued to characterize the Dragoon property as an exploration property with portions that had never been drilled. Subsequent to entering into the earn-in joint venture, BHP initiated a drilling program at Dragoon, consisting of three to five holes of between 1,200 and 2,500 m. Shortly thereafter, BHP withdrew from the joint venture, indicating that the Dragoon property drilling program identified only “weakly anomalous copper and molybdenum values,” which “provided insufficient incentive for [it] to continue with the project.” (See GMC press release dated April 21, 2006.)

Consistently over time, GMC characterized the Dragoon property as an exploration property. None of the press releases suggested that the weakly mineralized area at Dragoon was a proven or mineable reserve, or that the property was ready for development into a mine. Indeed, over a three-and-one-half-year period, GMC never once reported a quantified resource for Dragoon (such as the tons and grade of ore). As such, it can only be concluded that the information required to make a determination of whether the Dragoon property was a viable and/or practicable alternative to the Rosemont Project was simply not known.

Availability: Unknown
Cost: Unknown
Logistics and Technology: Unknown
Summary of Practicability: As described above, the Dragoon prospect was still in the early phases of exploration in 2005 and its owner, GMC, had not identified any potential mineral reserves or even mineral resources. As such, the practicability of this project in terms of cost, logistics, and technology could not be determined without extensive additional exploration and feasibility analysis. Subsequent exploration efforts have consistently failed to identify a viable Mineral Reserve or even Mineral Resource. The Dragoon Copper prospect therefore could not be considered a viable alternative to the Rosemont Project.

2.2.2.6. Copper Creek

The Copper Creek property is the proposed location of an underground copper mine approximately 75 miles northeast of Tucson, in Pinal County, Arizona. Redhawk Resources, Inc. (Redhawk) purchased the 7-mi² property in August 2005 for a total acquisition cost of approximately 1.8 million dollars. This purchase represented the culmination of two years of negotiations between Redhawk and the previous owner of the project. Although located at the intersection of known porphyry copper deposits, the Copper Creek property required significant further drilling to complete scoping and feasibility studies. As of March 2006, Redhawk was still in the process of exploring the Copper Creek mineral body and had not identified a Mineral Resource for the project.

Availability: Given Redhawk’s two-year of negotiations with the property owner, it is not reasonable to conclude that the Copper Creek property was available for purchase by Augusta in 2005.

Cost: Unknown

Logistics and Technology: Unknown

Summary of Practicability: Given that the Copper Creek property was not available for purchase by Augusta in 2005, it could not be considered a practicable alternative to the Rosemont Project. In addition, Redhawk was still in the exploration phase of the project in 2005, having not identified a Mineral Resource, so that the practicability (in terms of cost, logistics, and technology) of developing the Copper Creek deposit could not be determined. Copper Creek is therefore not a viable alternative to the Rosemont Project.

2.2.2.7. Resolution

The Resolution property is the current location of an ongoing program of exploration and pre-feasibility studies for a proposed deep underground copper mine near Superior, in Pinal County, Arizona. In 2002, Rio Tinto Ltd (Rio Tinto) earned a 55 percent share of the project after spending 25 million dollars on an exploratory program, leaving BHP with a 45 percent share. In 2005, the two companies reached an agreement to accelerate exploration in the following year. At that time, the joint venture was awaiting (and continues to wait for) the passage of a land exchange introduced in the U.S. House and Senate.
Availability: At the time of Augusta’s purchase of the Rosemont Property, both BHP and Rio Tinto were heavily invested in the development of the property and the outcome of the proposed federal legislation. It is unreasonable to conclude therefore that the Resolution property was available for sale at this time.

Cost: Unknown. Actions of the ownership group in pursuing land exchange and development suggest that the project is practical from a cost perspective, but the ongoing exploratory drilling program suggests that information regarding known resources is currently insufficient to support a feasibility study. In addition, the capital investment requirements represented a significant obstacle to Augusta’s participation in the Resolution project (see “Logistics and Technology” discussion below).

Logistics and Technology: The Resolution copper deposit is located nearly 1.5 miles below the ground surface and will require an enormous investment in infrastructure and technology to extract, making the Resolution project one of the most complex and challenging mining projects in North America. Only a very few mining companies in the world would have the capability to develop the project, and Resolution Copper Mining is comprised of two of the largest and most well capitalized of these firms (Rio Tinto and BHP). According to the Financial Times Global 500 Rank 2005, BHP was the largest mining company in the world in 2005, with a market capitalization of $81.1 billion (as of March 31, 2005) and total annual revenues of $22.9 billion (year-end June 30, 2004). The second largest mining company was Rio Tinto, with a market capitalization of $45.2 billion (as of March 31, 2005) and total annual revenues of $11.3 billion (year-end December 31, 2004).

By comparison, during the month of March 2005, Augusta Resource Corporation’s market capitalization ranged between $37 and $61 million. During the same period, Augusta Resource Corporation’s revenues were essentially nil, as it did not maintain any revenue-generating mineral operations.

Given the fact that the two largest mining companies in the world joined together to advance the Resolution Copper deposit because of the significant capital required and the technological challenges associated with developing such a large and deep resource, it is readily apparent that Augusta Resource Corporation, with such limited financial capitalization, could not have participated in the Resolution Copper project.

Summary of Practicability: Given that the Resolution project was not available for purchase by Augusta in 2005, it could not be considered a practicable alternative to the Rosemont Project. In addition, the Applicant was not in a financial position to address the significant technological and logistical challenges associated with advancing the Resolution Copper project. Finally, the Resolution Project was still an exploration project in 2005, and had not yet identified a Mineral Resource, let alone a Mineral Reserve. As such, it would not have been possible to determine the cost, logistics, or technological feasibility of the project at that time.
2.2.2.8. Monitor

The Monitor property is a copper exploration prospect near Hayden, in Pinal County, Arizona. GMC announced the acquisition of the rights to the Monitor copper prospect in January 2004. In that announcement, GMC indicated that it had “delineated an area of approximately 2 km$^2$ with characteristics suggestive of an underlying porphyry copper target.” A few months later, GMC issued a press release relating to an update of its world-wide exploration activities, in which it described itself as an “early stage exploration[ist]” with the ultimate goal of “identify[ing] properties with discovery potential.” Interestingly, although GMC provided significant information relating to certain of its properties, it only mentioned Monitor in passing, indicating that the property is “attracting interest from potential joint venture partners.” Shortly thereafter, GMC announced the completion of four technical reports, one of which related to Monitor. In that announcement, GMC strongly stated its strategy: “wealth creation through mineral exploration discovery and success.” GMC concluded in the Monitor technical report that additional surface work consisting of detailed mapping and rock chip and soil sampling should be conducted, which would aid in the refinement and prioritization of various drill targets. (See Report on Monitor property, Pinal County, Arizona, Randall L. Moore, May 19, 2004.) In a June 2004 press release, GMC provided an update to the exploration activity at Monitor, indicating that it continued to be encouraged by the results and reiterating that the property exhibited characteristics suggestive of an underlying porphyry copper occurrence.

In February 2005, GMC announced that it had entered into an exploration earn-in with Teck Cominco (Teck) whereby Teck agreed to make certain exploration expenditures to earn up to a 65 percent joint venture interest in the property. Subsequent to entering into the earn-in joint venture, Teck initiated a drilling program at Monitor, consisting of six holes of varying depths. GMC announced the results of the Teck drilling program in June 2006. Not long thereafter, Teck withdrew from the joint venture, indicating that the results of the drilling program were “inconclusive.”

In 2007, GMC spun off its North American mining unit into High Desert Gold Corporation (HDG). In 2007, HDG’s CSA filing indicated that Teck’s drill program “has shown the possibility for high-grade structurally controlled mineralization does not exist immediately below the old workings in the Monitor area,” but identified other potential exploration targets. There is no further mention of the Monitor property in HDG’s subsequent securities filings or currently on its website.

Consistently over time, GMC characterized the Monitor property as an exploration property. None of the press releases or technical reports suggested that the mineralized area at Monitor was a proven or mineable reserve, or that the property was ready for development into a mine. Indeed, over a nearly three-year period, GMC never once reported a quantified resource for Monitor (such as the tons and grade of ore). As such, it can only be concluded that the information required to make a determination of whether the Monitor property was a viable and/or practicable alternative to the Rosemont Project was simply not known.

Availability: There is no indication that the Monitor property was available for sale in 2005.
Cost: Unknown
Logistics and Technology:

Summary of Practicability: As described above, the Monitor prospect was still in the exploration phase in 2005 when Augusta purchased the Rosemont Property, and any potential Mineral Reserves, or even an estimated Mineral Resource, at Monitor were unknown. As such, the practicability of this project in terms of cost, logistics, and technology could not be determined without extensive additional exploration and feasibility analysis. As indicated above, the results of the exploration program subsequent to 2005 appeared to be mixed with regard to the potential for economically extractable ore, and it does not appear to have been pursued despite the continuing high price of copper. The Monitor prospect therefore could not be considered a viable alternative to the Rosemont Project.

2.2.2.9. Markham Wash

The Markham Wash property is a copper exploration prospect near Safford, Graham County, Arizona. In December 2004, GMC announced the acquisition of certain additional rights to the Markham Wash copper prospect. In that announcement, GMC indicated that it had “detected three high-priority anomalies” within an area of approximately 4 km² that it “interpreted as representing sulphide mineralization related to a porphyry copper system,” which prior drilling did not appear to have tested. GMC also stated that its “observations and conclusions further support the target being...an undiscovered] buried porphyry copper system.”

In March 2006, GMC announced that it had entered into an exploration earn-in with Teck whereby Teck agreed to make certain exploration expenditures to earn up to a 65 percent joint venture interest in the property. About one year later, GMC announced that it intended to spin off its North American assets to a new gold-copper-focused publicly traded company (HDG). The preliminary prospectus for HDG characterized the Markham Wash property as an early stage exploration prospect, classifying it as non-material “[o]ther [p]roperties” owned by HDG in the United States. Subsequent to the spinoff and entering into the earn-in joint venture, Teck initiated a drilling program at Markham Wash, consisting of two holes at approximately 600 m depth each. Not long thereafter, Teck withdrew from the joint venture. In June 2008, HDG dropped its interest in the property.

Consistently over time, GMC and HDG characterized the Markham Wash property as an exploration prospect. None of the press releases or the preliminary prospectus suggested that the mineralized area at Markham Wash was a proven or mineable reserve, or that the property was ready for development into a mine. Indeed, over a nearly three-and-one-half-year period, GMC and HDG never once reported a quantified resource for Markham Wash (such as the tons and grade of ore).

Availability: There is no indication that the Markham Wash property was available for sale in 2005.

Cost: Unknown
Logistics and Technology:

Summary of Practicability:
As described above, the Markham Wash prospect was in the early phase of exploration in 2005, and any potential Mineral Reserves, or even an estimated Mineral Resource, were unknown. As such, the practicability of developing this deposit in terms of cost, logistics, and technology could not be determined without extensive additional exploration and feasibility analysis. Subsequent exploration efforts have consistently failed to identify an estimated Mineral Resource or viable Mineral Reserve. The Markham Wash prospect therefore could not be considered a viable alternative to the Rosemont Project.

2.2.2.10. Oracle Ridge

The Oracle Ridge Copper Mine is a historic underground copper mine near Tucson, in Pima County, Arizona. The mine, which began operating in 1991, eventually closed in 1996 after operating difficulties and poor copper prices. Although some feasibility studies were completed in 1994, estimates of 18 million tons of proven copper reserves at the mine still have not been validated.

Pima County records show that in May 2004 the owners of the Oracle Ridge Copper Mine—Oracle Ridge Mining Partners—conveyed a group of patented mining claims consisting of approximately 927 acres to Marble Mountain Ventures LLC (MMV), an entity presumed to be engaged in a non-mining-related real estate investment and development business.

On the same day that MMV acquired the group of patented mining claims, it recorded a Declaration of Covenants, Conditions & Restrictions (CCRs) significantly restricting the use of the patented mining claims by all subsequent owners. Among other things, the CCRs indicated that although the CCRs did not apply to MMV, MMV “shall not engage in any mass industrial mining.” Further, the CCRs indicated that none of the owners of the patented mining claim group subject to the CCRs may engage in mass industrial mining, which was defined as a mining operation of the scope and magnitude that was performed on the property over the last 50 years.

Immediately after recording the CCRs, MMV conveyed an approximately 334-acre portion of the mining claim group to LW Holdings, L.L.C. (LWH), and an approximately 167-acre portion of the mining claim group to Old Pueblo Associates, LLC (OPA). The mineral interest was reserved to MMV in both these conveyances. In August 2004, the 167-acre portion of the mining claim group was conveyed by OPA to Stratton Springs Canyon, LLC, which subsequently conveyed the same to Regal Manor Condominiums, L.L.C. (RMC), in February 2007.

In March 2005, MMV conveyed an approximately 160-acre portion of the mining claim group to Summerland Ventures LLC (Summerland). The mineral interest was reserved to MMV in this conveyance.
Five years later, after the 2008 crash of the housing market, MMV, LWH, RMC, and Summerland, the collective owners of the 927-acre group of the Oracle Ridge Copper Mine patented mining claims, recorded a termination of the declaration of the CCRs on February 19, 2010, which extinguished, terminated, and forever released the restrictions associated with the CCRs. On the same day, MMV recorded a memorandum of agreement indicating that it had entered into an agreement to convey certain mineral rights associated with the patented mining claim group to Oracle Ridge Mining, LLC (ORM). Immediately thereafter, ORM recorded a memorandum of lease indicating that it had entered into an industrial lease agreement with MMV regarding certain surface rights associated with a portion of the patented mining claim group owned by MMV.

In a series of press releases issued between the months of August and September 2010, Gold Hawk Resources, Inc. (GHR), announced the acquisition of ORM, along with all the subsurface mining rights and the surface mining rights needed to explore, rebuild, and operate the Oracle Ridge Copper Mine. GHR has proposed an exploratory and mapping program to verify resource estimates should the sale be approved.

The chronology above indicates that a real estate investor purchased the Oracle Ridge Mining property, apparently for non-mining real estate investment or development purposes in May 2004, and by the declaration of the CCRs, immediately placed restrictions on future owners of the property from conducting any mining-related activities on the property. With the CCRs in place, the original investor presumably was able to sell off portions of the group of patented mining claims to other real estate investors. It was not until February 2010, after the housing market crash of 2008, that the original investor, along with all the subsequent owners/investors of the group of patented mining claims, terminated the CCRs, thereby providing the potential opportunity for mining to once again resume on the property. Given the fact that the property was severely restricted by the CCRs between May 2004 and February 2010, the Oracle Ridge Copper Mine property was not available for sale as a viable mining property during that period of time.

**Availability:** As indicated above, in 2005 the Oracle Ridge property was severely restricted by CCRs that prevented any mineral exploration or exploitation. Therefore, the Oracle Ridge deposit was not available for purchase as a mine property in 2005.

**Cost:** Unknown

**Logistics and Technology:** Unknown

**Summary of Practicability:** As indicated above, the current purchaser of this project is proposing an exploratory evaluation to confirm the reserve estimates that were calculated back in the 1990s. As such, it is difficult to ascertain what the practicability of the project would be. However, as stated above, the project was not available for purchase as a mine project in 2005 and therefore does not present a viable alternative to the Rosemont Project.
2.2.2.11. Bear Canyon

Bear Canyon is a recently recognized porphyry target within the historic Bisbee copper-producing region, approximately 28.8 miles west of Bisbee’s Copper Queen Mine in Cochise County. Although mineralization within the Bear Canyon area has been known since the 1880s, with minor wartime production during World Wars I and II (primarily tungsten and antimony with limited gold and silver), the porphyry deposit was not identified until 2007. Arizona Copper Corporation, the owner of the Bear Canyon project, is in the process of acquiring permits to initiate an exploratory drilling program at the project.

**Availability:** At the time Augusta purchased the Rosemont Property in 2005, the Bear Canyon project was an unknown and unquantified resource and, in fact, had not yet been discovered as a potential copper resource. The Bear Canyon project was therefore not available to Augusta as an alternative to the Rosemont Project.

**Cost:** Unknown

**Logistics and Technology:** Unknown

**Summary of Practicability:** As described above, because the Bear Canyon project was not identified until 2007, it was not available to Rosemont in 2005 and it is therefore not a practicable alternative to the Rosemont Project.

2.2.3. Offsite Alternatives Summary

The Applicant has completed an evaluation of a significant number of offsite alternatives over an expansive geographic area (more than 33,000 mi²). None of these alternatives represents a practicable alternative to the Rosemont Project due to the alternative 1) not being available or 2) being solely in an exploration phase and therefore without an identified Mineral Resource or Mineral Reserve in 2005. As such, there are no viable offsite alternatives to the Rosemont Project in southeastern Arizona (Pima, Pinal, Gila, Graham, Greenlee, Cochise, and Santa Cruz counties).

2.3. ROSEMONT-OWNED ALTERNATIVE MINERAL DEPOSITS

Recent and historical exploration has identified three mineral deposits in the vicinity of the Rosemont ore body, within the contiguous Rosemont patented claims. These areas are referred to, from east to west, as Broad Top Butte, Copper World, and Peach-Elgin ([Figure 5](#)). Details related to the history of these deposits and their exploration are provided in **Appendix A**.

During the earlier exploration period of the Rosemont area from the 1950s to the 1970s, extensive exploration of the Rosemont Property started on a regional basis and then progressed to a number of more specific deposits, including the Rosemont, Broad Top Butte, Copper World, and Peach-Elgin deposits. By about the middle 1970s, the cumulative results of the mineral evaluations from across the Rosemont Property had already identified the Rosemont deposit as the site with the best potential for being developed into an economic mine, and hence Rosemont became the focus of subsequent exploration...
efforts. The primary attributes of the Rosemont deposit that made it attractive were its significant size (estimated now at over 600 million tons of ore), favorable metal grades, and low stripping ratio, all of which contribute to the economic viability of deposit development.

Because of the focus on the Rosemont deposit in the early exploration phases, considerably more exploration drilling had been completed at the Rosemont deposit than at the other three nearby deposits at the time Augusta purchased the Rosemont Property in 2005 (over 200,000 ft of core for Rosemont and just over 30,000 ft for the other three deposits combined). In 1977, then owner Anamax commissioned an estimate of the Rosemont deposit that identified a geological resource of about 445 million tons of ore. Building on this information, ASARCO, in 1997, commissioned a preliminary feasibility analysis that identified a “mineable resource” at the Rosemont deposit of nearly 341 million tons at an average grade of 0.64 percent copper. Although neither of these estimates met the current (2005) definition of “Mineral Resource” or “Mineral Reserve,” Augusta staff had personal knowledge of the modern (1997) Rosemont evaluations by ASARCO, and understood that the extensive core data and analysis that had already been completed on the Rosemont deposit would allow Augusta to readily develop a modern Mineral Resource estimate for the deposit with minor additional drilling and engineering analysis. Proven and probable Mineral Reserves for the Rosemont deposit were estimated following the completion of a preliminary feasibility study in 2007, and the Reserve estimates were revised following additional feasibility analyses in 2009 and 2012.

By comparison, the minimal evaluation completed to date of the Broad Top Butte, Copper World, and Peach-Elgin deposits has provided, at best, only a preliminary estimate of the inferred mineral resource at these areas. It must be noted that at the time that Augusta purchased the Rosemont Property in 2005, a number of Augusta personnel, who cumulatively had worked in the copper mining industry for decades, had personal knowledge of the potential of the Rosemont deposit and knew that, although a formal Mineral Resource, per the then just established Canadian standard, had not yet been estimated, the effort to develop a Mineral Resource estimate using the hundreds of thousands of feet of drill core would be minimal. The fact of this substantial additional drill core data, coupled with the modern (1997) “mineable resource” estimated by ASARCO, clearly and distinctly distinguishes the Rosemont deposit from the other three nearby mineral deposits (Broad Top Butte, Peach-Elgin and Copper World).

Details related to these deposits are provided in the following sections, with additional detail provided in Appendix A.

2.3.1. Broad Top Butte

At the Broad Top Butte deposit, Anamax carried out an estimate in 1979 that found a preliminary estimated mineral resource of 8.8 million tons at an average grade of 0.77 percent copper and 0.037 percent molybdenum. This estimate must be considered to be historical in nature, is based on limited drilling results, and is not necessarily consistent with current industry practices and securities reporting requirements. The Applicant estimates it will take at least five years and 12 million dollars to conduct the necessary drilling and engineering to advance the property to a possible economic feasibility stage, although, as is the nature with any early stage exploration mineral project, there are no guarantees
that such a project will eventually be shown to be economic by a feasibility study. Given the lack of information for this deposit, it could not yet be considered a viable Mineral Resource under current definitions, and could therefore not be considered available.

**Size:**
Current estimates show 8.8 million tons of preliminary mineral resource.

**Availability:**
Available in the sense that Rosemont owns the deposit.

**Cost:**
Unknown. However, as indicated above, the cost just to complete exploration and feasibility analysis for this deposit is estimated at approximately 12 million dollars.

**Logistics and Technology:**
Largely unknown, although considerations of logistics and technology would presumably be similar to those for the Rosemont deposit.

**Summary of Practicability:**
Given the lack of information about this deposit, the feasibility of its extraction cannot be determined until a full exploration campaign and feasibility analysis are completed. Because of the considerable additional time and expense required to complete such an exercise, Broad Top Butte could not be considered to be available, and would therefore not be considered a practicable alternative.

### 2.3.2. Copper World

The Copper World deposit contains mineralization that was mined by a historical small-scale, high-grade mine. Little is known of the remaining mineralization, other than variable results from a few widely scattered drill holes. There is not enough information for the Applicant or predecessor companies to have estimated a mineral resource. It is most likely that a small deposit of low-grade mineralization may remain at Copper World that is only a fraction of what the mineable mineral reserve is for the Rosemont deposit.

Like the Broad Top Butte deposit, the considerable lack of information related to the Copper World deposit makes it impossible to categorize this deposit as a viable Mineral Resource under the current definition. Based on the very limited information that is available, it seems likely that whatever mineral resource remains at the Copper World deposit would be far smaller than the Rosemont deposit. As with the Broad Top Butte deposit, if the Copper World deposit were to be developed, it could only be as part of the development of the larger Rosemont deposit.

**Size:**
Unknown, although likely substantially smaller than the Rosemont deposit.

**Availability:**
Available in the sense that the Applicant owns the deposit.

**Cost:**
Unknown.

**Logistics and Technology:**
Largely unknown, although the location of the deposit on the west side of the Santa Rita Mountain ridgeline would significantly affect logistical considerations when compared to the Rosemont Project.
Summary of Practicability: Given the lack of information about this deposit, the feasibility of its extraction cannot be determined until a full exploration campaign and feasibility analysis are completed. Because of the considerable additional time and expense required to complete such an exercise, Copper World could not be considered to be available, and would therefore not be considered a practicable alternative.

2.3.3. Peach-Elgin

At the Peach-Elgin deposit, Anaconda carried out an estimate in 1964 that found a preliminary mineral resource of 13.7 million tons of sulfide mineralization at an average grade of 0.78 percent copper and 0.037 percent molybdenum, along with 9.7 million tons of oxide mineralization averaging 0.72 percent copper. In producing this estimate, Anaconda drilled a number of additional holes in the 1960s, the records for which were permanently lost before the Applicant obtained the property and property information. As with the 1979 Broad Top Butte estimate, this mineral resource estimate should be considered historical in nature and not necessarily consistent with current industry practices and securities reporting requirements. Given the lack of information for this deposit, it could not yet be considered a viable Mineral Resource under current definitions, and could therefore not be considered available.

This deposit is likewise very small, comprising only 4.3 percent of the mineable reserves identified at the Rosemont deposit. As with the other two nearby mineral deposits, the Peach-Elgin deposit has potential as a satellite area of production, but not as a viable alternative to the Rosemont deposit.

Size: Current estimates show 23.4 million tons of preliminary mineral resource.
Availability: Available in the sense that the Applicant owns the deposit.
Cost: Unknown
Logistics and Technology: Largely unknown, although the location of the deposit on the west side of the Santa Rita Mountain ridgeline would significantly affect logistical considerations when compared to the Rosemont Project.

Summary of Practicability: Given the lack of information about this deposit, practicability in terms of cost, logistics, and technology cannot be determined until a full exploration campaign and feasibility analysis are completed. Because of the considerable additional time and expense required to complete such an exercise, Peach-Elgin could not be considered to be available, and would therefore not be considered a practicable alternative.

2.3.4. Rosemont-Owned Alternatives Summary

The Applicant has evaluated the potential to develop three deposits within the Rosemont Holdings boundary. None of these deposits represents a practicable alternative to the Rosemont Project because a Mineral Reserve was not identified for any of these deposits in 2005, and a Mineral Resource could not be reasonably determined based on the paucity of information related to the deposits.
2.4. **ONSITE ALTERNATIVES**

The formulation of onsite alternatives has been based on information provided by the CNF and the Applicant, and is consistent with typical mine planning approaches. In proposing a mill and concentrate operation for sulfide ore with an open pit copper mine, the Applicant has already determined that an underground mine or *in situ* leach operation is not practicable and that the mineralogical characteristics of the leachable ore deposits make other extraction and processing techniques inappropriate. Alternative mining techniques that were considered but dismissed from further evaluation are addressed in the EIS completed for the Project.

The formulation of alternative mine development scenarios for an open pit copper mine is tied to the pit location, as the location of the deposit and considerations related to the appropriate pit location, depth, and configuration are dependent on the location and arrangement of the ore deposit. For the proposed Project, a floating cone evaluation of the Rosemont deposit resulted in the pit configuration proposed by the Applicant in the 2007 MPO (WestLand, 2007). The floating cone evaluation of potentially economic pit limits is based on a variety of criteria, including the nature and extent of the ore body that can be economically developed, as influenced by projected future copper prices, projected capital and operating expenses, financial risk factors, and pit stability considerations which set the appropriate setbacks, pit wall slopes, and benching necessary to achieve stable slopes and appropriate safety standards. The pit design was refined in 2009 based on a feasibility analysis. The proposed pit configuration for all alternatives considered in the EIS and this alternatives analysis is that with a pit bottom elevation of 3,050 ft amsl.

Onsite alternatives reflect a variety of configurations, which come primarily from the development and location of heap leach pads, dry stack tailings, waste rock storage, plant site facilities, and onsite and offsite ancillary facilities. Once the pit size and volumes of waste rock, dry stack tailings, and leachable or concentratable ore were defined, the configuration of suitable storage locations for waste rock and dry stack tailings and the acceptable locations for leach stockpiles and processing facilities could be identified. The placement of waste rock, dry stack tailings, heap leach pads, and processing facilities relative to the pit and to each other is not completely independent. There are various technical constraints relative to the interrelated aspects of these components that affect the location and configuration of each with respect to the others in each alternative. In addition to the configuration alternatives, there is one alternative relative to the sequencing of the dry stack tailings.

The development of leachable and concentratable reserves within the Rosemont deposit will result in a relatively fixed volume of material that must be accommodated in the various locations proposed for alternatives, in a manner that is practicable while achieving the Project’s overall purpose and need.

The area considered suitable for the evaluation of onsite alternatives is bounded by specific topographic and geographic features. In general, the analysis area is bounded on the west by the ridgeline of the Santa Rita Mountains and on the east by SR 83. The southern boundary of the analysis area was established by the watershed boundary of Cienega Creek, a sensitive riparian resource east of the Project site. Where no topographic or geographic feature constrains the mine plan area, cost considerations for haulage distance...
also limit the consideration of appropriate alternatives. The relationship between haulage distance and cost creates economic and sometimes logistical constraints that affect the practicability of alternatives.

2.4.1. Onsite Alternatives Development

2.4.1.1. Onsite Alternatives Considered but Dismissed

An expansive suite of alternatives was considered and dismissed as part of the draft EIS development process. Some examples include the mechanical conveyance of ore to a rail head, in situ mining in lieu of an open pit, and use of desalinated sea water for mining and ore processing. These alternatives and the rationale for their dismissal are discussed in detail in the EIS or in the EIS supporting documentation.

In addition to the EIS alternative development process, the Applicant evaluated a number of other onsite alternatives that were quickly dismissed due to obvious and significant adverse environmental effects.

- **Expand Pit West Through Ridge:** The Rosemont ore body includes economically recoverable reserves that would require expansion of the pit west through the Santa Rita Mountain ridgeline, including Weigles Butte. However, this larger pit would significantly impact the view of the Santa Rita Mountains from the heavily populated Sahuarita and Green Valley areas. This alternative would have also resulted in a significant increase in waste rock and tailings to be disposed of. Given these factors, the Applicant elected to limit the size of the pit to the current configuration.

- **Conventional Tailings Design:** The Applicant completed a tailings siting study in 2006 (Vector 2006) to identify potential locations for the development of a tailings facility. The study focused on conventional (slurry) tailings, but also evaluated the potential benefits of the use of dry stack tailings. The study concluded that conventional tailings facilities would result in a larger footprint than a comparably located dry stack tailings facility, predominantly because development of a conventional tailings facility requires the construction of a significant downgradient dam to contain the slurried tailings material. The sizes of the conventional tailings facilities evaluated in the siting study ranged from approximately 1,300 to 2,700 acres. Under the current alternative designs, the total area of dry stack tailings material and surrounding buttress ranges from approximately 870 to just over 1,200 acres. Although an analysis of the impacts to potential waters of the U.S. resulting from these larger tailings facilities has not been completed, it is assumed that the increase in impacts would have been commensurate with the increase in size of the facilities.

The size of the conventional tailings facilities was such that the total volume of an appropriately sized tailings facility and the waste rock material from the operations could not be restricted to a single drainage basin (i.e., Barrel Canyon). Use of a conventional tailings facility therefore would have required development in another drainage basin, such as Sycamore Canyon or east of SR 83 in upper Davidson Canyon, with waste rock being deposited in Barrel Canyon, significantly increasing the geographic scope of the Rosemont Project. The conventional tailings dam had other significant environmental drawbacks as well:

- Requires considerably more water usage than dry stack tailings
- Increased risk of seepage to groundwater
− Increased risk of windblown tailings
− No opportunity for concurrent reclamation

Given the larger footprint and significant environmental disadvantages of a conventional tailings design, the Applicant did not pursue this alternative further.

- **Pit Backfill**: Rosemont evaluated in depth the potential to backfill, or partially backfill, the pit with waste rock material. Implementation of a pit backfill alternative would result in significant additional environmental effects and safety considerations when compared with other alternatives. A thorough discussion of the legal implications of a pit backfill alternative, as well as technical and cost challenges associated with three pit backfill alternatives are provided in a separate memorandum and letter, respectively, provided in Appendix B of this document but are summarized below.

Implementation of a pit backfill alternative would effectively result in extending the mining operations for 3 to 22 years, depending on the extent of backfilling. The waste rock material to be backfilled into the pit would have to be re-mined, hauled, and deposited back in the pit. Environmental effects (continuing and otherwise) resulting from this alternative include:

− Removal of the hydraulic sink within the pit, thereby removing the passive containment system contemplated in the Arizona Department of Environmental Quality (ADEQ) Aquifer Protection Permit;
− Forestalling of reclamation until backfill activities are complete (i.e. there will not be able to be any concurrent reclamation of the majority of the impacted area, though the tailings facility may be able to be reclaimed concurrently with operations.);
− Continued dewatering of downstream reaches of Barrel and Davidson canyons until reclamation can be accomplished and final post-mining stormwater controls can be put in place;
− Continued impacts to air quality resulting from dust generation and truck emissions;
− Continued use of diesel fuel for haul trucks;
− Continued use of water for dust suppression;
− Continued impacts to visual resources as reclamation cannot be accomplished until backfill activity is complete.

The backfilling activity would also result in heightened safety concerns, as haul trucks are not designed to carry full loads downhill.

Potential waters of the U.S. and riparian habitat impacted under this alternative would be lost even if surface flow paths could be re-established within the former footprint of the waste rock and tailings facilities. Downgradient impacts to potential waters of the U.S. and riparian habitat would continue
for another 3 to 22 years beyond mine life, until stormwater flows could be restored following the pit backfill effort.

Given the above, backfill of the pit does not represent a reasonable alternative for the Rosemont Project.

2.4.1.2. Selected Onsite Alternatives

Various configurations of the largest Project structural elements (i.e., heap leach pads, dry stack tailings, and waste rock storage) have been considered. In addition, one alternative is considered that changes the configuration of the pit. Six alternatives affecting the configuration of the mine plan elements and other items are contemplated in this document. The onsite alternatives will be detailed and analyzed in Chapter 3, and are identified as follows:

- Alternative 1: Mine Plan of Operations
- Alternative 2: Phased Tailings
- Alternative 3: Barrel (Proposed Action)
- Alternative 4: Barrel Trail
- Alternative 5: Scholefield-McCleary
- Alternative 6: Modified Pit Configuration

2.4.2. Elements Common to All Onsite Alternatives

Certain elements of the Project planning have not been individually evaluated in the discussion of the alternatives provided below. These items are common to all the alternatives and are listed here to provide an overall understanding of the Project and the context of the alternatives considered, and to reduce the need to describe the common elements within the description of each alternative. These items are described below.

Production Rates, Processing Facility Output, and Types of Equipment: Production rates, processing facility output, and types of equipment used will be the same for all the onsite alternatives. The information provided here is derived from the 2012 feasibility study. The most recent feasibility study for the Rosemont Project provides a mineral reserve calculation of 667 million tons of ore, and the Project is expected to produce approximately 243 million pounds of copper per year for approximately 21 years for each alternative. The average annual production of molybdenum and silver is projected to be 5.4 million pounds and 2.9 million ounces, respectively. There is one exception to the expected production: an alternative that considers a smaller pit (Alternative 6), which will reduce the total availability of ore for production. The major mining equipment on site will include drills, loading units, trucks, and support units. The types of equipment will be similar within each alternative, although there may be different quantities of equipment required for the various alternatives and throughout the life of each alternative.
Mineral Processing Operations and Techniques: Mineral processing operations and techniques will generally be the same for each of the alternatives. It should be noted that Rosemont's Proposed Action (Barrel Alternative) does not include the construction of a heap leach and associated SX/EW processing operations. An analysis of the removal of the heap leach and associated facilities from the other alternatives is provided in Section 3.1.7, below.

Mining of the ore will be through conventional open-pit mining techniques. Mining operations will be carried out in the open pit with benches that are 50 ft in height. The pit will be constructed to meet the standards required for stability as identified by the Applicant’s geotechnical engineering analysis and will conform to Mine Safety and Health Administration standards.

Waste rock will be blasted and transported by haul truck to the waste rock storage areas. Ore will be blasted and either transported by haul truck to the leach pad or crushed and loaded onto a conveyor for transport to the mill, depending on the type of ore. Ore will be processed either by conventional sulfide milling or by oxide leaching. The copper concentrates from the milling operations (sulfide material) will be shipped offsite to a smelter. Leach ore (oxide material) will be placed on the leach pad. The heap leach facility will be large enough to contain all the oxide material processed on a lined leach pad. Drainage around the facility will be provided by the stormwater management facilities. Sufficient pond sizing will be available for emergency overflow containment of the 100-year, 24-hour storm event, with pumping capacity to manage additional flows. Solutions from the pad will be collected in a solution pond and then processed through the SX/EW plant. Copper cathodes generated from the SX/EW plant will be transported offsite for further processing.

Waste rock buttresses will be constructed for the dry stack tailings facilities. The tailings will be filtered prior to disposal and delivered by conveyor from the filter plant to the tailings disposal location to be placed with a radial stacker against the starter buttresses.

General Plant Site Location: The location of the plant site with respect to the pit is similar for all the onsite alternatives. The arrangement of facilities within the plant site has been optimized for all but the Mine Plan of Operations Alternative (Alternative 1).

Reclamation and Closure: The overall slopes will be left at 3:1, which will provide appropriate slopes for reclamation. Topsoil will be removed, stored, and then replaced on portions of the waste rock storage and dry stack tailings facilities as well as the perimeter buttresses. Plants utilized in the reclamation effort will include native grasses, shrubs, forbs, and trees, as well as transplanted and propagated agave plants. Under Alternatives 1, 2, and 3, reclamation of the outer waste rock buttress will be completed concurrently with operations, starting in Year 1. Under Alternatives 4 and 5, concurrent reclamation, to the extent that it could occur, would not occur until a much later date in the operations due to constraints of slope and logistics, respectively. Additional detail is provided in the sections below.

Primary and Secondary Access and Utility Alignments: Primary access to the Project site will be from SR 83 for all the onsite alternatives. The actual location for the turnout and the alignment of the roadway vary slightly between the alternatives due to changes in the configuration of the waste rock and tailings,
but the primary access is from the east in all alternatives. Secondary access and utility alignments will be from the west for all the onsite alternatives. The water supply system and electrical power alignments will generally follow the secondary access road alignment.
3. ALTERNATIVES DESCRIPTION, PRACTICABILITY DETERMINATION, AND ENVIRONMENTAL ANALYSIS

Each of the onsite alternatives considered is briefly described below. Following each description is a discussion of each alternative’s practicability. Table 3 summarizes a number of key differences between each of the alternatives. Minor changes in impacts from previous versions of this document relate to refinement of the alternative designs and associated security fencing, and broader assumptions about impacts related to the primary access road.

Avoidance and minimization have been achieved for the onsite alternatives in a number of ways. As described above, a guiding principal in the development of alternatives was to limit the project to a single drainage (Barrel Canyon) to minimize the impact to potential waters of the U.S. The dry stack tailings technology and modern plant design have allowed for a relatively smaller footprint for the alternatives considered. Previous project concepts contemplated by ASARCO when they owned the Project area in the 1990’s included the use of conventional (slurry) tailings and impacted an area considerably larger than any of the alternatives developed for the EIS or this alternatives analysis (see discussion of conventional tailings design in Section 2.4.1.1 above). Minimization of impacts to potential waters of the U.S. is achieved through best management practices as outlined in ADEQ's Arizona Pollutant Discharge Elimination System (AZPDES) Multi-Sector General Permit (MSGP) for stormwater discharges and the best available demonstrated control technologies (BADCT) design of the facilities ADEQ Aquifer Protection Permit (APP). As noted in Subpart H of the Section 404(b)(1) guidelines (40 CFR §230.72), minimization of adverse effects can be achieved by “selecting discharge methods and disposal sites where the potential for erosion, slumping or leaching of materials into the surrounding aquatic ecosystem will be reduced.” The BMP and BADCT prescriptions of the AZPDES and APP programs, respectively, are designed to achieve these goals. These include use of sediment basins, lined containment ponds, capping of tailings material post-closure, and minimizing point and non-point pollutant discharges. Additional minimization efforts include stormwater control designs that route as much unimpacted water as feasible into downstream flow systems.

The discussion of onsite alternatives includes an estimate of impacts as follows:

- **Direct and indirect impacts to potentially jurisdictional waters**: The estimate of direct impacts to potential waters of the U.S. includes that area of potential waters within each alternative that will be directly filled by waste rock, native fill, etc. Indirect impacts to potential waters of the U.S. were determined by calculating the area of potential waters from the toe of the waste rock and/or tailings pile downstream to the confluence with the nearest large drainage. Additional indirect downstream impacts to potential waters of the U.S. were determined based on the modeled reduction in average annual flow volume within Barrel and Davidson canyons. The modeled flow reductions are described in the EIS completed by the CNF.

- **Direct and indirect impacts to riparian habitat**: In this analysis, riparian habitat mapping is provided by Pima County at the online Pima County MapGuide. Direct impacts include those...
areas of mapped riparian habitat that occur within the security fence for each alternative. Impact results for riparian habitat are described fully in the EIS for the Project.

It should be noted that impacts to downstream riparian habitat are dependent on the reduction in surface water flow and the type of habitat within each stream reach. Impacts to downstream riparian habitat will qualitatively be similar under all alternatives (see discussion below), though likely greater under alternatives with greater reduction in stormwater flows. Within Barrel Canyon, downstream of the operations, effects on the xeroriparian habitat could vary from reduced vegetation volume to mortality of individuals, though a complete loss of xeroriparian habitat is unlikely.

Within Davidson Canyon, from the confluence with Barrel Canyon to Davidson Spring, riparian habitat is largely xeroriparian, with pockets of mesoriparian habitat. Effects on the pockets of mesoriparian habitat may include reduced recruitment, increased mortality rates, decreased canopy height and vegetation volume, and potentially a transition to deeper-rooted species (e.g. tamarisk). Impacts to xeroriparian within this reach of Davidson Canyon would be expected to be similar to, though less than, those described for Barrel Canyon. That is, impacts could range from reduced vegetation volume to mortality of individuals, but a complete loss of xeroriparian habitat is unlikely.

- **Number of springs supporting riparian vegetation that are directly impacted or highly likely to be indirectly impacted**

- **Number of springs supporting riparian vegetation that will possibly be indirectly impacted**

### 3.1. Onsite Configuration Alternatives

#### 3.1.1. Alternative 1 – Mine Plan of Operations

Alternative 1 is the configuration presented in the July 2007 MPO (WestLand, 2007). The facilities for this alternative incorporate McCleary, Barrel, and Wasp Canyons (*Figure 6*). For this alternative, waste rock will be placed in the Barrel Canyon drainage. The dry stack tailings will be stored in two separate phases, the North (McCleary Canyon) and the South (Barrel Canyon) Dry Stacks. Tailings will be dewatered at the plant site facilities and then conveyed overland to the tailings facilities. Dry stack tailings will be placed in the North Dry Stack area (McCleary Canyon) first, for a period of approximately 14 years. During Year 12, preparation work will begin in the South Dry Stack area to prepare the facility for tailings placement. Tailings will be placed in the South Dry Stack facility (Barrel Canyon) by Year 14. The heap leach facility will be located in the Barrel Canyon drainage.

The perimeter berms will be located in the Barrel Canyon drainage, while the buttresses will be located in both Barrel and McCleary canyons. A large underdrain feature, called the “central drain,” will be located along the major McCleary Canyon drainage between the two tailings phases. The primary offsite roadway alignment presented in the original MPO is shown in *Figure 6*. The primary access will follow a roadway alignment that crosses both Scholefield and McCleary Canyons and the confluence of Barrel Canyon near the...
the intersection with SR 83 at approximately milepost 46.9. A variety of elements related to the construction and impacts of this configuration are presented in Table 3, below.

**Environmental Effects:** Implementation of Alternative 1 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 42.5 acres
- Indirect impacts to potential waters of the U.S.: 36.9 acres
- Direct impacts to riparian habitat: 674.6 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 14
- Number of springs possibly indirectly impacted: 35

An evaluation completed by Tetra Tech (2010a) shows that the average annual stormwater flows within Barrel Canyon at the SR 83 bridge immediately upgradient of the confluence with Davidson Canyon will be reduced by approximately 45.8 percent as a result of this alternative. Graphic representation of the reaches of Barrel and Davidson canyons that will be dewatered as a result of all alternatives is shown in Figure 7.

**Practicability Determination:** This alternative is likely practicable. That is, Alternative 1 is available, logistically and technologically feasible, practicable from a cost perspective, and consistent with the Applicant’s Project purpose. However, additional engineering and hydrologic evaluation of the central drain design indicated that long-term maintenance of the drain could be a concern, along with additional contact between stormwater and tailings and increased seepage to groundwater. The development of Alternative 2 (below) was accomplished, in part, to address these concerns.
### Table 3. Summary of Key Elements of Onsite Alternatives

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<td>Total area direct impacts (acres)</td>
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<td>5,471</td>
<td>5,421</td>
<td>5,878</td>
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<td>Total exclusion (fenced) area (acres)</td>
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<td>5,471</td>
<td>5,421</td>
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<td>Pit size (acres)</td>
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<td>950</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>600</td>
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<tr>
<td>Waste rock area (acres)</td>
<td>2,000</td>
<td>1,370</td>
<td>1,460</td>
<td>1,820</td>
<td>1,298</td>
<td>1,370</td>
</tr>
<tr>
<td>Waste rock ultimate elevation (ft amsl)</td>
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<td>5,470</td>
<td>5,435 / 5,700</td>
<td>5,300 / 5,600</td>
<td>5,500</td>
<td>&lt; 5,470</td>
</tr>
<tr>
<td>Tailings area (acres)</td>
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<td>1,135</td>
<td>987</td>
<td>1,040</td>
<td>1,214</td>
<td>1,135</td>
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<tr>
<td>Tailings storage ultimate elevation (ft amsl)</td>
<td>5,250</td>
<td>5,250</td>
<td>5,300</td>
<td>5,238</td>
<td>5,387</td>
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<tr>
<td>Leach pad area (acres)</td>
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<td>126</td>
<td>--</td>
<td>126</td>
<td>126</td>
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<tr>
<td>Leach pad ultimate elevation – before cover (ft amsl)</td>
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<td>5,380</td>
<td>--</td>
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<tr>
<td>Estimated average haulage distance – waste rock (ft)</td>
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<td>17,515</td>
<td>17,515</td>
<td>27,645</td>
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<tr>
<td>Estimated average conveyor distance – tailings (ft)</td>
<td>12,000</td>
<td>11,105</td>
<td>14,385</td>
<td>14,385</td>
<td>19,450</td>
<td>11,105</td>
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</table>
3.1.2. Alternative 2 – Phased Tailings

Alternative 2 consists of a modification to the 2007 MPO (Alternative 1) as a response to issues raised during public scoping. This alternative is similar to Alternative 1 in that the waste rock and tailings facilities will be confined to McCleary and Barrel Canyons (Figure 8). However, in addition to a number of minor design element changes and mitigation concepts, this alternative includes an alternative tailings sequence in which the McCleary Canyon drainage will be impacted later in the development of the Project. As with Alternative 1, the facilities for this alternative incorporate Wasp, Barrel, and McCleary Canyons.

The phasing for this alternative starts in Barrel Canyon and leaves McCleary Canyon open for a period of approximately 10 years prior to any tailings deposition activity in this area. This keeps the footprint for the first 10 years isolated to an area of Barrel Canyon. As with Alternative 1, the tailings will be stored in two separate phases, the North (McCleary Canyon) and the South (Barrel Canyon) Dry Stacks. Tailings will be dewatered at the plant site facilities and then conveyed overland to either of the tailings facilities. Under Alternative 2, dry stack tailings will be placed in the South Dry Stack first for a period of approximately 12 years, leaving McCleary Canyon open. During Year 10, preparation work will begin in the North Dry Stack area (McCleary Canyon) to prepare the facility for tailings placement. Tailings will be placed in the facility by Year 12.

As under Alternative 1, the waste rock and heap leach facilities will be placed in the Barrel Canyon drainage under this alternative. The perimeter berms will be located in the Barrel Canyon drainage, while the buttresses will be located in both Barrel and McCleary Canyons. A revised underdrain system will be located along the major drainages underlying the facilities. This alternative includes a revised alignment for the offsite roadway, as shown in Figure 8. The same elements presented in Alternative 1 relative to construction and impacts have been analyzed for Alternative 2 and are presented in Table 3.

Environmental Effects: Implementation of Alternative 2 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 41.8 acres
- Indirect impacts to potential waters of the U.S.: 37.2 acres
- Direct impacts to riparian habitat: 629.4 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 14
- Number of springs possibly indirectly impacted: 35

Average annual stormwater flows in Barrel Canyon at the SR 83 bridge will be reduced by 44.3 percent under this alternative (Tetra Tech, 2010b).

Practicability Determination: This alternative is practicable.
3.1.3. Alternative 3 – Barrel (Proposed Action)

It should be noted that, in addition to being the Proposed Action, the Barrel Alternative has also been identified as the Preferred Alternative of the CNF in the Draft EIS. Under this alternative, both dry stack tailings and waste rock will be confined to Barrel Canyon and an unnamed tributary of Barrel Canyon between Barrel Canyon proper and SR 83 (Figure 9), referred to colloquially as “Trail Canyon,” presumably for its proximity to the Arizona Trail. The facilities for this alternative incorporate Wasp and Barrel Canyons. Waste rock storage is provided in both Barrel Canyon and Trail Canyon. Tailings will be dewatered at the plant site facilities and then conveyed overland to the tailings facility. Dry stack tailings will be located entirely within Barrel Canyon. The perimeter berms and buttresses will be located in the Barrel Canyon drainage as well.

There will be no underdrains or heap leach facility as part of this alternative. The roadway alignment for this alternative is the same as for Alternative 2. The same elements presented in Alternative 1 relative to construction and impacts have been analyzed for Alternative 3 and are presented in Table 3.

Environmental Effects: Implementation of Alternative 3 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 40.0 acres
- Indirect impacts to potential waters of the U.S.: 28.4 acres
- Direct impacts to riparian habitat: 587.4 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 13
- Number of springs possibly indirectly impacted: 36

The reclamation designs for Alternative 3 have been optimized to maximize downstream flows both during operations and post-closure. Under Alternative 3, annual average stormwater flows in Barrel Canyon at the SR 83 bridge will be reduced by 17.2 percent after approximately Year 10 (Tetra Tech, 2012a). Due to the deposition of waste rock in Trail Canyon, this alternative has higher impacts to visual resources along SR 83 than either Alternative 1 or 2.

Practicability Determination: This alternative is practicable.

3.1.4. Alternative 4 – Barrel Trail

Similar to Alternative 3, this alternative has been developed to address potential concerns related to visual aesthetics and stormwater runoff. Under this alternative, the surface of the waste rock dumps and the covered tailings facility and heap leach pad would be modified to affect a more “natural” contour, resulting in a considerable expansion of the facility footprint (Figure 10). Alternative 4 is otherwise similar to Alternative 3.
Environmental Effects: Implementation of Alternative 4 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 50.0 acres
- Indirect impacts to potential waters of the U.S.: 34.1 acres
- Direct impacts to riparian habitat: 632.6 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 13
- Number of springs possibly indirectly impacted: 36

Under this alternative, annual average stormwater flows in Barrel Canyon at the SR 83 bridge will be reduced by 42.0 percent (Tetra Tech, 2010c).

Air modeling completed for this alternative indicates that Alternative 4 would not meet National Ambient Air Quality Standards (NAAQS) for particulate matter (PM$_{10}$) (JBR Environmental Consultants, 2012). This air modeling effort has been reviewed by the CNF and EPA. Finally, because this alternative will require substantial modification of the waste rock and tailings facilities surfaces at the end of mining, concurrent reclamation under this alternative, if it could occur, would only be able to be accomplished at some later point in the development of the project. The majority of reclamation, therefore, would likely occur at closure.

Practicability Determination: This alternative is practicable.

3.1.5. Alternative 5 – Scholefield-McCleary

Alternative 5 (Scholefield-McCleary) was developed in an effort to avoid cultural resources, riparian habitat, and recreational opportunities within Barrel Canyon. Under this alternative, the dry stack tailings will be located entirely within Scholefield Canyon (Figure 11). Waste rock will be located in two locations, both outside the canyon bottoms: 1) adjacent to and immediately south of the dry stack tailings within the McCleary Canyon drainage basin, but outside the drainage bottom, and 2) between Wasp and Barrel Canyons, overlying the heap leach pad once leaching operations have ceased in Year 6 and the heap leach pad has been reclaimed.

Two mechanisms for transporting the tailings to Scholefield Canyon are being considered for this alternative: conveyor and slurry pipeline. For the conveyor option, tailings will be dewatered at the plant site facilities and then conveyed overland to the tailings facility. For the slurry pipeline option, the tailings will be transported to a separate tailings filter plant and dewatered prior to their placement in Scholefield Canyon via an additional conveyor. The perimeter berms and buttresses will be located in the Scholefield Canyon drainage. The heap leach facility will be located in the Barrel Canyon drainage. This alternative includes a primary access roadway alignment that originates farther south on SR 83, as shown in Figure 11. The same elements presented in Alternative 1 relative to construction and impacts have been analyzed for Alternative 5 and are presented in Table 3.
Compared to the other alternatives, the Scholefield-McCleary alternative presents a number of operational challenges.

- In order to maximize the volume of material placed in McCleary Canyon, the slopes are necessarily long and uninterrupted by stormwater controls to slow sheetflow (Figure 12). Because the waste rock material will be stored on the relatively steep natural topography of the slopes of above McCleary Canyon (rather than in the canyon bottoms, as with the other alternatives), the risk of slope failure under this alternative is greater than under the other alternatives.

- Stormwater management on the long, unbroken slopes will require substantial stormwater controls at the toe of the slopes. Sheetflow from the long, unbroken slopes will report to the stormwater controls at a greater velocity than with the other alternatives, where intermediate stormwater controls will reduce stormwater velocity. Alternatively, implementation of intermediate stormwater controls for the Scholefield-McCleary alternative to break up the slopes would require an expanded footprint (Tetra Tech, 2012b).

- Because of the relatively limited footprint and steep slopes of the waste rock facility under this alternative, reclamation of the waste rock slopes will be challenging and will have to occur at some later point in the development of the project, with the majority of the reclamation likely occurring at closure.

- If a conveyor is used, slopes for the conveyor will be restricted to less than a 12 percent grade, requiring a relatively long conveyor route, crossing multiple potential waters of the U.S., including McCleary Canyon, Scholefield Canyon, and small unnamed tributaries of both these drainages and Barrel Canyon drainage.

- If a pipeline is used, additional disturbance will be required for the remote filter plant as well as at least one drain pond in the event of a pipeline failure.

- This alternative (either the conveyor or pipeline) has a higher risk for operational interruptions than under the other alternatives due to the increased infrastructure associated with the conveyor and pipeline.

- The haulage length required for this alternative will require 10 additional haul trucks to be added to the fleet to reflect the lengthened haul to the waste rock facility in McCleary Canyon and the buttress in Scholefield Canyon.

Given the technical challenges described above, the Scholefield-McCleary Alternative represents a significant increase in cost to construct the Rosemont Project compared to the other alternatives. The cost to haul material to construct the waste rock dump and the tailings buttress will require an initial $35 million compared to the other alternatives, and will cost an additional $237 million over the life of the mine. The cost to construct the conveyor system to the distant tailings facility in Scholefield Canyon is over $69 million, and will require an additional life-of-mine power cost of approximately $72 million. The cost for engineering controls to reduce the risk of slope failure on the waste rock pile has not been calculated, but would certainly be expected to be greater under this alternative compared to the other alternatives.
Environmental Effects: Implementation of Alternative 5 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 26.2 acres
- Indirect impacts to potential waters of the U.S.: 22.7 acres
- Direct impacts to riparian habitat: 641.6 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 19
- Number of springs possibly indirectly impacted: 32

Alternative 5 results in fewer direct impacts to potential waters of the U.S. (26.2 acres) than Alternatives 1 through 4 do. However, this alternative results in the second highest impacts to riparian habitat (641.6 acres) of all alternatives, and well more than Alternative 3 (Barrel Alternative). Average annual flood flows in Barrel Canyon at the SR 83 bridge will be reduced by 18.4 percent as a result of this alternative (Tetra Tech, 2010d), which represents a greater reduction in flow than Alternative 3 (Barrel Alternative).

However, this alternative would result in a number of other significant environmental effects when compared to the other alternatives, including those listed below, which prevented the CNF from identifying this alternative as the Preferred Alternative in the Draft EIS:

- The direct loss of Scholefield Spring, one of the only special aquatic sites (wetlands) identified within the Project site and a feature that supports the giant sedge, designated by the U.S. Forest Service as “sensitive.” While Scholefield Spring is likely to be impacted over the life of the mine through groundwater drawdown, that impact is a projected one based on the assumption that the spring is dependent on regional groundwater. If it turns out that there are other localized sources feeding that spring, the impacts may not be as adverse as predicted. Moreover, those impacts will occur substantially later in time than would occur if the springs were lost through fill activities (they would be lost completely early in the mine life).

- Development of operations within approximately 0.5 mile of a significant lesser long-nosed bat roost site (Helena Mine). Although it has been shown that mine operations are compatible with lesser long-nosed bat maternity roost sites (notably with the operation of the Cyprus Tohono Corporation mine facility near the Old Mammon Mine), an alternative that was developed further away from the roost feature would be expected to have less potential to adversely affect the roost site or the individuals within it.

- Greater impacts to air quality. Air modeling indicates that the Scholefield Alternative would not meet National Ambient Air Quality Standards (NAAQS) for particulate matter (PM10 and PM2.5) (JBR Environmental Consultants, 2012). This air modeling effort has been reviewed by the CNF and EPA. As described above, implementation of this alternative would require the addition of 10 haul trucks to the fleet, with the attendant increase in emissions. Per the October 2011 DEIS, development of the
Scholefield-McCleary Alternative will result in 14.1x increase in background levels of PM$_{10}$ and an 8.4x increase in nitrogen oxide over background levels, which represents the greatest impacts of all alternatives.

- Significantly greater impact to visual resources. Under the Scholefield-McCleary Alternative, nearly 22,000 acres of the Coronado National Forest designated with very high or high scenic integrity will be impacted, compared to less than 15,000 acres for the Proposed Action (Alternative 3). Portions of the waste rock and tailings facilities for this alternative will be visible from areas west of the Santa Rita Mountains, the only alternative where this occurs.

- A substantial adverse impact to lands designated by the Pima County Sonoran Desert Conservation Plan as being a Biological Core area. The total area of Biological Core affected by Alternative 5 (1,347.8 acres) is more than five times greater than the next highest impact (250.7 acres under Alternative 1), due to the location of the tailings facility, waste rock storage facility, associated haul roads, and conveyor system within designated Biological Core areas.

- As indicated above, reclamation of the waste rock under the Scholefield-McCleary Alternative would not occur concurrently with operations as it would under Alternatives 1, 2 and 3, and reclamation options in general would be severely limited due to the steepness of the slopes and access challenges associated with the waste rock facility in McCleary Canyon.

**Practicability Determination:** This alternative suggests a waste rock disposal method (stacked on slopes outside of drainages) that is not commonly used in copper mines in Arizona due to cost, stability, and stormwater management considerations.

In addition, the Scholefield-McCleary Alternative presents logistical and cost challenges due to significant increases in haulage distance for waste rock and conveyor or pipeline distance for dry stack tailings material, as well as an increased haulage distance for deposition of tailings buttress material in Scholefield Canyon. A substantial portion of the increased costs represent increased energy requirements, which are difficult to predict long term but are expected to increase over the life of the mine. The total increased cost would be expected to be even higher given the technological and logistical challenges of stacking the waste rock on the side of a hill, coupled with the construction of adequate stormwater controls at the toe of the waste rock slopes.

Given the significant increased logistical challenges and cost of this alternative, it is not considered practicable. In addition, the significant adverse environmental effects of this alternative, described above, would prevent this alternative from being identified as the least environmentally damaging practicable alternative (LEDPA).

### 3.1.6. Alternative 6 – Modified Pit Configuration

Alternative 6 consists of a modification to Alternative 2 (Phased Tailings Sequence) in which a portion of the proposed pit would remain undeveloped to avoid mining through Wasp Canyon (*Figure 13*). Under this alternative, a portion of the Rosemont ore body would not be recovered, eliminating the seventh (and final) mining phase and shortening the life of the mine by four years. The result of this revised pit
design is a loss of over 87 million tons of sulfide ore, which represents a 16 percent reduction in recoverable sulfide ore. The facilities for this alternative incorporate Barrel, Sycamore, McCleary, and portions of Wasp Canyons, although the upper extent of Wasp Canyon would remain largely open. Stormwater flows within Wasp Canyon would impound or flow through the waste rock facility. The leach stockpiles and waste rock facilities would be constructed similarly to Alternative 2 in terms of slopes and methods, but waste rock facilities would contain an estimated 25 percent less waste rock. This reduction in waste would reduce the facility height and the facility footprint would remain essentially the same. In order to avoid loss of waters in Wasp Canyon, this alternative would not include an upgradient stormwater diversion channel around the pit, as is contemplated for all the alternatives with a full-size pit. All other items relative to the configuration of the facilities and tailings sequence would be identical to those described in Alternative 2.

**Environmental Effects:** Implementation of Alternative 2 will result in the following impacts:

- Direct impacts to potential waters of the U.S.: 41.0 acres
- Indirect impacts to potential waters of the U.S.: 40.3 acres
- Direct impacts to riparian habitat: 629.4 acres
- Indirect impacts to riparian habitat: 664.5 acres
- Number of springs directly or highly likely impacted: 14
- Number of springs possibly indirectly impacted: 35

Impacts to potential waters of the U.S. and riparian habitat under this alternative are similar to those under Alternatives 1 and 2, with the exception of a portion of Wasp Canyon. Avoidance of impacts to Wasp Canyon would result in approximately 0.8 fewer acres of direct impacts to potential waters of the U.S. than Alternative 2, for a total direct impact to potential waters of the U.S. of 41.0 acres. Impacts to stormwater flows under this alternative would be similar to those under Alternatives 1 and 2, with reductions in average annual flows into Davidson Canyon of 44.3 percent.

This reach of Wasp Canyon would be isolated from downstream receiving waters by the construction of the waste rock facility and would be bounded on either side by a waste rock dump and the pit. In addition, the haul road from the pit to the waste rock dump would be required to cross the wash in three places during successive phases of mine life. As such, the functions and values of the avoided reach of Wasp Canyon would be significantly compromised.

**Practicability Determination:** This alternative is not practicable for several reasons. First, the alternative is logistically impracticable. Continued stormwater flows within Wasp Canyon would compromise the stability of the pit wall on the south and east portions of the pit, where the relatively low-strength Willow Canyon arkose and alluvium occur (*Appendix C*). This impact to stability represents a threat to the safety of mine employees. As such, a stormwater diversion channel and groundwater dewatering system would be required to keep this reach of Wasp Canyon dewatered. The construction of the stormwater diversion
channel would result in the “loss” of this reach of Wasp Canyon due to the dewatering effects of the channel.

As was noted by the Corps Los Angeles District in a recent 404(b)(1) analysis (Newhall Ranch Project; Corps File No. 2003-01264-AOA), “the substantial cost increases associated with some alternatives also must be viewed in light of the amount of additional avoidance of waters of the United States that they provide. A substantial cost increase may be reasonable if impacts also are reduced substantially, while a large increase in cost associated with a minimal reduction in impacts may not be reasonable.” As is demonstrated here, due to logistical constraints, Alternative 6 results in essentially no avoidance of loss of potential waters of the U.S. Given this, Alternative 6 would not be considered a practicable alternative.

### 3.1.7. Removal of Heap Leach and Associated Facilities

Only the Barrel Alternative (Alternative 3, the Proposed Action) is designed to not include a heap leach and associated SX/EW facilities, due to logistical constraints associated with the smaller footprint of this alternative. This section provides an evaluation of the effect of removing the heap leach from the other action alternatives.

Removal of the heap leach and SX/EW facilities from the other alternatives will not result in reduced impacts to potential waters of the U.S. because the heap leach pads are completely encapsulated by waste rock (where impacts to potential waters of the U.S. have already been identified) and the SX/EW is constructed on a ridge outside of all potential waters of the U.S. in all of the alternatives. Because the total volume of material (waste rock, tailings, and heap leach material) will remain largely unchanged (that is, the oxide ore that was to be heap leach material will now either be tailings or waste rock), the footprint of the facilities will not change with the removal of the heap leach and SX/EW. As such, the elimination of the heap leach pads from any of the other alternatives does not affect the determination of the LEDPA.

The elimination of the heap leach pads and SX/EW facilities from any of the alternatives will affect some other aspects of the alternative, as outlined below:

- Electrical usage will be reduced from an estimated 794,000,400 to 738,420,400 kW-hr/year. However, the total connected load for the Rosemont Project is estimated to be approximately 126 megawatts (MW) and will require a transmission voltage of 138 kV. The estimated demand load is about 96.5 MW and the estimated operations load is about 92.8 MW, providing for a configuration that will still require the use of a 138 kV line to transmit electricity.

- Although fresh water usage is anticipated to be reduced by approximately 650 acre-ft/year with the removal of the heap leach and SX/EW, variability in the requirements for water for dust control in order to meet air permit requirements necessitate that estimated total water usage remain at the permitted amount of 6000 acre-ft/year.

- The outdoor lighting necessary to operate the heap leach pads and SX/EW facilities will be eliminated, reducing nighttime light pollution by approximately 105,538 lumens. This estimate does not include the reduction in lighting from the removal of the SX/EW facilities, tanks, and ponds.
• The minor risk of spills related to the transportation of sulfuric acid on State Route 83 will be eliminated.

Additional discussion regarding the removal of the heap leach and SX/EW facilities from practicable alternatives (Alternatives 1, 2, 4, and 5) is provided in the following sections. As indicated here, the elimination of the heap leach and SX/EW facilities does not affect the determination of the LEDPA for the Rosemont Project.

3.1.7.1. Alternative 1A - Mine Plan of Operations without Heap Leach and SX/EW Facilities

As shown in Figure 6, under the alternative presented in the Mine Plan of Operations (Alternative 1), the entirety of the proposed heap leach pad would ultimately be completely encapsulated within the final waste rock area. As discussed above, if the heap leach facility were removed from Alternative 1, the majority of the material that would have been leached within the heap leach facility will be treated as waste rock, with only a minor portion of this material being processed within the mill. As such, the same volume of material (waste rock and tailings) will be incorporated into the final waste rock and tailings storage facility, resulting in no change to the facility footprint (Figure 14). Because the removal of the heap leach and SX/EW facilities results in no change to the facility footprint, there would be no change to the direct and indirect effects to potential waters of the U.S. and riparian habitat under Alternative 1A compared to Alternative 1 (as described in Section 3.1.1 above). Other environmental effects will be as described in Section 3.1.7, above.

3.1.7.2. Alternative 2A - Phased Tailings without Heap Leach and SX/EW Facilities

Similar to the changes described under Alternative 1A above, the removal of the heap leach and SX/EW facilities from Alternative 2, the Phased Tailings Alternative (Figure 8), will result in no change to the facility footprint (Figure 15). Because no change to the facility footprint or final project configuration would result from the removal of the heap leach and SX/EW facilities from the Phased Tailings Alternative, direct and indirect impacts to potential waters of the U.S. and riparian habitat will be the same under Alternative 2A as they would be under Alternative 2 (as described in Section 3.1.2 above). Other environmental effects will be as described in Section 3.1.7, above.

3.1.7.3. Alternative 4A - Barrel Trail without Heap Leach and SX/EW Facilities

As with the other alternatives, the design of the Rosemont Project under Alternative 4, the Barrel Trail Alternative, results in the heap leach facility being completely encapsulated within the waste rock storage facility within the first 10 years of mine operations (Figure 10). As with the other alternatives, therefore, the removal of the heap leach facility from the Barrel Trail Alternative will not result in any changes to the facility footprint because essentially the same volume of material (waste rock and tailings) will need to be stored within the these facilities. Direct and indirect impacts to potential waters of the U.S. and riparian habitat, therefore, will be the same under Alternative 4A (Figure 15) as under Alternative 4 (as described above in Section 3.1.4). Other environmental effects will be as described in Section 3.1.7, above.
3.1.7.4. Alternative 5A - Scholefield-McCleary without Heap Leach and SX/EW Facilities

As shown in Figure 11, the heap leach facility under the Scholefield-McCleary Alternative is completely encapsulated by waste rock by Year 10 of mining operations. Under Alternative 5A (Figure 17), the heap leach and SX/EW facilities will be removed from the operations, and that material that had been designated for leaching will instead be predominately waste rock, with some minor amount of tailings. The volume of material to be stored within the waste rock and tailings facility storage areas, therefore, will remain essentially unchanged, and no change in the facility footprint will be realized. As such, implementation of Alternative 5A would result in identical effects to potential waters of the U.S. and riparian habitat as those under Alternative 5 (as described in Section 3.1.5 above). Other environmental effects will be as described in Section 3.1.7, above.

3.2. Utility Line Alternatives

As described above, electrical power and water will be brought to the Project site from the west for all onsite alternatives. This section describes alternative alignments and, in the case of the waterline, alternative technologies to the proposed action.

3.2.1. Power

Electrical power will be provided by Tucson Electric Power (TEP), which has completed the process for a Certificate of Environmental Compatibility (CEC) from the Arizona Corporation Commission. The CEC process included review of a number of potential alternative alignments for the power line (Figure 18).

For all alternatives, power was provided from a link attached to transmission lines on the South Substation loop. All alternatives include above-ground transmission lines and an associated unpaved maintenance road. In general, no transmission line poles, substations, or other structures were to be constructed in potential waters of the U.S. Impacts to potential waters of the U.S. would occur almost solely from the construction of a 12-ft-wide unpaved access road, and most of these impacts were anticipated to be temporary; that is, where feasible, the potential waters of the U.S. would be restored to preconstruction contours following construction of the transmission lines and access road. The only permanent fill would be at the culverted crossings of waters and at no more than three (3) utility poles in the steeper portions of the alignment through the Santa Rita Mountains. Estimated permanent fill is 0.05 acre with an additional estimated temporary fill of 0.25 acre for temporary construction access.

Impacts to potential waters of the U.S. resulting from the various alternatives are provided in Table 4, below. Again, the majority of these impacts would be temporary.
Table 4. Impacts to Potential Waters of the U.S. from Transmission Line Alternatives

<table>
<thead>
<tr>
<th>Alignment</th>
<th>Impact to Potential Waters of the U.S. (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Route</td>
<td>0.10</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>0.22</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>0.29</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>0.40</td>
</tr>
<tr>
<td>Alternative 4</td>
<td>0.20</td>
</tr>
</tbody>
</table>

The ACC selected the Preferred Route which also resulted in the fewest impacts to potential waters of the U.S. The Preferred Route, therefore, represents the least environmentally damaging practicable alternative for the power line.

3.2.2. Water

Two waterline alignments have been proposed: the one that was provided in the 2007 MPO (WestLand, 2007), and a second that largely parallels Santa Rita Road through the Santa Rita Experimental Range and an existing unpaved road over the Santa Rita Mountains, through Lopez Pass. In discussions with the Arizona State Land Department and the University of Arizona (which are responsible for the Santa Rita Experimental Range), the Applicant determined that the preferred alignment for all parties is that which parallels Santa Rita Road (Figure 19). This alignment also comports with the Preferred Route for the power line, described above.

With either alignment, the pipeline will be constructed with a minimum soil cover of 36 in within State Land easements, and 24 in on the mine property. The pipe bedding requirements will follow the manufacturer’s recommendations. Isolation valves will be installed in the pipeline at intervals of approximately 3,000 ft and at elevation changes of 250 ft.

Impacts resulting from the installation of the pipeline itself will, for most drainage crossings, be temporary, as the pipe trench will just be backfilled with the same soil material that had been removed and sidecast to create the trench. In drainages where the stability of the pipe is of concern, self-compacting pipe bedding material (e.g., crushed stone) may be placed immediately around the pipe. The remainder of the trench would be backfilled with native material. The total width of the trenching and sidecast will range from 30 to 52 ft, depending on whether or not power distribution will be included in the trenching. There are an estimated 54 crossings of potential WUS resulting from the proposed waterline.

For drainage crossings where the wash material is comprised of soil and gravel, the pipeline will be buried below the calculated scour depth. Use of a non-erosive material, such as concrete, is only anticipated to be required in areas where the pipeline will be placed in relatively soft bedrock. In these instances, a non-erosive material, such as concrete, will be used to backfill the trench over the pipe to the
same level as the bedrock. As a result, the bottom elevation of the potential WUS will not change. Some minor bank stabilization may also be required in association with these crossings.

Construction of the waterline includes a permanent unpaved access road, which will provide access to the powerline as well for most of the respective alignments. Impacts to potential WUS resulting from the access road are anticipated to be minimal, as culverts will not be required for the majority of crossings. Most wash crossings will be at-grade, or will have minor fill of native material during the construction period to facilitate use by light vehicle traffic. These minor fills will be removed following completion of the waterline. In other areas, the access road is anticipated to divert back to Santa Rita Road for short reaches in order to avoid wash crossings. Culvert crossings will likely only be required where the roadway crosses potentially jurisdictional waters on the east end of the alignment, on the slopes of the Santa Rita Mountains. It is assumed that no more than five (5) such culverted crossings will be required, with a maximum width of 40 ft per crossing. Some minor bank stabilization may also be required in association with these culverted road crossings.

Construction of the pipeline will include four forebay reservoirs and pump stations. The reservoirs and pump stations will be built outside potential WUS.

Because the impacts to potential waters of the U.S. from either alignment will be minimal and almost exclusively temporary (and therefore comparable), this analysis considers only the preferred alignment along Santa Rita Road (Figure 19). The two alternatives to be considered for the construction of the waterline relate to the technology to be used: 1) standard trenching and 2) jack-and-bore beneath the potential waters of the U.S.

Under the standard trenching alternative, based on refinements to the pipeline construction design, impacts to potential waters of the U.S. would total approximately 1.03 acre of temporary impacts and 0.20 acre of permanent impacts resulting from the construction of road crossings and grade control structures. This construction method will cost between $210 and $360 per linear foot, depending on the size of pipe that is used.

Under the second waterline alternative, the waterline will be installed beneath potential waters of the U.S. using jack-and-bore technology, such that there would be no discharge of fill material to potential waters of the U.S. The estimated cost for the jack-and-bore alternative is between $1,100 and $1,800 per linear foot, or even more, depending on how large the wash crossing is. For the largest washes within the analysis area, additional costs will be incurred by the contractor for the excavation and shoring of the jack-and-bore pits. Utilizing jack-and-bore technology for the largest wash crossings within the analysis area will cost an estimated $1.5 million compared to $180,000 to $250,000 for the standard trenching technology. Jack-and-bore methods also result in substantially more disturbance to native vegetated ground than standard trenching techniques. This is due to the fact that the wash crossing itself is generally unvegetated (i.e., is located within the ordinary high water mark of the wash) while the staging areas located in the adjacent upland areas are generally vegetated. Staging areas are needed on either side of a wash being crossed, both for equipment and deposition of excavated material. Thus, avoiding temporary impacts within the wash itself results in increased adverse effects to upland areas. On balance then, jack-and-bore methods are not less environmentally damaging.
As demonstrated here, the use of jack-and-bore technology costs between five and eight times that of standard trenching technology, results in an impracticable cost increase over the standard trenching methodology, and is more environmentally damaging. As such, standard trenching represents the LEDPA for the Project waterline.

4. SUMMARY AND CONCLUSIONS

This alternatives analysis has been completed in order to identify the LEDPA for the development of the Rosemont Project.

An analysis of potential offsite alternatives that were identified as being in existence in 2005 when Augusta Resource Corporation purchased the Rosemont Property was done at the request of the Corps. No viable offsite alternatives were identified.

The onsite alternatives that were evaluated as part of this analysis focused on various configurations of the dry stack tailings, waste rock dumps, and heap leach pad. The locations of the pit and plant site were assumed to remain the same for all alternatives. Other ancillary facilities (minor access roads, etc.) would be expected to have relatively minimal impacts to waters of the U.S. Table 5 provides a summary of the practicability criteria for the various onsite alternatives, selected environmental effects of each alternative, and a determination of practicability.

As shown in Table 5, Alternatives 1 through 4 have been determined to be practicable alternatives to the Rosemont Project. Although Alternative 1 is practicable when evaluating availability, costs, logistics, and technology, it presents challenges with regard to long-term management of stormwater flows and would therefore not represent an appropriate alternative.

Alternative 5 (Scholefield-McCleary) is not practicable due to logistical challenges and cost, and has other significant environmental effects that would prevent it from being considered the LEDPA, per the 404(b)(1) guidelines (40 C.F.R. §230.10(a)). These impacts are described in Section 3.1.5 of this document, and include: direct loss of Scholefield Spring (a potentially jurisdictional wetland), proximity to a significant lesser long-nosed bat roost site, greater impacts to air quality (does not meet NAAQS for PM$_{10}$ or PM$_{2.5}$), overall larger footprint area, significantly greater impact to visual resources, a substantial adverse impact to lands designated by the Pima County Sonoran Desert Conservation Plan as being a Biological Core area, increased energy and fuel use, and an extremely limited ability to conduct reclamation concurrently with operations.

Of the three remaining alternatives, Alternative 4 (Barrel Trail) has the greatest direct impacts to waters of the U.S. (84.1 acres). Of the two remaining alternatives, Alternative 3 has the lowest comparable direct and indirect effects to potential waters of the U.S. (68.4 acres). Alternative 3, therefore, is the LEDPA for the Rosemont Project.

Of the five alignments considered as part of the Arizona Corporation Commission’s Certificate of Environmental Compatibility (CEC) for the Rosemont Project power line, the Preferred Route was selected for the CEC. This alternative resulted in the fewest impacts to potential waters of the U.S., the
The two alternatives evaluated for the offsite waterline include a standard trench construction methodology that would result in 1.03 acre of temporary and 0.20 acre of permanent impacts to potential waters of the U.S. and cost an estimated $210 to $360 per linear ft. The other alternative entails using a jack-and-bore technique for installing the waterline below the washes that would result in no impacts to potential waters of the U.S. but would increase adverse impacts to upland vegetation and cost an estimated $1,100 to $1,800 per linear ft, or more, depending on the size of the pipe that is used and the width of the wash crossing. Because the jack-and-bore technology results in other environmental consequences at a cost five to eight times higher than that for the standard trenching technology, it is not a practicable or least environmentally damaging alternative.
### Table 5. Summary of Impacts and Practicability of Onsite Alternatives

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<td>Availability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Cost</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Project Purpose</td>
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<td>Yes</td>
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<td>Logistics and Technology</td>
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<td>Impacts to potential waters of the U.S. (acres)</td>
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<tr>
<td>Direct</td>
<td>42.5</td>
<td>41.8</td>
<td>40.0</td>
<td>50.0</td>
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<tr>
<td>Indirect</td>
<td>36.9</td>
<td>37.2</td>
<td>28.4</td>
<td>34.1</td>
<td>22.7</td>
<td>40.3</td>
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<td>Total</td>
<td>79.4</td>
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<td>68.4</td>
<td>84.1</td>
<td>48.9</td>
<td>81.3</td>
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<td>Special aquatic sites</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Direct impacts to total riparian habitat (per Pima County mapping) (acres)</td>
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<td></td>
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<tr>
<td>Area in Sonoran Desert Conservation Plan Biological Core (acres)</td>
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<td>Reduction in average annual stormwater flows reporting to Davidson Canyon (%)</td>
<td></td>
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<tr>
<td>Other sensitive resources</td>
<td></td>
<td></td>
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<tr>
<td>Practicability</td>
<td>YES – However, may be technological concern regarding long-term maintenance of stormwater underdrains.</td>
<td>YES – Improved stormwater management design</td>
<td>YES – longer haulage profile, but economically viable</td>
<td>YES – longer haulage profile and significant reclamation costs, but economically viable</td>
<td>NO – significantly increased cost over proposed action. Logistically impracticable due to need to stack waste rock on slope and significant haul distances. Impacts to sensitive resources not affected in other alternatives. Minimal options for reclamation.</td>
<td>NO – logistically impracticable due to need to dewater Wasp Canyon area. In addition, considerably increased cost over proposed action, as well as significant loss of revenue.</td>
</tr>
</tbody>
</table>
5. REFERENCES


Pima County, Arizona
Sahuarita, Green Valley, Mount Fagan,
Corona De Tucson, Empire Ranch,
& Helvetia USGS 7.5' Quadrangles

ROSEMONT PROJECT
404(b)(1) Alternatives Analysis

VICINITY MAP
Figure 1
ROSEMONT PROJECT
404(b)(1) Alternatives Analysis

ALTERNATIVE 1A
MINE PLAN OF OPERATIONS
WITHOUT NEAR LEACH AND SK/EW FACILITIES

Figure 14
APPENDIX A

ROSEMONT LETTERS REGARDING NEARBY DEPOSITS
Mr. Brian Lindenlaub  
Westland Resources, Inc.  
4001 East Paradise Falls Drive  
Tucson, AZ  85712

August 30, 2010


Mr. Lindenlaub

I am sending you the following discussion regarding the U.S. Army Corp Of Engineers Alternative 6 for the Rosemont Project, Pima County, Arizona. This is a follow up on information provided previously starting in September 2009. The discussion addresses the vastly higher economic potential and more advanced state of evaluation of the Rosemont Deposit, compared with other known deposits on the Rosemont Property, along with technical and financial reporting requirements that must be adhered to in presenting any public information on these deposits.

General Mining Project Evaluation & Financial Reporting

Introduction

A mining project begins with the exploration of a geologically favorable region. As the results of more and more exploration and evaluation become available for the region certain areas are targeted as being more favorable. Increasingly detailed work will show what the relative potential of each targeted area is, and typically identify the highest potential target area. Exploration is then focused on the best potential area. When sufficient geologic data has been collected, mine engineering is conducted, culminating in a comprehensive economic feasibility study. A positive conclusion from the feasibility study will justify the investment of significant capital used to construct the mine facilities and bring the operation into production. Even before the construction capital is committed, however, significant expenditures have been incurred on the exploration and engineering efforts.

During this exploration and engineering process, exploration information is advanced to define geologic Mineral Resources, which in turn are categorized as economic Mineral Reserves with the implementation of the mine engineering and cost considerations, all of which are conducted as part of the process of the economic feasibility evaluation. Within a feasibility study, the identification and reporting of Mineral Resources and Mineral Reserves is rigorously regulated by various security exchange commissions. All work is prepared under the supervision of a “Qualified Person” or “Competent Person.” A Qualified Person is officially defined as: “An individual who is an engineer or geoscientist with at least five years of experience in mineral exploration, mine development or operation or mineral project assessment, or any combination of these; has experience
relevant to the subject matter of the mineral project and technical report; and is a member or licensee in good standing of a professional organization." The Qualified Person takes the professional and legal responsibility for any publicly released project information prepared under their supervision.

Financial & Technical Reporting

Any publicly traded company has a fiduciary duty to make the best investment decisions for the benefit of the stockholders of the company, including any decisions regarding project development, while concurrently considering other possible uses of capital funding. Corporate financial reporting, including economic feasibility studies, must meet the regulatory and reporting requirements of the security commissions in the jurisdiction(s) in which the company reports. United States based companies must meet the requirements of the United States Securities And Exchange Commission (SEC). It is not unusual for mining companies to have a financial presence in more than one country (i.e. Canada, United Kingdom, etc.) which then requires reporting in compliance with each of these jurisdictions. A summary of the application of the requirements for Mineral Resource and Mineral Reserve reporting is summarized in an independent Pincock Perspective bulletin (International Mining Consultants) dated November 2003 (Attachment A).

REPORTING REQUIREMENTS IN THE UNITED STATES

The United States Stock Exchange Commission (SEC) regulates the reporting of Resources and Reserves for mineral companies with United States stock exchange listings. The SEC has issued Industry Guide 7: Description of Property by Issuers Engaged or to be Engaged in Significant Mining Operations (Attachment B) for guidance. In practice, mining companies often also make use of the Mineral Resource and Mineral Reserve reporting guideline developed by the United States professional group Society of Mining, Metallurgy and Exploration (SME). The SME has developed A Guide For Reporting Exploration Information, Mineral Resources, And Mineral Reserves (“SME Reporting Guide”) dated 2007 (Attachment C). Industry Guide 7 is generally consistent with the SME Reporting Guide, with some differences, including no requirement for a qualified person and requiring the term “mineralized material,” rather than mineral resources. SEC practice is that mineralized material may only include measured and indicated categories and may not include inferred category material, as they consider it too speculative. Also, SEC practice is to have reserves defined by a feasibility study for undeveloped properties, with necessary permits reasonably pending or having been issued. A mine plan or prefeasibility study is acceptable for additions to operating mines. The SME Reporting Code requires that Mineral Reserves be based on appropriate assessments, which may include feasibility studies, carried out to demonstrate that the reserves are economically viable. Reserves are to be based on prices at the time of the determination, but can consist of a three year historic average to minimize price volatility.

REPORTING REQUIREMENTS IN CANADA

Canada is a common location for mining companies to have either primary or secondary registration. In Canada, the Canadian Securities Administrators (CSA) regulates the reporting of resources/reserves for mineral companies with Canadian stock exchange listings. The CSA has issued National Instrument 43-101 (NI 43-101), a rule that governs how stock issuers disclose technical information about mineral projects, which originally became effective on February 1,
2001, with the latest update effective on December 30, 2005 (Attachment D). The rule incorporates the Mineral Resource and Mineral Reserve reporting guidelines developed by the Canadian Institute Of Mining, Metallurgy and Petroleum (CIM) entitled CIM Standards On Mineral Resources And Reserves (“CIM Standards”), the latest version dated December 11, 2005. The CIM Standards are very similar to those of the SME Reporting Code, as they were developed in collaboration with common professional groups. The rule requires that all disclosure be based on work by a “Qualified Person” (QP) and requires stock issuers to file Technical Reports for which there is a prescribed format. Mineral exploration conducted to delineate a deposit is to follow the Mineral Exploration Best Practices guidelines published in June 2000 (Attachment E). Mineral Resource estimation is to follow the Estimation of Mineral Resources and Mineral Reserves Best Practices guidelines, dated November 23, 2003 (Attachment F).

The CIM Standards do not allow for inferred Mineral Resources to be added with either measured and/or indicated resources for presenting a total mineral resource estimate. An issuer should not disclose the results of an economic evaluation that used inferred Mineral Resources; however, a preliminary assessment or scoping study at an early stage of a project can use inferred Mineral Resources in an economic evaluation as long as it is clearly stated as such. The CIM Standards requires that reserves be based on at least a Preliminary Feasibility Study or Prefeasibility Study, demonstrating that, at the time of reporting, economic extraction can be justified.

Project Advancement

Exploration and evaluation conducted by a company is the process used to identify projects that have the best economic potential for development. A project identified as having economic potential for advancement is then advanced consistent with industry standard practices. This project advancement can be grouped into general stages including deposit exploration drilling, project economic feasibility, and project development. During each stage, financial and technical work must be conducted and can only be reported consistent with regulatory requirements.

Stage 1: Deposit Exploration Drilling

The first stage of a mineral exploration project is to conduct evaluations of the geologic character and mineral distribution sufficient to allow for the identification of a mineral deposit for which an initial mineral resource estimate can be conducted. Mineral resources have been officially been defined as: “A concentration or occurrence of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth’s crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.” Mineral Resources are sub-divided, in order of increasing geological confidence, into inferred, indicated, and measured categories.

Stage 2: Project Economic Feasibility

The next major stage of a mineral exploration project is to incorporate mine, metallurgical, and environmental engineering to determine what part of the mineral resource is economically extractable, which then allows for an estimate of the Mineral Reserve (mineable part of the Mineral Resource). Mineral Reserves have been officially defined as: “The economically mineable part of a
Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when the material is mined.” Mineral Reserves are sub-divided, in order of increasing economic confidence, into proven and probable categories. Material that cannot be considered as part of the economic Mineral Reserves must remain as Mineral Resource for reporting purposes.

**Stage 3: Project Development**

Once the economic feasibility study has demonstrated the mineral project to be economically viable, the next step includes detailed engineering, environmental impact analysis, and procurement of project financing. The geological Mineral Resource and economic Mineral Reserve are largely fixed at this point but may be updated if additional project information becomes available. In such circumstances, the additional information is usually incorporated into an economic feasibility study update.

With Regards,

Mark G. Stevens, Professional Geologist
V.P. Exploration

Mr. Lindenlaub

I am sending you the following discussion regarding the U.S. Army Corp Of Engineers Alternative 6 for the Rosemont Project, Pima County, Arizona. This is a follow up on information provided previously starting in September 2009. The discussion addresses the vastly higher economic potential and more advanced state of evaluation of the Rosemont Deposit, compared with other known deposits on the Rosemont Property, along with technical and financial reporting requirements that must be adhered to in presenting any public information on these deposits.

Rosemont Copper Project Evaluation

Introduction

The Rosemont Copper Project is the cumulative result of more than 50 years of exploration drilling and mine engineering evaluations by several successive mining companies, at a total cost estimated to be on the order of $150 million dollars (Rosemont Copper Company does not have the accounting records of previous mining companies and these costs can only be estimated). Rosemont Copper Company envisions that the Rosemont Project will consist of the mining of the Rosemont Deposit in order to extract copper, as well as molybdenum and silver. The Rosemont Deposit was identified through extensive mineral exploration carried out on the Rosemont Property. Exploration conducted on the property during the period from the 1950s to the 1970s initially consisted of work conducted on a more regional property basis, but then progressed to a number of more specific deposit areas, as favorable results were obtained in these areas. Deposit areas that became more of a focus included Rosemont, Broadtop Butte, Copper World, and Peach-Elgin; each of which had various degrees of previous mining activity dating back as far as the late 1800s.

By about the middle 1970s, the cumulative results of the mineral evaluations from across the Rosemont property had identified the Rosemont mineral deposit as the site with the best economic potential for being developed into an economic mine, and hence Rosemont became the focus of subsequent work. The recognition of the potentially larger deposit size and better economic return from the Rosemont deposit was not only the conclusion of the mining company owners at that
time, Anamax, but also was the consistent conclusion of subsequent mining company owners ASARCO, and then Rosemont Copper Company. The economic potential of the Rosemont site was so clearly demonstrated from exploration drilling, that upon entering into a purchase agreement for the property in 2005, Rosemont Copper immediately continued the process of advancing the Rosemont Deposit, with very little attention given to the other mineralized areas on the property.

Rosemont Copper Company’s work on the Rosemont Deposit requires corporate financial reporting of Rosemont Project information, including economic feasibility study results, consistent with the regulatory and reporting requirements of the United States Securities And Exchange Commission (for United States securities reporting) and the Canadian Securities Administrators (for Canadian securities reporting). The Canadian Securities Administrators requirements are generally accepted as being more detailed, but adherence must be made to both systems. As a publically traded company, Rosemont Copper Company has a fiduciary duty to make the best investment decisions for the benefit of the stockholders of the company, including any decisions regarding project development, while concurrently considering other possible uses of capital funding. The Rosemont Project has advanced over the last several years by Rosemont Copper Company as being the best alternative for corporate investment. Implementing this process, Rosemont Copper Company has successively invested approximately $115 million in the Rosemont Copper Project, over the last five years. This does not include the investment made by previous mining company owners, estimated to be on the order of $35 million (in current dollars) for the previous Rosemont Deposit work.

**Rosemont Project Advancement by Rosemont Copper Company**

Since its purchase, Rosemont Copper Company has advanced the Rosemont Project in a manner consistent with industry practices. From the work conducted previously, Rosemont Copper Company recognized that the Rosemont deposit had the best potential for development, as had the previous mining company owners. Rosemont Copper Company has since proceeded to advance the Rosemont Deposit from exploration through economic feasibility to the current project development stage.

**Stage 1: Deposit Exploration Drilling (2005 – 2008)**

Previous mining company owners of the Rosemont property drilled 179 holes, for a total of 209,999 feet, in the Rosemont deposit. Subsequently, Rosemont Copper Company has conducted three progressive drilling campaigns to further explore the Rosemont deposit, totaling 75 drill holes for 113,876 feet of drilling. This additional drilling was necessary to better delineate geologic lithology and structure in the deposit, as well as to more accurately quantify the grade distribution of the mineralization to be consistent with industry standard practices. At the time of this initial work in 2005 and 2006, it was only appropriate to report on Mineral Resources of the Rosemont Deposit. The estimation of the Mineral Resources and assessment of the reasonable prospects for economic extraction required the judgment of a consulting engineer to serve as the official Qualified Person. In early 2007, the positive results from preliminary assessments of the Rosemont Deposit, allowed for the corporate decision to proceed to the next stage.


Rosemont Copper Company completed an economic feasibility study in August 2007. The study demonstrated the positive economic viability of the Rosemont Deposit. With the receipt of
subsequent information with regards to the Mineral Resources, Mineral Reserves, metallurgy, and capital and operating costs; an Updated Feasibility Study was finalized in January 2009. Again, the feasibility update demonstrated the positive economic viability of the Rosemont Deposit. For each of these studies, a Mineral Reserve was reported. The current Rosemont Mineral Reserve is estimated to include 1) 546 million tons of sulfide ore averaging 0.45% copper, 0.015% molybdenum, and 0.12 ounces per ton silver and 2) 70 million tons of oxide ore averaging 0.17% copper. Mineral Reserves of this magnitude demonstrate that the Rosemont Deposit is a large deposit. This Mineral Reserve is capable of supporting a 20 plus year mine life, at a production rate of 75,000 tons of ore per day. The estimation of the Mineral Reserves and determination of economic feasibility for the project required the expertise of a team of company and consulting engineers. The lead engineer for each of the technical disciplines involved in the study served as a Qualified Person. The positive economic finding of the feasibility studies allowed for the corporate decision to advance the project to the next stage.

**Stage 3: Rosemont Project Development (2009 – Current)**

Rosemont Copper Company is currently in this stage of activity, which includes detailed engineering, environmental impact analysis, and procurement of project financing. The geological Mineral Resource and economic Mineral Reserve are largely fixed as of the 2009 feasibility study update.

Rosemont’s focus all along has been entirely on the advancement of the Rosemont Deposit and has spent little or no time, effort, or cost on other Rosemont property prospect areas; as it was recognized from the initial property purchase, that the best economic potential identified to date on the property, was in the Rosemont Deposit. As such, Rosemont Copper Company has spent more than $115 million dollars in this effort, including $30 million on land purchases, $22 million on exploration drilling, $23 million on project engineering, and $22 million on environmental studies. This does not acknowledge the cost of exploration drilling by previous mining company owners, who likely spent on the order of $35 million on exploration drilling (in current dollars) and geologic evaluation, on the Rosemont Deposit area.

With Regards,

Mark G. Stevens, Professional Geologist
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 August 30, 2010


Mr. Lindenlaub

I am sending you the following discussion regarding the U.S. Army Corp Of Engineers Alternative 6 for the Rosemont Project, Pima County, Arizona. This is a follow up on information provided previously starting in September 2009. The discussion addresses the vastly higher economic potential and more advanced state of evaluation of the Rosemont Deposit, compared with other known deposits on the Rosemont Property, along with technical and financial reporting requirements that must be adhered to in presenting any public information on these deposits.

Broadtop Butte Copper Project Evaluation

Introduction

The Broadtop Butte Deposit is one of several mineralized areas that occur on the Rosemont Property. During the earlier exploration period from the 1950s to the 1970s, extensive exploration of the Rosemont Property, started on a regional basis and then progressed to a number of more specific deposits, one of which was Broadtop Butte. By about the middle 1970s, the cumulative results of the mineral evaluations from across the Rosemont property had already identified the Rosemont Deposit as the site with the best potential for being developed into an economic mine, and hence Rosemont became the focus of subsequent work.

Historical Evaluation

The Broadtop Butte Deposit occurs approximately 6,000 feet to the north of the Rosemont Deposit. A total of 18 holes have been drilled at Broadtop Butte, for a total of 10,170 feet. Drilling was conducted during the 1960s and 1970s on the deposit. Little work has been conducted since that time, because of the focus on the better economic potential at the Rosemont Deposit. It is estimated that approximately $2 million (in current dollars) had previously been spent on exploration of the Broadtop Butte Deposit.

Detailed exploration information on the Broadtop Butte Deposit does not exist. Drilling results deposit obtained during the 1960s and 1970s are widely spaced and are only sufficient for the preliminary estimation of a Mineral Resource, but not Mineral Reserves, based on current standard
industry practices and security exchange reporting requirements. Previously in 1979, Anamax carried out an estimate that found a Mineral Resource of 8.8 million tons at an average grade of 0.77% copper and 0.037% molybdenum. It is noted that this estimate must be considered to be historical in nature and is not necessarily consistent with current industry practices and securities reporting requirements.

Potential Plan

Rosemont Copper Company has spent very little time and effort evaluating the Broadtop Butte Deposit, as earlier exploration results indicated this location had less economic potential than the Rosemont Deposit. At some point in the future, Rosemont Copper Company intends to conduct further work at Broadtop, to better evaluate the mineral potential. This work can only be conducted pending the priority for availability funds to cover the costs of the further work. Rosemont Copper Company estimates it will take at least $12 million to conduct the necessary drilling and engineering to advance the property to a possible economic feasibility stage. This work is likely to take 5 years to carry out. As is the nature with any early stage exploration mineral project, there can be no guarantees that such a project will eventually be shown to be economic by a feasibility study. Rosemont Copper Company believes from the existing information that the Broadtop Butte Deposit has potential as a smaller satellite area of production, but not as a possible substitute for the planned Rosemont Deposit production.

It is noted that United States Securities And Exchange Commission and Canadian Security Administrator requirements prohibit the public presentation of any Mineral Reserve without the requisite geologic study and corresponding engineering studies. Such a representation can be very misleading with the results being very speculative. As such, Rosemont Copper Company would be at risk to consider generating such an evaluation.

Conclusion

The geologic Mineral Resource currently known in the Broadtop Butte Deposit is only a fraction (1.6%) of what the mineable Mineral Reserve is in for the Rosemont Deposit. As such, the Broadtop Butte Deposit is not “available” as a substitute for the Rosemont Deposit. In addition, there is insufficient engineering to currently qualify the Broadtop Butte mineralization as a Mineral Reserve. Until such time as a comprehensive program of exploration drilling, metallurgical testing, mine planning, and economic evaluation have been completed in a definitive feasibility study, the Broadtop Butte mineralization cannot be considered “capable of being done”. For Rosemont to attempt to do so currently would be speculative and prohibited by financial regulation. The Broadtop Butte Deposit is neither “available” nor “capable of being done” and cannot be considered as “practicable”.

With Regards,

Mark G. Stevens, Professional Geologist
V.P. Exploration
Mr. Brian Lindenlaub  
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4001 East Paradise Falls Drive  
Tucson, AZ  85712

August 30, 2010


Mr. Lindenlaub

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Copper World Project Evaluation

Introduction

The Copper World Deposit is one of several mineralized areas that occur on the Rosemont property. During the earlier exploration period from the 1950s to the 1970s, extensive exploration of the Rosemont Property, started on a regional basis and then progressed to a number of more specific deposits, one of which was Copper World. By about the middle 1970s, the cumulative results of the mineral evaluations from across the Rosemont property had already identified the Rosemont Deposit as the site with the best potential for being developed into an economic mine, and hence Rosemont became the focus of subsequent work.

Historical Evaluation

The Copper World Deposit occurs approximately 10,000 feet to the northwest of the Rosemont Deposit. Copper World was a significant part of the Helvetia area production during the late 1800s, from selective underground high-grade areas. During the 1960s and 1970s, 28 holes were drilled at Copper World, for a total of 11,449 feet. Little exploration work has been conducted since that time, because of the focus on the better economic potential at the Rosemont Deposit. A reclamation action by ASARCO in the 1990s resulted in part of the surface area being graded and contoured where historical turn of the century mining took place. It is estimated that approximately $3 million (in current dollars) had previously been spent on exploration and another 0.5 million on the previous reclamation of the Copper World Deposit.
Detailed exploration information on the Copper World Deposit does not exist. Drill holes in the deposit obtained during the 1960s and 1970s are widely spaced and are not sufficient for the preliminary estimation of a Mineral Resource and certainly not for a Mineral Reserve, based on current standard industry practices and security exchange reporting requirements. Drilling results are mixed, some encouraging, some not so encouraging, that together would indicate a smaller, geologically complex deposit is more likely present in the area. 

**Potential Plan**

Rosemont Copper Company has spent very little time and effort evaluating the Copper World Deposit, as earlier exploration results indicated this location had less economic potential than the Rosemont Deposit. At some point in the future, Rosemont Copper Company intends to conduct further work at Copper World, to better evaluate the mineral potential. This work can only be conducted pending the priority for available funds to cover the costs of the further work. Rosemont Copper Company estimates it will take at least $7 million to conduct the necessary drilling and engineering to advance the property to an a possible economic feasibility stage. This work is likely to take 3 to 5 years to carry out. As is the nature with any early stage exploration mineral project, there can be no guarantees that such a project will eventually be shown to be economic by a feasibility study. Rosemont Copper Company believes from the existing information that the Copper World Deposit has potential as a smaller satellite area of production, but not as a possible substitute for the planned Rosemont Deposit production.

It is noted that United States Securities And Exchange Commission and Canadian Security Administrator requirements prohibit the public presentation of any mineral reserve without the requisite geologic study and corresponding engineering studies. Such a representation can be very misleading with the results being very speculative. As such, Rosemont Copper Company would be at risk to consider generating such an evaluation.

**Conclusion**

The Copper World Deposit contains mineralization that was mined by a historical small-scale, high-grade mine. Little is known of the remaining mineralization, other than variable results from a few widely scattered drill holes. There is not enough information for Rosemont Copper Company or predecessor companies to have estimated a Mineral Resource. It is most likely that a small deposit of low-grade mineralization may remain at Copper World that is only a fraction of what the mineable Mineral Reserve is in for the Rosemont Deposit. As such, the Copper World Deposit is not “available” as a substitute for the Rosemont Deposit. Since there is no current geologic Mineral Resource, there is no mineable Mineral Reserve, as no engineering has been conducted. Until such time as a comprehensive program of exploration drilling, metallurgical testing, mine planning, and economic evaluation have been completed in a definitive feasibility study, the Copper World mineralization cannot be considered “capable of being done”. For Rosemont to attempt to do so currently would be speculative and prohibited by financial regulation. The Copper World Deposit is neither “available” nor “capable of being done” and cannot be considered as “practicable”.

With Regards,

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August 30, 2010


Mr. Lindenlaub

I am sending you the following discussion regarding the U.S. Army Corp Of Engineers Alternative 6 for the Rosemont Project, Pima County, Arizona. This is a follow up on information provided previously starting in September 2009. The discussion addresses the vastly higher economic potential and more advanced state of evaluation of the Rosemont Deposit, compared with other known deposits on the Rosemont Property, along with technical and financial reporting requirements that must be adhered to in presenting any public information on these deposits.

Peach-Elgin Project Evaluation

Introduction

The Peach-Elgin Deposit is one of several mineralized areas that occur on the Rosemont property. During the earlier exploration period from the 1950s to the 1970s, extensive exploration of the Rosemont Property, started on a regional basis and then progressed to a number of more specific deposits, one of which was Peach-Elgin. By about the middle 1970s, the cumulative results of the mineral evaluations from across the Rosemont property had already identified the Rosemont Deposit as the site with the best potential for being developed into an economic mine, and hence Rosemont became the focus of subsequent work.

Historical Evaluation

The Peach-Elgin Deposit occurs approximately 15,000 feet to the northwest of the Rosemont Deposit. Peach-Elgin was a significant part of the Helvetia area production during the late 1800s, from selective underground high-grade areas; with some surface production in the middle 1900s. During the 1960s and 1970s, 21 holes were drilled at Peach-Elgin, for a total of 8,600 feet. Little exploration work has been conducted since that time, because of the focus on the better economic potential at the Rosemont Deposit. It is estimated that approximately $2.0 million (in current dollars) had previously been spent on the drilling and evaluation of these 21 holes at the Peach-Elgin Deposit.

Detailed exploration information on the Copper World Deposit does not exist. Drilling results from the deposit obtained during the 1960s and 1970s are widely spaced are only sufficient for the
preliminary estimation of Mineral Resource, but not Mineral Reserves, based on current standard industry reporting requirements. Previously in 1964, Anaconda carried out an estimate that found a Mineral Resource of 13.7 million tons of sulfide mineralization at an average grade of 0.78% copper and 0.037% molybdenum, along with 9.7 million tons of oxide mineralization averaging 0.72% copper. It is noted that this estimate must be considered to be historical in nature and is not necessarily consistent with current industry practices and securities reporting requirements. In producing this estimate, Anaconda drilled a number of additional holes in the 1960s, the records for which were permanently lost before Rosemont Copper Company obtained the property and property information.

Rosemont Copper Company has spent very little time and effort evaluating the Peach-Elgin Deposit, as earlier exploration results indicated this location had less economic potential than the Rosemont Deposit. At some point in the future, Rosemont Copper Company intends to conduct further work at Peach-Elgin, to better evaluate the mineral potential. This work can only be conducted pending the priority for available funds to cover the costs of the further work. Rosemont Copper Company estimates it will take at least $10 million to conduct the necessary drilling and engineering to advance the property to an a possible economic feasibility stage. This work is likely to take 5 years to carry out. As is the nature with any early stage exploration mineral project, there can be no guarantees that such a project will eventually be shown to be economic by a feasibility study. Rosemont Copper Company has no evidence that the Peach-Elgin Deposit would be a possible substitute for the planned Rosemont Deposit production.

It is noted that United States Securities And Exchange Commission and Canadian Security Administrator requirements prohibit the public presentation of any mineral reserve without the requisite geologic study and corresponding engineering studies. Such a representation can be very misleading with the results being very speculative. As such, Rosemont Copper Company would be at risk to consider generating such an evaluation.

Conclusion

The geologic Mineral Resource currently known in the Peach-Elgin Deposit is only a fraction (4.3%) of what the mineable Mineral Reserve is in for the Rosemont Deposit. As such, the Broadtop Butte Deposit is not “available” as a substitute for the Rosemont Deposit. In addition, there is insufficient engineering to currently qualify the Broadtop Butte mineralization as a Mineral Reserve. Until such time as a comprehensive program of exploration drilling, metallurgical testing, mine planning, and economic evaluation have been completed in a definitive feasibility study, the Broadtop Butte mineralization cannot be considered “capable of being done”. For Rosemont to attempt to do so currently would be speculative and prohibited by financial regulation. The Broadtop Butte Deposit is neither “available” or “capable of being done” and cannot be considered as “practicable”.

With Regards,

Mark G. Stevens, Professional Geologist
V.P. Exploration
ROSEMONT COPPER PROJECT

AN ANALYSIS OF THE FOREST SERVICE’S AUTHORITY TO REQUIRE PIT BACKFILLING AS POST-MINING RECLAMATION

Prepared by Fennemore Craig, P.C.

February 20, 2012

I. Introduction

Rosemont Copper Company (Rosemont) is developing a copper mine along the eastern slope of the Santa Rita Mountains, within the historic Helvetia-Rosemont Mining District in Pima County, Arizona. The proposed mine and related facilities (the Project) will be located on a mixture of private and National Forest System land, and a small amount of state land.

The Project involves the development of an open pit mine with ore processing facilities consisting of both milling and copper leaching. Conventional heap leach technology will be used at the site along with a “dry stack” tailings storage method associated with the milling process. Details of the mine operation are provided in the Rosemont Project Mine Plan of Operations (July 2007). The anticipated life of the mine is 20 years, following which the areas disturbed by mining activities will be reclaimed. A copy of a map depicting the configuration of the Project after 20 years is attached hereto.

At its rim, the ultimate open pit will be about 6,500 feet across north to south, about 6,000 feet across east to west, and will be between 1,800 to 2,900 feet deep. The total land surface of the pit (at pre-mine elevation) is about 700 acres. Approximately 80 percent of the pit is located within Rosemont’s private land, which consists of patented lode mining claims with extralateral mineral rights. The remainder of the pit is on National Forest System land, on which Rosemont holds unpatented lode mining claims. Notably, the central portion of the pit is within Rosemont’s private land, while National Forest System land is located primarily along the southern and southeastern pit edges.

In connection with the Mine Plan of Operations, Rosemont prepared and submitted a post-mining reclamation plan to the Forest Service. In addition, Rosemont submitted a Mined Land Reclamation Plan to the Division of Mined Land Reclamation in the Office of the State Mine Inspector (Mine Inspector) in accordance with Arizona law. The Mine Inspector approved the Mined Land Reclamation Plan in 2009. The Forest Service’s Draft Environmental Impact Statement for the Project identifies the Mined Land Reclamation Plan as one of the major permits required for operation.1

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1 USDA Forest Service, Draft Environmental Impact Statement for the Rosemont Copper Project 41 (Sept. 2011). The Forest Service explained that the Mined Land Reclamation Plan “[a]pplies to reclamation activities at the site” and “[r]equires certification, plan updates, annual reporting, and financial assurance.” Id.
Under Rosemont’s Mined Land Reclamation Plan, the open pit will not be backfilled. The pit instead will be secured by a perimeter fence and interior earthen berm, which also provides visual mitigation. Groundwater flow modeling completed by Montgomery & Associates in 2009 indicates that the open pit will create a hydraulic sink and that a pit lake will develop over several decades. This condition is viewed as beneficial because it ensures long-term containment of pit water and protection of local and regional groundwater aquifers in accordance with Arizona’s aquifer protection program.\(^2\)

Nevertheless, certain commenters (e.g., Pima County) contend that the Forest Service should require, as part of Rosemont’s plan of operations, that the open pit be backfilled with waste rock removed from the pit and tailings produced by the concentration of ore. Although pit backfilling is rarely required in circumstances analogous to this Project due to various technical, economic and environmental constraints, apparently backfilling is being seriously considered by the agency.

As explained below, however, the Forest Service lacks authority to override Arizona law and regulate the manner in which Rosemont’s private land is reclaimed. The Forest Service’s authority is limited to reasonable regulation of mining activities occurring on National Forest System land. The agency has no jurisdiction over private land uses. Instead, that authority rests with the Mine Inspector and is governed by Arizona law. Consequently, the imposition of a backfilling requirement as a condition in Rosemont’s plan of operations would be unlawful.

Even if such authority existed, the imposition of such a requirement would violate the Takings Clause of the Fifth Amendment, which provides that private property shall not be taken for public use without just compensation. It is well established that “where the government requires an owner to suffer a permanent physical invasion of his property – however minor – it must provide just compensation.”\(^3\) Here, Rosemont would be compelled to use its private property to store waste rock and tailings, directly interfering with future mineral development and related uses of the property. This is functionally equivalent to the classic taking in which the government directly appropriates private property for its own use, and would violate the Constitution.

For these reasons, pit backfilling is not a viable option. Frankly, we are perplexed by the Forest Service’s consideration of pit backfilling given the Forest Service’s limited authority and the takings implications of such a requirement.

II. Applicable Statutes and Regulations

A. Private and State Land

Arizona’s Mined Land Reclamation Act, A.R.S. § 27-901 et seq., was enacted in 1994 and provides a comprehensive program governing the reclamation of private and

\(^2\) A.R.S. § 49-241- § 49-252.

state land disturbed by mining activities. Under the Act, owners and operators of mining units undertaking activities causing a surface disturbance greater than five contiguous acres must obtain approval of a reclamation plan and financial assurance mechanism by the Mine Inspector.\(^4\) Reclamation plans are subject to public notice and comment; any person who may be adversely affected by the plan may submit a written objection.\(^5\) A public hearing may be held if there is sufficient public interest.\(^6\) An applicant is also required to submit a financial assurance mechanism within 60 days from plan approval, which is also subject to review and approval.\(^7\)

In evaluating the sufficiency of a reclamation plan, the Mine Inspector is required to consider the “technical and economic practicability of the proposed reclamation measures, taking into account the site-specific circumstances at the mine unit and the proposed post-mining land use objectives.”\(^8\) Notably, backfilling or returning material to an open pit is not required where backfilling is “impracticable” and provided that public access to the pit is restricted by fencing or other institutional controls.\(^9\) In determining impracticability, A.R.S. § 27-975(B) requires the Mine Inspector to consider the following six factors:

1. The cost to perform the reclamation;
2. The topography of the site;
3. The geology and stability of the site;
4. The time required to perform the reclamation;
5. The consumption of resources required to perform the reclamation; and
6. The impact on future access to mineral resources.

In circumstances where mine activity occurs on private and adjacent public lands, the statutes contemplate coordination between the Mine Inspector and the federal land management agency in order to avoid duplication of efforts in inspection and enforcement.\(^10\) Any reclamation plan or financial assurance mechanism approved by a federal land management agency must be “consistent with the requirements of state law” and may only supersede a state reclamation plan if a request for such action is expressly

\(^4\) See A.R.S. § 27-921.
\(^5\) A.R.S. § 27-929.
\(^6\) A.R.S. § 27-929(D).
\(^7\) A.R.S. § 27-992; see also A.A.C. R11-2-801- R11-2-822.
\(^8\) A.R.S. § 27-973(B).
\(^9\) A.R.S. § 27-975(A).
\(^10\) A.R.S. § 27-932(A).
made by the owner/operator of the project and upon subsequent approval of the Mine Inspector. 11

B. National Forest System Land

The Mining Law of 1872 (Mining Law), codified at 30 U.S.C. §§ 21-42, declares that “all valuable mineral deposits in lands belonging to the United States,” as well as “the lands in which they are found,” are “free and open” to exploration, occupation and purchase. 12 The Mining Law also allows citizens to locate and patent lode and placer mining claims and to locate and patent non-mineral lands for mill sites. 13 It created a system that is self-initiated, i.e., no federal permit or approval is necessary to locate a mining claim. 14

Under the Mining Law, a mining claim locator has the right to occupy the claim for the exploration and development of minerals, and for uses reasonably related thereto. For example, in Shumway, which involved a dispute with the Forest Service over the occupancy of unpatented mill site claims, the Ninth Circuit held that the Shumways “had a possessory right to their mill sites” and “were not only permitted, but until their right to a patent vested, required to use and occupy the mill sites for milling purposes, and were entitled to have a residence, equipment, materials, tools, and other property on the site incident to milling operations.” 15

The Organic Act of 1897 granted the Forest Service authority to promulgate regulations for the protection of National Forests. 16 The Act also imposed limits on that authority with respect to mining-related activities, requiring that no regulation may “prohibit any person from entering upon the national forests for all proper and lawful purposes, including that of prospecting, locating and developing the mineral resources thereof.” 17 Thus, the Forest Service may “adopt reasonable rules and regulations which

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11 A.R.S. § 27-932(B); see also A.A.C. R11-2-204.
12 30 U.S.C. § 22; see also United States v. Shumway, 199 F.3d 1093, 1098 (9th Cir. 1999).
14 See, e.g., Union Oil Co. v. Smith, 249 U.S. 337, 346 (1919); Davis v. Nelson, 329 F.2d 840, 845 (9th Cir. 1964).
15 Shumway, 199 F.3d at 1103; see also id. at 1105 (“The owner of a mining or mill site claim does not need a patent, or a vested right to issuance of a patent, to possess and use the property for legitimate mining or milling purposes.”); United States v. Richardson, 599 F.2d 290, 292-93 (9th Cir. 1979) (The Mining Law “granted a locator broad possessory rights,” which have been “consistently recognized so long as the uses were incident to prospecting and mining.”)
16 16 U.S.C. § 551; see also Shumway, 199 F.3d at 1106.
17 16 U.S.C. § 478; see also Siskiyou Regional Educ. Project v. U.S. Forest Serv., 565 F.3d 545, 558 (9th Cir. 2009); Okanogan Highlands All. v. Williams, 236 F.3d 468, 477-78 (9th Cir. 2000); Shumway, 199 F.3d at 1106.
do not impermissibly encroach upon the right to the use and enjoyment of [mining] claims for mining purposes.”

Pursuant to this authority, the Forest Service has adopted regulations, currently codified at 36 C.F.R. subpart 228, setting forth “the rules and procedures for the use of the surface of National Forest System lands in connection with operations authorized by the [Mining Law].” These regulations require that miners obtain approval of a plan of operations prior to conducting any activities that “might cause significant disturbance of surface resources.”

A plan of operations describes the type of operations proposed and the manner in which they will be conducted. Mining operations must be conducted, “where feasible,” in a manner that “minimize[s] adverse environmental impacts on National Forest surface resources.” This regulation sets forth various requirements that must be satisfied for environmental protection, including reclamation. The plan of operations must describe the measures that will be taken to meet these requirements. In approving the plan of operations, the Forest Service must “analyze the proposal, considering the economics of the operation along with the other factors in determining the reasonableness of the requirements for surface resource protection.”

With respect to reclamation, the Forest Service’s regulations state that “[u]pon exhaustion of the mineral deposit or at the earliest time during operations,” the operator shall, “where practicable, reclaim the surface disturbed in operations.” Among other things, the operator must take measures to “prevent or control onsite and off-site damage to the environment and forest surface resources” including the “reshaping and revegetation of disturbed areas, where reasonably practicable.” The basic goal, according to the Forest Service Manual, is to achieve a safe and ecologically stable condition and land use consistent with long-term forest land and resource management plans and local environmental conditions, including applicable “State air and water

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18 United States v. Weiss, 642 F.2d 296, 299 (9th Cir. 1981); see also Shumway, 199 F.3d at 1107 (Under Weiss, “the Forest Service may regulate use of National Forest lands by holders of unpatented mining claims ... but only to the extent that the regulations are ‘reasonable’ and do not impermissibly encroach on legitimate uses incident to mining and mill site claims.”); Okanogan Highlands, 236 F.3d at 478 (quoting and following Shumway and Weiss in rejecting challenge to Forest Service’s approval of plan of operations for gold mine).
19 36 C.F.R. § 228.1.
20 Id. at § 228.4.
21 Id.
22 Id. at § 228.8 (emphasis added).
23 Id. These requirements also include compliance with applicable air quality, water quality, and solid waste standards, as well minimizing impacts to scenic values, fish and wildlife habitat, and roads, again “to the extent practicable.”
24 Id. at § 228.5(a).
25 Id. at 228.8(g) (emphasis added).
26 Id. at 228.8(g)(4) (emphasis added).
quality requirements." 27 When required, an operator must furnish a bond or other financial assurance with to ensure compliance with his reclamation plan. 28

Consistent with Arizona’s Mined Land Reclamation Act, the Forest Service’s regulations and manual contain provisions for cooperation in circumstances where there are multiple agencies with jurisdiction over mining operations. The Forest Service’s policy is to utilize cooperative agreements to eliminate duplicative bonding and conflicting reclamation requirements. 29 Furthermore, the agency’s regulations provide that “certification or other approval issued by State agencies or other Federal agencies of compliance with laws and regulations related to mining operations will be accepted as compliance with similar or parallel requirements of these regulations.” 30

III. Analysis

As stated in the Introduction, approximately 80 percent of the open pit is located on Rosemont’s private land where the primary ore body is located, including the central portion of the pit area. National Forest System land is located primarily along the southern and southeastern edges of the pit. The National Forest Land inside the pit cannot be backfilled without first requiring Rosemont to backfill its private property. Stated another way, if the pit is backfilled, no National Forest System land would be included in the area backfilled until the entire pit is nearly full. Furthermore, in the case of partial backfilling, no National Forest System land associated with the pit would actually be covered – only Rosemont’s private land, including any undeveloped mineral resources.

Under these circumstances, the Forest Service lacks legal authority to require Rosemont to backfill the pit, and, moreover, such a requirement would violate the Takings Clause of the Fifth Amendment.

First, the Forest Service cannot override Arizona law and impose its own reclamation standards and requirements on mining activities occurring on private land. As stated, Arizona has enacted a comprehensive statute, the Mined Land Reclamation Act, which governs the reclamation of private and state land disturbed by mining. 31 That statute governs the reclamation of Rosemont’s private land, including the patented mining claims that contain the bulk of the ore body and, consequently, the primary area that will be mined. Under Arizona law, backfilling is not required where it is impracticable, which is determined on the basis of six specific factors. 32

27 FSM 2840.3.
28 36 C.F.R. § 228.13.
29 FSM 2846.
30 36 C.F.R. § 228.8(h).
31 A.R.S. § 27-901 et seq.
32 A.R.S. § 27-975(B).
The Mine Inspector approved Rosemont’s Mined Land Reclamation Plan for the Project in 2009. That plan governs and controls Rosemont’s reclamation of its private land. Backfilling of the open pit is not required under this plan. The elements of the plan cannot be superseded unless Rosemont requests that such action be taken and it is approved by the Mine Inspector. And as previously explained, the Forest Service’s surface use regulations state that the state reclamation plan will be accepted as compliance with any reclamation requirements developed for adjoining National Forest System land. Having adopted this regulation, the Forest Service must comply with it.

Second, the Forest Service has not been delegated authority to regulate mining or, for that matter, any other land use activity occurring on private land. As explained, the Organic Act grants the Forest Service authority to regulate the occupancy and use of the National Forests, subject to the rights of miners to occupy and use National Forest System land for mining-related purposes. The agency’s regulations likewise apply to the “use of the National Forest System lands” under the Mining Laws. They provide no basis to regulate the use of private land. Consequently, if the Forest Service imposed backfilling as a reclamation requirement – regardless of whether full or partial backfilling is required – the agency would be ignoring its limited authority under the Organic Act and asserting jurisdiction over the manner in which private land is used, creating a square conflict with Arizona law (and its own regulations) in the process.

Finally, requiring Rosemont to backfill all or a portion of the pit would violate the Takings Clause of the Fifth Amendment by forcing Rosemont to suffer a permanent physical invasion of its private property without compensation. Although the classic taking involves the transfer of property to the government by eminent domain, the Takings Clause applies to other government actions that effectively achieve the same result. Thus, government actions that are functionally equivalent to the classic taking are subject to the Takings Clause.

The Supreme Court has long held that it is a taking when government regulation forces a property owner to submit to a physical invasion or occupation of his property.

33 A.R.S. § 27-932(B); A.A.C. R11-2-204(A).
34 36 C.F.R. § 228.8(h).
35 See, e.g., Nat’l Ass’n of Home Builders v. Norton, 340 F.3d 835, 852 (9th Cir. 2003) (holding that the Fish and Wildlife Service must follow its policy establishing the criteria for distinct population segments in determining whether the Arizona pygmy-owl population is eligible to be listed under the Endangered Species Act).
36 See, e.g., Okanogan Highlands, 236 F.3d at 478; Shumway, 199 F.3d at 1107; Weiss, 642 F.2d at 299.
37 36 C.F.R. § 228.1.
39 Id.
40 See, e.g., Lingle, 544 U.S. at 538 (“[W]here government requires an owner to suffer a permanent physical invasion of her property – however minor – it must provide just
Thus, in *Loretto v. Teleprompter Manhattan CATV Corp.*, for example, the Court held that a law requiring landlords to permit cable companies to install cable facilities in apartment buildings effected a taking of the landlords’ property, without regard to whether the action achieves an important public benefit.\(^{41}\) The Court explained that “[p]roperty rights in a physical thing have been described as the rights to possess, use and dispose of it. … To the extent that the government permanently occupies physical property, it effectively destroys each of these rights.”\(^{42}\)

Similarly, in *Kaiser Aetna v. United States*, the Court held that the government's assertion of a navigational servitude under the Commerce Clause, which allowed public access to an improved pond, was a taking.\(^{43}\) The Court emphasized that the servitude took the landowner’s right to exclude others, “one of the most essential sticks in the bundle of rights that are commonly characterized as property.”\(^{44}\) The Court also explained:

This is not a case in which the Government is exercising its regulatory power in a manner that will cause an insubstantial devaluation of petitioner's private property; rather, the imposition of the navigational servitude in this context will result in an actual physical invasion of the privately owned marina. ... And even if the Government physically invades only an easement in property, it must nonetheless pay compensation.\(^{45}\)

Here, requiring Rosemont to backfill its pit in order to reclaim National Forest System land would result in a permanent physical invasion of Rosemont’s private property, on which the pit is centered. The placement of hundreds of millions of tons of waste rock and tailings in the pit would directly and substantially diminish Rosemont's property rights by preventing future exploration and development of valuable minerals

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\(^{41}\) *Loretto*, 458 U.S. at 426 (“We conclude that a permanent physical occupation authorized by government is a taking without regard to the public interests that it may serve. Our constitutional history confirms the rule, recent cases do not question it, and the purposes of the Takings Clause compel its retention.”).

\(^{42}\) *Id.* at 435 (quoting *United States v. General Motors Corp.*, 323 U.S. 373, 378 (1945)) (citation and quotation marks omitted).


\(^{44}\) *Id.* at 176.

\(^{45}\) *Id.* at 180; see also *United States v. Causby*, 328 U.S. 256, 265, n. 10, (1946) (“[A]n owner is entitled to the absolute and undisturbed possession of every part of his premises, including the space above, as much as a mine beneath.”); *Pumpelly v. Green Bay Co.*, 13 Wall. (80 U.S.) 166, 181 (1872) (“[W]here real estate is actually invaded by superinduced additions of water, earth, sand, or other material, or by having any artificial structure placed on it, so as to effectually destroy or impair its usefulness, it is a taking, within the meaning of the Constitution.”).
that may exist within the boundaries of Rosemont’s patented mining claims, as well as the claims’ extralateral rights granted under the Mining Law.  

Given that the principal value of Rosemont’s private land within and adjacent to the pit area is based on its mineral resources, forcing Rosemont to fill the pit in connection with reclaiming adjoining federal land (and despite having a reclamation plan approved by the responsible state agency – the Mine Inspector) would directly invade Rosemont’s property interests, violating the Takings Clause. To borrow a metaphor used by the Supreme Court, the Forest Service not simply take a single “strand” from the “bundle” of Rosemont’s property rights: it would chop through the bundle, taking a slice of every strand and leaving Rosemont with bare legal title to the pit area, precluding its future use for mineral development.  

IV. Conclusion

We are perplexed by the Forest Service’s apparent fixation on pit backfilling. Putting aside the obvious technical, economic, and environmental problems that backfilling would create, the Forest Service lacks legal authority to mandate the backfilling (or any other reclamation) of private land under the Organic Act and the agency’s surface use regulations. Instead, those regulations plainly provide that the Forest Service will accept the Mine Inspector’s approval of Rosemont’s reclamation plan under Arizona’s Mined Land Reclamation Act. And even if such authority existed, backfilling would effect a taking of Rosemont’s private property by causing Rosemont to suffer a physical invasion of its property in violation of the Takings Clause of the Fifth Amendment. In light of these serious legal problems, pit backfilling is not an option and should not be considered by the agency.

46 30 U.S.C. § 26; see also, e.g., Del Monte Mining & Milling Co. V. Last Chance Mining & Milling Co., 171 U.S. 55 (1898) (dispute over extralateral rights associated with patented lode mining claims with overlapping side lines).

47 Loretto, 458 U.S. at 435.
May 8, 2012

Mr. Jim Upchurch
Forest Supervisor
Coronado National Forest
30 West Congress
Tucson, Arizona 85701

Re: Response to April 9, 2012 and March 14, 2012 Forest Service Letters

Dear Mr. Upchurch:

In response to your letters dated April 9, 2012 and March 14, 2012, Rosemont presents the following information to specifically respond to your questions enumerated below.

As a preliminary matter, we want to again emphasize that any backfilling alternative will necessarily involve the use of Rosemont’s property, given that 80% of the pit will be located on Rosemont’s private land, including the central portion of the pit area. Rosemont has previously explained why the Forest Service lacks legal authority to override Arizona law and regulate the manner in which Rosemont’s private land is reclaimed. The Forest Service’s authority is limited to reasonable regulation of mining activities occurring on National Forest System land. The agency has no jurisdiction over private land uses. Instead, that authority rests with the Arizona State Mine Inspector and is governed by Arizona law. Consequently, the imposition of a backfilling requirement in Rosemont’s plan of operations would be unlawful.

Moreover, the Forest Service’s imposition of a backfilling requirement would violate the Takings Clause of the Fifth Amendment, which provides that private property shall not be taken for public use without just compensation. Rosemont would be compelled to use its private property to store waste rock and tailings, directly interfering with future mineral development and other private land uses. This is functionally equivalent to the classic taking in which the government directly appropriates private property for its own use, and would violate the Constitution.

Inherent in NEPA and its implementing regulations is a “rule of reason,” which ensures that the information developed during the process is useful to the decision-making process. The CEQ regulations instruct agencies to use the NEPA process identify “the significant environmental issues deserving study and deemphasizing insignificant issues, narrowing the scope of the environmental impact statement.” 40 CFR 1501.1(d). The information the Forest Service has requested on the technical, economic and environmental aspects of pit backfilling (as well as other recent information requests) is inconsistent with NEPA’s rule of reason and appears intended to generate useless information.

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STOCK SYMBOL: AMX TSX - AZC Tucson, Arizona 85740-5130  FAX: (520) 495 3540
Additional questions posed from the April 9, 2012 letter:

*Impacts to the economic viability of mine operations for both partial and full pit backfill. Please provide this information broken out in major work items. The impacts should be described in terms of specific costs such as operator salary, equipment capacity, and haulage costs, and costs of additional equipment and/or equipment depreciation.*

Assuming, for the sake of argument, that the Forest Service has authority to override Arizona law and regulate mining activities on private land, the impacts of backfilling would be very substantial, even under a partial backfill scenario.

A partial pit backfill would be accomplished using one shovel, with mining taking place at a rate of 28 to 29 million tons per year. The total amount of material that would be rehandled is about 84 million tons, which is a substantial amount of material. We expect that such an effort would require 35 months or almost three years to complete the backfill, assuming that operations take place during two work shifts covering 24-hours per day, 365 days per year. To accomplish this Rosemont believes:

- A fleet of 16 trucks (219,665 operating hours) would be required to optimize the shovel productivity.
- Other heavy equipment, such as road graders, water trucks, loaders, and bulldozers, also will be required to manage the hauling operations.
- The number of operators required for this amount of equipment is 110.
- Maintenance personnel for the heavy equipment would total 37.
- Rosemont would have to maintain a safety department, environmental department, human resources, accounting, payroll, accounts payable, purchasing, warehousing, and supervisory staff. The estimated number of salaried personnel required for the support and supervisory roles would be approximately 30.
- Equipment would be moved from the current fleet of shovels, trucks, and support equipment. Of the required equipment fleet, four of the trucks and much of the support equipment will be nearing the end of their useful lives. The trucks will require a “rebuild” to equip it for downhill haulage, which is estimated to cost $1.5 to $2 million per truck, depending upon the operating hours and general equipment condition.
- While Rosemont considers specific mining cost information proprietary, current (2012 dollar) cost updates for mining, less the cost of drilling and blasting, total approximately $0.80 per ton. Support costs would add an additional $0.20 to $0.25 per ton. Thus, total costs for backfill (excluding capital costs) would be approximately $1.00 to $1.05 per ton.
- The estimated total cost for this effort would be $84 million to $88 million excluding capital costs.

A complete waste rock pit backfill would be accomplished using two shovels, with mining taking place at a rate of 56 to 58 million tons per year. The total amount of material that would be rehandled is 881 million tons (1.8 billion tons of material less the material used to cover heap leach facilities and the tailings buttresses and cover). This would require approximately 16 years to complete, again assuming that operations take place during two 12-hour work shifts per day, 365 days per year. To accomplish this we believe:

- A fleet of 16 trucks (1,017,000 operating hours) would be required to optimize the shovel productivity.
• Other heavy equipment, such as road graders, water trucks, loaders, and bulldozers, would be required to manage the hauling operations.
• The number of operators required for this amount of equipment is 125.
• Maintenance personnel for the heavy equipment would total 41.
• Rosemont would have to maintain a safety department, environmental department, human resources, accounting, payroll, accounts payable, purchasing, warehousing, and supervisory staff. The estimated number of salaried personnel required for the support and supervisory roles is approximately 34.
• Equipment would be moved from the current fleet of shovels, trucks, and support equipment. Of the required equipment fleet, 11 of the trucks and much of the support equipment would be nearing the end of their useful lives. All but five of the trucks will need to be replaced at an estimated cost (in current dollars) of $3.5 million per truck. The five remaining trucks will need to be rebuilt at a cost of $1.5 to $1 million per truck.
• While Rosemont considers specific mining cost information proprietary, current cost updates for mining less the cost of drilling and blasting total approximately $0.80 per ton. Support costs would add an additional $0.26 to $0.33 per ton. Thus, total costs for backfill (excluding capital costs) are $1.06 to $1.13 per ton.
• The total cost for complete waste rock pit backfill will be $934 million to $996 million, excluding capital costs.

Finally, complete backfill of material using existing equipment would be impossible; large haulage and loading equipment cannot drive on the tailings. However to provide the Forest Service with an order of magnitude for scale of the operations required, Rosemont’s mining consultants have prepared an analysis assuming that loading and haulage could take place on the tailings stack in a manner similar to the waste rock.

If this scenario were technically possible, a complete pit backfill would be accomplished using three shovels, mining at a rate of 30 million tons per year. The total amount of material to be rehandled is 1,850 million tons. This would require approximately 22 years to complete, again assuming that operations take place during two 12-hour work shifts per day, 365 days per year. To accomplish this we believe:

• A fleet of 28 trucks (1,858,000 operating hours) would be required to optimize the shovel productivity.
• Other heavy equipment, such as road graders, water trucks, loaders, and bulldozers, would be required to manage the hauling operations.
• The number of operators required for this amount of equipment is 190.
• Maintenance personnel for the large equipment would total 64.
• Rosemont would have to maintain a safety department, environmental department, human resources, accounting, payroll, accounts payable, purchasing, warehousing, and supervisory staff. The estimated number of salaried personnel required for the support and supervisory roles is approximately 40.
• Equipment would be moved from the current fleet of shovels, trucks, and support equipment. All but five of the trucks and much of the support equipment would be nearing the end of their...
useful lives. The replacement cost of each truck (in current dollars) is about $3.5 million, five of the trucks will require being rebuilt.

- While Rosemont considers specific mining cost information proprietary, current cost updates for mining less the cost of drilling and blasting total approximately $0.80 per ton. Support costs would add an additional $0.26 to $0.33 per ton. So total costs for backfill (excluding capital costs) are $1.06 to $1.13 per ton.

- The total cost for a complete pit backfill this would be $1,961 million to $2,091 million excluding capital costs.

Impacts to the ability to conduct concurrent reclamation activities. Please be specific as to where in the project area concurrent reclamation would be affected and why and how these effects could be mitigated.

Under a partial backfill scenario, material would be mined between the 5500 foot elevation and the 5300 foot elevation on the eastern waste rock dump and transported back into the pit. Thus, the eastern waste rock dump would be reclaimed after backfilling operations are completed. Concurrent reclamation could be completed as contemplated on the northern and eastern edge of the tailings facilities, the southern waste rock dump and a portion of the waste rock dump below the 5300 foot elevation. No mitigation is planned for this additional disturbance.

Under the complete waste rock backfill scenario, concurrent reclamation activities would be completed on the tailings buttress areas not integrated with waste rock or the eastern and northern buttress areas. All other reclamation activities would necessarily be postponed until the completion of backfill operations. No mitigation has been planned for this disturbance and the cost of reclaiming the area is unknown.

Under the complete backfill scenario, no concurrent reclamation activities would be undertaken, and reclamation would necessarily be postponed until the completion of backfill operations. No mitigation is planned for this additional disturbance.

Again, this may have a significant impact on reclamation bonding requirements and estimated bonds. As stated, Rosemont’s strategy depends upon concurrent reclamation to maintain bonds at acceptable levels. The Arizona Mine Inspector approved Rosemont’s Mined Land Reclamation Plan for the project in 2009. The Forest Service’s surface use regulations state that the State of Arizona reclamation plan will be accepted as compliance with any reclamation requirements developed for adjoining National Forest System land. See 36 CFR. 228.8(h). Pit backfilling is not consistent with the state reclamation plan, and it is uncertain whether the reclamation plan approved by the Mine Inspector will apply to Rosemont’s private land. If the Forest Service takes control of Rosemont’s private land and mandates pit backfilling, the bonding requirement may increase to unsustainable levels.

Duration and nature of activities that could result in extended impacts to resources such as air quality, public health and safety, night skies, socioeconomic factors (including quality of life issues), noise and biological resources (i.e., disturbance from noise, lights, etc.). Provide justification for duration of various activities an examples.

The Rosemont site would remain an active mining area for the duration of the backfill activities. This would include traffic for employees for two shifts per day 365 days per year. Deliveries of materials and supplies necessary for mining activities, such as fuel, tires, lubricants, parts and equipment, would occur
as well. Mining and loading activities associated with transporting waste rock (and tailings) would occur outside of the open pit and closer to the edge of the facilities. Consequently, environmental impacts such as fugitive dust emissions, lights, and noise may be more severe. Moreover, impacts from mining would continue an additional three to 22 years, depending on which the backfill scenario is evaluated, with nothing being produced, nothing being sold, and generating no positive cash flow. Consumption of fuels and generation of noise, dust, light, and traffic would continue throughout the entire period. Thus, we anticipate that the environmental impacts of backfilling will be very similar to the impacts resulting from mining operations but may be more pronounced due to the location of the activities.

What is uncertain is the additional impacts that would result under the complete waste rock backfill and complete backfill scenarios given the placement and subsequent excavation of all or a substantial portion of the waste rock dump and tailings facilities. Obviously, these areas will be denuded and severely damaged under either scenario, and whether and how they would be reclaimed is unknown and probably cannot be determined with any degree of certainty. It is possible that portions of these areas may be permanently impaired and never return to a healthy, functioning ecological condition. The short-term and long-term impacts of a backfill alternative may therefore be greater than would result under Rosemont’s concurrent reclamation program in the Preferred Alternative.

Impacts addressing the future possibility to further expand mining operations based on market conditions or actual production results from partial or full pit backfill.

Any material placed at the bottom of the pit and over the remaining mineralized material would increase costs, and reduce the value of the material left in the bottom of the pit by restricting access. Indeed, if the Forest Service imposes a backfilling requirement and orders the pit filled with waste rock, it is unclear whether and how Rosemont’s property could be used in the future, should an increase in metals prices, new technological advances or other circumstances make additional resource uses viable. For this reason, such an action by the Forest Service would result in a taking of the future resource value of Rosemont’s private property.

Questions (with additional specificity) from the March 14, 2012 letter:

1. Previous reports, dated in 2010, state that backfill material would be pulled from the side of the waste rock facility closest to the pit.
   a. Is that assumption still current in light of the most recent plans for the Preferred Alternative?

   No. Based on the configuration required for the Preferred Alternative, waste rock could not be removed from the side of the facility closest to the pit. The material closest to the pit is actually covered leach facilities or tailings, which would not be a suitable materials source area for backfill material.

   b. If not, where would the waste rock be pulled from now and what is the rationale for changing this location? Would you consider backfilling with heap leach material and/or tailings, and if not, can you provide your justification for not considering these options?
Waste rock would be excavated from the eastern portion of the waste structure. This material is suitable for backfill and mining-related uses. We do not consider heap leach material and/or tailings suitable for backfill for a number of reasons:

- Heap leach facilities are facilities that are engineered and constructed to meet specific stability requirements that were vetted and have been permitted through ADEQ. Additionally, the heap leach facilities are constructed on liners that are not intended to support future excavation activities.

- When a heap leach facility is excavated, low pH solutions that remain within the dump matrix will be exposed to the elements, personnel, and environment. This solution, along with water used to control dust during excavation or during storm events, could cause the amount of solutions draining through the facility to increase. When coupled with the unknown effect that excavation-related activities could have on the liners, this does not seem to be a prudent risk.

- Tailings are not considered suitable for pit backfill. Excavating and rehandling fine-grained materials placed in a facility that has been engineered to ensure stability and minimize erosion also increases the potential for environmental impacts. Moreover, dust generated from excavation and transportation activities can only be managed through dust suppression techniques that could require significant additional water consumption.

- The stability of the tailing management facility has been engineered using the buttresses, construction compaction, and water management. Future excavation is not part of the design elements for those facilities.

- The heap leach has been constructed using specific construction requirements to protect the liners under the leach materials. These protective specifications do not include contingencies for mining the heap leach facility.

- Finally, heap leach material and tailings are considered process materials and disposal in the pit would require detailed analysis and permitting from ADEQ. To Rosemont’s knowledge, ADEQ has never permitted the backfilling heap leach material, tailings or waste rock below local groundwater levels, or recognized pit backfilling as a “Best Available Demonstrated Control Technology.” Further, the use of tailings, waste rock, or spent heap leach material as backfill has not been contemplated in the establishment of the monitoring plans or closure concepts presented.

c. **Please specify whether the location of backfilled materials applies to complete and/or partial backfill.**

Based on your question, this information specifically applies to partial pit backfill. However, the discussion above is applicable to all pit backfill scenarios.

2. **Previous calculations, as well as more recent modeling, have made estimates of how much material would be able to be backfilled into the pit while still maintaining the hydraulic sink. For instance the recent modeling by Montgomery & Associates and Engineering Analytics estimates**
that from 3.58 to 4.28 billion cubic feet could be backfilled depending on the backfill elevation, representing approximately 12 to 14% of the total stacked material (i.e., waste rock tailings, and heap leach).

a. Are these the best estimates available for the volume of material that could be backfilled and still maintain a hydraulic sink?

The previous estimates of the volume of material that could be backfilled and still maintain a hydraulic sink was developed by using mine planning software. The estimates that were calculated in the groundwater models are direct measurements of open space in the pits and does not include ramps, swell factors, placement requirements, etc. The specific volume that was estimated did not incorporate any of the factors of safety that would be afforded by incorporating the sensitivity analysis. Rosemont has calculated the elevation using the sensitivity analysis in the hydrologic studies to determine lowest water elevations to maintain the hydrologic sink. Material elevations were kept below this lowest water elevation when volumes were calculated.

b. Please provide some context with this volume, to understand what this volumetric change would mean for the Barrel alternative. What height or footprint difference would removal and backfill of this volume make?

The “footprint difference,” if the hydraulic sink is maintained, lowers the elevation of the eastern dump by approximately 200 feet. There would be no change to the overall operations footprint.

c. Please address the safety factor (be specific) that is considered in the modeling analysis in order to ensure maintenance of a hydraulic sink. For instance, under the modeled scenarios, how deep would the pit lake be while still maintaining the hydraulic sink?

Hydrogeologic modeling results for the anticipated pit lake included sensitivity analysis that showed the variance associated with changes in precipitation, evaporation, seepage, and other inputs. At the upper end of the evaporation range (30% over “normal”), the anticipated pit lake is approximately 3945 to 4012 feet in elevation. To be conservative and ensure that partial backfilling will not to not eliminate the hydraulic sink, a 3825 foot elevation was selected for the partial pit backfill analysis.

3. What volume of material would be backfilled in a full pit backfill scenario? How is the volume calculated and does it vary by lithology?

The volume does not vary by lithology, rock density is an average for the deposit. The material for the backfill in situ density is 11.85 cubic feet per ton, with a swell factor of 1.3. The full pit backfill scenario incorporates 812,489,000 cubic yards of material that would be compacted into the pit. The material would be stacked to an elevation of 5300 feet with an ultimate overall slope above the pit rim of 2:1 or 26 degrees. We note that this 2:1 resulting slope is steeper than the 3:1 outslopes proposed for the Rosemont ridge landform in the original MPO, the 3 or 3.5:1 slopes proposed for the phased tailings alternative, and the outslopes proposed in the preferred “Barrel Only” alternative.
4. **Previous reports, dated in 2010, infer that it might only take 3 years in addition to the 20 year mine life to complete backfill**

There appears to be confusion between “backfill,” “partial backfill with hydraulic sink retention,” “complete waste rock backfill,” and “total backfill including rehandling of waste rock, tailings, and spent leach rock.” Because of the volumes of material involved, the cost implications of any of these scenarios are substantial and, in Rosemont’s view, represent unwarranted interference with the lawful exercise of its mining rights and use of its private property.

   a. **Can you confirm how long it would take to complete a partial backfill that would still maintain a hydraulic sink? Please explain the aspects that are considered in this time calculation (hours of operation, equipment used, number of haulage trips, etc.).**

   Again, the estimate for partial backfill with retention of hydraulic sink is approximately three years, assuming that no unforeseen problems are encountered. This estimate is based on approximately 219,665 operating hours using 1 trucks, and one shovel for the main mining operation. The mining operation support equipment, administration staff, maintenance staff, etc., are not included.

   b. **Can you specify how long it would take to complete a full pit backfill? Please explain the aspects that are considered in this time calculation.**

   A complete backfill is estimated to take 22 years, assuming that operations take place during two 12-hour work shifts per day, 365 days per year and no problems are encountered. Approximately 30 million tons of material would be excavated and transported to the pit each year. Time is calculated on haulage cycles, distances, time, rates for loading and dumping, and the time associated with downhill haulage loaded into an open pit.

5. **In order to complete a full or partial pit backfill, logistically, are there operational changes that would result in changes to the overall environmental effects? For instance, what changes in timing of reclamation activities, additional equipment operation, additional traffic, etc. would be expected? Please specify which operational changes and environmental effects apply to each backfill scenario.**

   Under a partial backfill scenario, material would be mined between the 5500 foot elevation and the 5300 foot elevation on the eastern waste rock dump and moved back into the pit. Concurrent reclamation could be completed as contemplated on the northern and eastern edge of the tailings facilities, the southern waste rock dump and a portion of the dump below the 5300 foot elevation. There would be no significant operational changes other than mining operations shifting from the pit to the waste rock dump area. Environmental effects would be extended by three years. In addition, the excavation and transportation activities would be concentrated along the eastern waste rock dump, which may increase certain environmental impacts (e.g., dust, light and noise), as previously discussed. Under this scenario, the ultimate elevation for partial pit backfill would be 382 feet.

   Under the complete waste rock backfill scenario, concurrent reclamation activities would be completed on the tailings buttress areas not integrated with waste rock on the eastern and...
northern buttress areas. All other reclamation activities would be suspended pending the completion of pit backfill. All impacts would extend for approximately 16 years for the mining phase. During this period, excavation and transportation activities would be concentrated along the eastern portions of the mine area and away from the pit, which may increase certain environmental impacts (e.g., dust, light and noise), as previously discussed. Presumably there would be an additional period of activity involving reclamation of the denuded area while the area that formerly contained the waste rock dump is recontoured, seeded, and reclaimed. As stated above, it is uncertain whether this area will return to a healthy ecological condition. Under this scenario, the ultimate backfill elevation in the pit would be about 490 feet.

This will have an impact on the bonding requirements and estimated bonds. Rosemont’s strategy depends upon concurrent reclamation to maintain bonds at acceptable levels. Backfilling pushes the bonding requirement to unsustainable levels while still requiring concurrent reclamation expenditures.

Under the complete backfill scenario, no concurrent reclamation activities would be completed. All impacts would extend for 22 years beyond the mining phase and then presumably for an additional period while reclamation of the now denuded area for the material that has now been removed is recontoured, seeded, managed, etc. The ultimate backfill elevation in the pit will be 5300 feet, exceeding the 5050 ground elevation by 250 feet.

Bonding requirements and estimated bonds under both the complete waste rock backfill scenario and the complete backfill scenario are likely to change significantly. Arizona Department of Environmental Quality approved the closure concept for the heap leach and set a bonding amount which does not include moving the heap or filling in the pit. The Arizona Mine Inspector approved Rosemont’s Mined Land Reclamation Plan for the project in 2009. Pit backfilling is not consistent with that reclamation plan, and it is uncertain whether the reclamation plan approved by the Mine Inspector will apply to Rosemont’s private land. Rosemont’s strategy depends upon concurrent reclamation to maintain bonds at acceptable levels. Backfilling pushes the bonding requirement to unsustainable levels while still requiring concurrent reclamation expenditures.

6. Please provide the most recent estimate for the economic costs of conducting a partial backfill that would still maintain a hydraulic sink.

Assuming that the bonding requirements did not change, the overall cost is between $84 and $8 million excluding additional capital costs.

7. Please provide a recent estimate for the economic costs of conducting a full pit backfill.

The cost for a waste rock backfill will be $933 to $996 million exclusive of capital costs and changes to bonding requirements. The cost for a full pit backfill will be $1,961 million to $2,091 million exclusive of capital costs and changes to bonding requirements.

We hope that the responses along with the attached memo from our mine planning consultants’ answers your questions regarding pit backfill.
Regards,

Original signed by:

Katherine Ann Arnold
Vice President, Environmental and Regulatory Affairs

Cc: Chris Garrett, SWCA
File

Doc. No. 031/12-15.3.1
6959305
Memorandum

From: Bob Fong, Marc Schulte
To: Fermin Samorano, Rosemont Copper
Date: December 10, 2009
Re: Backfill Pit to 3825 ft Elevation - Revision

This memorandum is a follow-up to a previous version ‘Memo - Rosemont - Backfill Pit to 3825.docx’, issued on November 17, 2009, which summarizes the findings from a scoping level study on an option to rehandle some of waste dump to backfill the pit at the end of mine life for mine closure and reclamation purposes. The pit is required to be backfilled to the 3825 ft elevation. The pit and waste dump designs and layouts are those from the Rosemont Copper 2009 Feasibility (Feasibility) study. The top of the waste dump is 5470 ft elevation.

This memorandum version includes the contents of the previous version, as well as an evaluation of an alternate strategy.

ASSUMPTIONS

The assumptions for this assessment are provided by Rosemont Copper. Assumptions that are not available from Rosemont are developed by MMTS, based on their best knowledge.

Excavation of the waste dump will be south of the leach pad area. The leach pad design has undergone updates since the Feasibility study, and the latest version has not been provided to MMTS. The outline of the north pad from the Feasibility study is assumed for this study.

All waste material from excavated from the dump will be suitable for backfilling the pit.

One cable shovel from the mine equipment fleet will be used for excavation of the waste dump. The existing truck fleet for hauling the material from the dump to the pit will be the 793C trucks.

Waste material in-situ density is 11.85 ft^3/ton, and the swell factor in the dump is 1.3.

SUMMARY OF FINDINGS

The area of the dump that will be excavated is on the west side. The bottom of the cut will be the 5200 ft elevation. Figure 1 shows the excavated area and the backfill to the 3825 ft elevation in the pit.

The total material quantity required to backfill the pit to the 3825 ft elevation is calculated to be 46 M-cu. yds (loose), equivalent to 80 M-tons. An allowance of 5% is added to the fill quantity to widen areas on the in-pit road for runaway ramps. Total material to be re-handled from the waste dump is 84 M-tons. A
single shovel mining at a rate of 28 to 29 M-tons per year will require 35 months, or almost 3 years to complete the backfill requirement.

The trucks will excavate the waste dump on 50 ft benches starting on the 5400 bench. This first bench will be 70 ft high and may require a dozer to cut it down to the shovel operating bench height. The trucks will haul the material from the dump to the pit, following the in-pit ramp to the 3825 ft elevation. The material will be end dumped at that location until a pad can be established. The pad will be extended out to its entirety at that elevation.

![Figure 1: EXCAVATION AREA AND BACKFILL IN-PIT](image)

The downhill hauls into the pit will be stressful on the loaded trucks, having to negotiate 3 switchbacks and -10% grades. Truck simulations were run on the haulage profiles, and they indicate that maximum speed of the trucks on the in-pit ramp will be approximately 13 mph, in 2nd gear. They will be further...
slowed down at each switchback to 7 mph for safety. The haulage routes from the top and bottom benches of the waste dump are shown in Figures 2 and 3.

The haulage productivities are estimated to be 379 t/hr for the top of the waste dump at the 5400 bench, and 419 t/hr at the bottom, 5200 bench. They are summarized in Table 1, and are used to estimate the total required trucks.

Figure 2: HAULAGE FROM 5400 BENCH TO 3825 ELEV IN-PIT DUMP
Figure 3: HAULAGE FROM 5200 BENCH TO 3825 ELEV IN-PIT DUMP
Table 1: HAUL PRODUCTIVITIES BY BENCH

<table>
<thead>
<tr>
<th>Bench Elev.</th>
<th>Quantity k-tons</th>
<th>Cum. Quantity k-tons</th>
<th>Haul Prod. t/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>5450</td>
<td>8,938</td>
<td>8,938</td>
<td>379</td>
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<td>5400</td>
<td>18,435</td>
<td>27,373</td>
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<tr>
<td>5300</td>
<td>16,277</td>
<td>62,338</td>
<td>411</td>
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<tr>
<td>5250</td>
<td>12,977</td>
<td>75,315</td>
<td>419</td>
</tr>
<tr>
<td>5200</td>
<td>8,720</td>
<td>84,036</td>
<td></td>
</tr>
</tbody>
</table>

The required truck operating hours are summarized by year in Table 2. It is estimated that 16 trucks will be required in the first 19 months when the top half of the dump is excavated, and 15 trucks for the remainder of the project.

Table 2: REQUIRED HAULAGE HOURS AND UNITS

<table>
<thead>
<tr>
<th>Post Mining Year</th>
<th>Rehandle Quantity k-tons</th>
<th>CAT 793C Truck Fleet Oper. Hrs</th>
<th>Units</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>28,774</td>
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<td>16</td>
</tr>
<tr>
<td>2</td>
<td>28,853</td>
<td>72,439</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>26,409</td>
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<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>84,036</td>
<td>211,201</td>
<td>16</td>
</tr>
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</table>
ALTERNATIVE STRATEGY - BACKFILL FROM 4625 ft ELEVATION

To avoid the downhill haul around the switchbacks and reduce the truck hour requirements, the option of backfilling from a higher pit elevation is assessed. More material will be required as a portion will hang up on the highwall above the targeted 3825 ft elevation. This alternative study will determine whether it is feasible to move more material at higher truck productivities and dozer push the spoil pile down to the 3825 ft elevation.

The plan is to haul from the waste dump to the first switchback from the pit rim at 4750 ft elevation and dump a -5% fill access along the pit wall to 4700 ft elevation. From that location, a -5% fill pad is extended into middle of the pit to a final dump elevation of 4625 ft. Figure 4 shows the layout of the accesses and the backfill almost to the 3825 ft elevation. To entirely fill up to the 3825 ft level will require dozer push of over 200 ft vertical elevation.

The total material mined from the waste dump is estimated to be 96 M-cu. yds (loose), more than twice that of the base case where the material is hauled to the 3825 ft elevation. It is estimated that the average haulage productivity is 667 t/hr, compared to an average of 400 t/hr for the haulage to the 3825 ft elevation. This represents approximately 40% less truck hours.
This option does not appear to be feasible as the quantity of material moved eliminates the haulage savings. An additional shovel will also be necessary to complete the project over the 3 year period. Otherwise it will take 6 years to complete with a single shovel, which will prolong the mine closure period and add to the costs. Further closure costs may be incurred if it is necessary to reclaim the backfill material above the 3825 ft level in the pit. This alternative will likely be costlier.

Employing an extended conveyor to dump the waste into the centre of the pit will reduce the amount of material hang up on the highwall. This may be another option worth investigating.

Reference files:

- Haul Estimates for 3825 Backfill Rev.xlsx
- Rehandle Cut 5200_Vols Rev.xlsx
Memorandum

From: Marc Schulte
To: Fermin Samorano
cc: Bob Fong
Date: May 02, 2012
Re: Backfill Pit - All Waste Options

This memorandum is a follow-up to three previous versions:

- 'Memo - Rosemont - Backfill Pit to 3825 - Revision.docx', issued on December 10, 2009
- 'Memo - Rosemont - Backfill Pit to 3825.docx', issued on November 17, 2009
- 'Memo - Rosemont - Backfill Pit to 3825, MPS Update 120215.docx' issued on February 15, 2012

This memo summarizes the findings from a scoping level study on an option to rehandle some of waste dump to backfill the pit at the end of mine life for mine closure and reclamation purposes. Two scenarios are examined:

- Backfilling the pit with all material except the leach pads and tailings facilities.
- Backfilling the pit with all material.

The pit designs and layouts are those from the Rosemont Copper 2009 Feasibility (Feasibility) study. The waste dump designs and layouts are from Tetratech's current 2012 'Barrel Only' waste structure. This waste design is not currently finalized, so the designs shown in this memo are in draft form and may change.

ASSUMPTIONS

The assumptions for this assessment are provided by Rosemont Copper. Assumptions that are not available from Rosemont are developed by MMTS, based on their best knowledge.

Excavation of the waste dump will be from a centroid point in the dump and hauled to the pit entrance. For the first case (leaving tails and leach material), the waste will be hauled down to the 4900 elevation in the pit. For the second case (all material backfilled), the waste will be hauled to the 5050 pit entrance.

All waste material from excavated from the dump will be suitable for backfilling the pit.

Two cable shovels from the mine equipment fleet will be used for excavation of the waste dump. The existing truck fleet for hauling the material from the dump to the pit will be the 793D trucks.

Waste and leach material in-situ density is 11.85 ft^3/ton, and the swell factor in the dump is 1.3. The compacted swell factor in the backfilled pit is 1.25. Tailings in-situ density is 18.36 ft^3/ton. It is assumed that the backfilled tailings will keep this same density.

SUMMARY OF FINDINGS, CASE 1, Everything backfilled except leach and tailings
All the waste areas will be excavated and placed back into the pit, except for the tails and leach structures.

The quantity of waste removed from the waste structure will be 503,022 kyd$^3$. This will translate into 484,260 kyd$^3$ of compacted volume in the pit.

Total tonnage of material to be re-handled from the waste dump is 881 M-tons. Two shovel mining at a rate of 30 M-tons per year will require 15 years to complete the backfill requirement.

The trucks will excavate the waste dump on 50 ft benches starting on the 5650 bench. The trucks will haul the material from the dump to the pit, following the in-pit ramp to the 4900 ft elevation. The material will be end dumped at that location until a pad can be established. The pad will be extended out to its entirety at that elevation. For safety reasons, it may be necessary to build this dump pad at a lower elevation in the pit, below 4900. This circumstance would increase the backhaul cycle times, and add costs that haven't been accounted for in the hauler estimates below.

Figure 1: EXCAVATION AREA AND BACKFILL IN-PIT
Truck simulations were run on a haulage profile from the dump centroid to the 4900 elevation of the pit. The haulage route chosen is shown in Figure 2. The haulage productivities are estimated to be 867 t/hr for all waste haul, and are used to estimate the total required trucks.

Figure 2: HAULAGE FROM WASTE CENTROID TO 4900 ELEV IN-PIT DUMP
The required truck operating hours are summarized by year in Table 1. It is estimated that 16 trucks will be required for the entire backfilling project.

<table>
<thead>
<tr>
<th>Post Mining Year</th>
<th>CAT 793C Truck Fleet</th>
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<tbody>
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<td></td>
<td>Oper. Hrs</td>
</tr>
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<td>1</td>
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<td>69,198</td>
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<td>14</td>
<td>69,198</td>
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<tr>
<td>15</td>
<td>47,775</td>
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<td>16</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,016,550</strong></td>
</tr>
</tbody>
</table>

This option adds ~15 years of costs to the mining activities, thereby delaying the mine closure. It is also questionable as to whether the landscape has actually been improved.

This option also sterilizes any possible economic ore at the bottom of the pit that could potentially be mined in the future.
SUMMARY OF FINDINGS, CASE 2, Everything Backfilled

All the waste areas will be excavated and placed back into the pit.

The quantity of waste removed from the waste, tailings and leach structures will be 1,173,968 kyd³. Of this total, 371,660 kyd³ will be tailings, and 802,308 kyd³ will be waste and leach material. This will translate into 812,489 kyd³ of compacted volume in the pit.

Total tonnage of material to be re-handled from the waste dump is 1,850 M-tons. Three shovel mining at a rate of 30 M-tons per year will require 21 years to complete the backfill requirement.

The trucks will excavate the waste dump on 50 ft benches starting on the 5650 bench. The trucks will haul the material from the dump to the pit. The material will be end dumped at the pit rim until a pad can be established. The pad will be extended out to its entirety at that elevation. 50ft lifts will be placed above the 5050 elevation, up to the 5300 elevation. Overall slope on the waste above the pit rim is 2:1 or 26 degrees.

For safety reasons, it may be necessary to build this dump pad at a lower elevation in the pit, below the pit rim. This circumstance would increase the backhaul cycle times, and add costs that haven’t been accounted for in the hauler estimates below.

Figure 3: EXCAVATION AREA AND BACKFILL IN-PIT
Truck simulations were run on a haulage profile from the dump centroid to the 5050 elevation of the pit, as well as every 50 ft lift above the pit rim. The haulage routes chosen are shown in Figure 4.

The haulage productivities are estimated to average 996 t/hr for all waste haul, and are used to estimate the total required trucks.

For this scenario it is assumed that the shovels and trucks can work on the tailings material, benching it on 50ft lifts. In the current design criteria, the haul trucks cannot operate on the tailings during the construction of this structure, so this criteria would have to change in order to excavate it out by truck and shovel. It may be necessary to mine the tailings material by another method, rather than truck and shovel. Possibly some sort of continuous mining method.

Figure 4: HAULAGE FROM WASTE CENTROID TO BACKFILL DUMP

![Diagram showing haulage routes from waste centroid to backfill dump](image)
The required truck operating hours are summarized by year in Table 2. It is estimated that 19 trucks will be required for the entire backfilling project.

<table>
<thead>
<tr>
<th>Post Mining Year</th>
<th>CAT 793C Truck Fleet</th>
<th>Oper. Hrs</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>19</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>84,436</td>
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<td><strong>Total</strong></td>
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<td><strong>28</strong></td>
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This option adds ~22 years of costs to the mining activities, thereby delaying the mine closure. It is also questionable as to whether the landscape has actually been improved. It may be necessary to reclaim the slopes on the backfilled material, thereby pushing the mine closure out even further.

The dust level in re-handling the dry stack tailings would cause environmental issues that may have to be dealt with over the long term.

This option also sterilizes any possible economic ore at the bottom of the pit that could potentially be mined in the future.
Reference files:

- Productivity Estimates for Pit Backfill, no tails or leach.xlsx
- Productivity Estimates for Pit Backfill, all material.xlsx
- Rosemont Pit Backfill, no tails or leach 120418.fpc
- Rosemont Pit Backfill, all materials, 120418
May 1, 2012

Mr. David Krizek  
Rosemont Copper Company  
P.O. Box 35130  
Tucson, Arizona 85740-5130

Re: Vehicle traffic on tailing surface

Dear David:

Rosemont Copper Company has asked if haul truck traffic, either loaded or unloaded, can travel on top of the dry stacked tailings. This question is based on correspondence from Mr. Derek Wittwer to Mr. Fermin Samorano dated August 19, 2009. In this correspondence, a table was provided that identified set-back distances for equipment near the crest of the dry stacked tailings. The correspondence also indicated that, based on experience at other dry stack tailings facilities, the minimum time to wait prior to driving on the surface is three days, regardless of lift height.

As a clarification to this previous correspondence, AMEC does not recommend haul truck traffic directly on the dry stacked tailings surface. This applies to both loaded and unloaded haul trucks. Light vehicles (pickup trucks) and tracked equipment required for moving the conveyor systems and spreading the “filter cake” should be able to travel on the tailings surface with minimal difficulties. Should haul trucks be required to travel over the tailing surface, road plating and preparation would be required. This plating material can consist of mine waste or other gravel/rock sources that are appropriate to distribute loads from the haulage equipment. Thickness plating for haul truck traffic should be determined based on equipment-specific loads.

If you have any questions or comments, please contact this office, at your earliest convenience.

Sincerely,

AMEC Environment & Infrastructure, Inc.

Ryan T. Baker, P.E.  
Specialty Outside Consultant

R. Michael Smith, P.E.  
Vice President

RTB:rb
APPENDIX C
ROSEMONT
TECHNICAL
MEMORANDUM
AVOIDANCE OF
WASP CANYON
WASH
Rosemont Copper Company

To: Jamie Sturgess, Kathy Arnold
From: Fermin A. Samorano – Mine Manager
CC: 
Date: September 1, 2010
Re: Avoidance of Wasp Canyon Wash

General Comments:

During the review of the smaller pit alternative that entailed avoidance of Wasp Canyon, there were several mining-related issues that had to be addressed. These issues were operational, safety, reserves, and logistics. For this evaluation we had Moose Mountain Technical Services develop a Wasp Canyon Avoidance Pit and calculate lost mineral resources based on the current Stall my pit shell. In addition, Tetra Tech researched the flows into and around the affected area, and Call and Nicholas evaluated the new pit geometry and associated stability issues.

Mining Resources:

In their evaluation, Moose Mountain Technical Services identified a loss of 87,295,000 tons of ore at a grade of 0.39% copper and 0.018% molybdenum when compared to the Rosemont Copper Updated Feasibility study pit. The potential value of the sterilized metal, as approximated by Moose Mountain, is USD $326,652,000 million (undiscounted), using $1.75/lb copper.

At today’s prices, ranging from USD $3.30 to USD $3.50, this would represent potential cash flow losses (undiscounted) of approximately USD $1.2 billion.

The potential losses only takes into account the proven and probable reserves and does not include inferred resources at the USD $1.75 pit shell or the additional resources available at higher copper prices. A detailed study of these resources is beyond the scope of this evaluation, but a Leach’s Grossman run at different copper prices show the potential gain (Moose Mountain September 1, 2010 Memorandum).

The loss of over 87 million tons of sulfide ore would result in an increase in the cost of the project. The initial capital investment for a mining project is substantial, and Rosemont is no exception with an initial capital cost of an estimated $897.2 million. The initial capital investment would be the same even with the smaller pit because the first six phases of mine development would be the same under both pit scenarios. The estimate of initial capital covers the first three years of mine development, which occurs within the first phase of development. For example, the size of the mill is dependent on daily throughput, not total volume of ore, and the number of trucks would be the same because the first six phases and destinations of the smaller pit are identical to the proposed pit.

The way that a large project becomes economically viable is to be able to amortize these significant capital costs over a commensurately substantial ore tonnage. With a fully-sized pit, the capital costs will be spread over the recovery of approximately 546 million tons of sulfide ore (proven and probable), for an
estimated cost of approximately $1.64 per ton of sulfide ore. By reducing the volume of recovered sulfide ore by 87 million tons, the per ton cost increases to approximately $1.95 per ton of sulfide ore, a 19% increase in the cost of production.

Operations:

Water management will still be a significant part of the mine operations in order to avoid operational delays and address any potential safety issues. Specifically, the following projects will need to be implemented regardless of the size of the pit:

1. Storm water diversion above the open pit. For this project we have designed two diversions that route the surface flows around the upgradient portion of the open pit to avoid flooding the operations during significant rain storms throughout the operations.

2. The development of drainages under the waste rock and dry stack landforms that keep water from ponding on the eastern and southern edges of the pit which may cause a saturation of the low-strength Willow Canyon arkose and alluvium geologic formations.

3. Dewatering of the low-strength Willow Canyon arkose and alluvium from the 5,100 foot elevation to the 4,400 ft elevation along the eastern and southern edges of the pit. We have to start dewatering these critical areas before we start to mine in these units for stability and safety.

All three of these water management projects are critical for pit slope stability and safety, particularly on the southern and eastern portions of the pit where the Willow Canyon arkose and alluvium occur. As shown in the attached memorandum by Call and Nicholas, this area of the pit has the lowest strength and therefore requires the shallowest slope angles. Of particular importance to the stability of this area of the pit is that it be dewatered down to the 4,400 ft elevation (Call and Nicholas, 2010).

Because the dewatering of the Willow Canyon arkose and alluvium is so critical to the stability of that portion of the pit, development of the storm water diversion channel around the pit is also necessary. As shown in the attached technical memorandum from Tetra Tech, construction of the designed storm water diversion channel will reduce flows in this area by approximately half (from 588 cfs to 321 cfs in the 100-year/24-hour storm), resulting in a commensurate reduction in surface water volume (from 82.20 to 40.17 acre-feet in the 100-year/24-hour storm event).

In addition to the projects described above, additional infrastructure will need to be established within the Wasp Canyon area. During the development of the individual mine phases we will have three separate haul road crossings, averaging approximately 150 ft in width, across Wasp Canyon to the waste rock dumps in Barrel Canyon. In addition, there are pipelines to and from the heap leach, as well as a main power line and mine power line that will be constructed along the Wasp Canyon haul road corridor (see Attached Figure).

Summary:

Avoiding Wasp Canyon significantly reduces the economics of the Rosemont Copper Project by limiting the recovery of proven and probable ore reserves. The estimate of the sterilization of the ore in the area does not include potential inferred resources.
The avoidance of the wash does not change the operational requirements for the project. We will still have to develop diversions channels for routing water away from the operations, we will have to develop drainages for local waters around the pit edge and we will have to keep the Willow Canyon arkose and alluvium dewatered in this area to protect against high wall failure for the safety of the employees.
1. DESIGN OF THE PLANT SITE AND ASSOCIATED DIVERSIONS AT THE PWTS POND AND ACCESS ROADS COMPLETED BY MJ ENGINEERING.

2. DESIGN OF THE DRY STACK TAILINGS AND ASSOCIATED DIVERSIONS BY AMEC.

3. OPEN PIT OUTLINE BY MOOSE MOUNTAIN.

NOTES:

ULTIMATE ROSEMONT RIDGE LANDFORM (BASE CONCEPT) AND PLANT SITE FACILITIES WITH MODIFIED PIT
MEMORANDUM

From: Bob Fong (MMTS)  
To: Fermin Samorano, Rosemont Copper  
Date: August 30, 2010  
Re: Rosemont Copper - Address to Questions on Ultimate/Economic Pit, Updated September 1, 2010

This memorandum addresses the questions in your August 9th, 2010 email to me with respect to ultimate pit reserves, reserves that are restricted by the wasp Canyon, and other optimized pit resources.

1. Development of Optimized Pit and Pit Reserves

The floating cone, or Lerchs Grossman (LG, also known as Whittle), are open pit optimization methodologies that are accepted industry wide as a first approach to determining economic pit limits.

The computer algorithm reads in economic parameters - metal price, metal recoveries, mining and process costs, and generates a pit shell on a 3D geology block model. This pit shell contains all incremental ore blocks that are economic based on the input parameters, and considers the overlying waste blocks that have to be stripped. Model blocks immediately outside this pit shell are deemed uneconomic.

The limits of the potential pit can be restricted for non-economic reasons such as encroachment on infrastructure or avoidance areas. For the Rosemount ultimate pit, restrictions are applied to the west so that the potential pit wall does not extend beyond the top of the mountain ridge.

An ultimate pit with ramp accesses, smooth pit walls and phase development is designed using the economic LG pit shell. A net smelter return value (NSR /t) is calculated for each block in the 3D block model that is contained in the ultimate pit. This value represents the combined net metal value on per ton basis. A cut-off NSR value is established as the value of the block that is sufficient to pay for the plant process and G & A costs. For this project it was determined to be $3.56 /t for sulfide ores and $2.19 /t for oxide ores. Ore blocks that are equal or above these values are destined to the mill, and those below are designated as waste blocks destined to the waste disposal sites. The sum of the contained blocks that are above the cut-off NSR determine the ore reserves.
2. Ultimate Pit Reserves and Comparison with Wasp Canyon Restricted Pit

The reserves for the ultimate pit in the feasibility study and the pit restricted by the Wasp Canyon are summarized in Tables 1 and 2. (from Memo_Wasp Canyon Restricted Pit-Rev2.pdf). Fig. 1 shows that the restricted pit is fully contained within the ultimate pit. The incremental difference is 87 M-tons of ore from the restricted pit to the ultimate pit, with an average NSR value of $12.69/t, well above the cut-off value.

### Table 1 Ultimate Pit Quantities

<table>
<thead>
<tr>
<th></th>
<th>Insitu ORE</th>
<th>Run of Mine</th>
<th>Waste Total</th>
<th>ROM S/R</th>
<th>Diluted Grade NSR ($/ton)</th>
<th>Diluted Grade TCU (%)</th>
<th>Diluted Grade MO (%)</th>
<th>Diluted Grade AG (oz/ton)</th>
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<tbody>
<tr>
<td>Wasp Canyon Restricted Ultimate Pit</td>
<td>511,364</td>
<td>529,020</td>
<td>928,913</td>
<td>1.8</td>
<td>12.26</td>
<td>0.43</td>
<td>0.013</td>
<td>0.11</td>
</tr>
<tr>
<td>Feasibility Ultimate Pit</td>
<td>595,302</td>
<td>616,315</td>
<td>1,231,171</td>
<td>2.0</td>
<td>12.32</td>
<td>0.42</td>
<td>0.013</td>
<td>0.11</td>
</tr>
<tr>
<td>Differential</td>
<td>83,938</td>
<td>87,295</td>
<td>302,258</td>
<td>3.5</td>
<td>12.69</td>
<td>0.39</td>
<td>0.018</td>
<td>0.11</td>
</tr>
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</table>

### Table 2 Ultimate Pit – Sulphide Ores

<table>
<thead>
<tr>
<th></th>
<th>Run of Mine</th>
<th>Diluted Grade NSR ($/ton)</th>
<th>Diluted Grade TCU (%)</th>
<th>Diluted Grade MO (%)</th>
<th>Diluted Grade AG (oz/ton)</th>
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<tbody>
<tr>
<td>Wasp Canyon Restricted Ultimate Pit</td>
<td>459,058</td>
<td>13.54</td>
<td>0.46</td>
<td>0.014</td>
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<td>Feasibility Ultimate Pit</td>
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<td>Differential</td>
<td>87,282</td>
<td>12.75</td>
<td>0.39</td>
<td>0.018</td>
<td>0.11</td>
</tr>
</tbody>
</table>
3. Potential Pit Resources at Variable Copper Prices

The feasibility study shows the analyses of the various potential pit limits tested against metal prices and costs scenarios (See Rosemont Pit Optimization MS-EP Summary, Oct 24 08. XLS). Economic reserves will primarily be dependent on metal prices. The bases for the economic pit are $1.75 /lb Cu, $15.00 /lb Mo, and $10.00 /oz Ag. If long term metal prices do not decline significantly below these assumptions, the current pit design and reserves will remain economically viable.

The potential economic pit is shown to be larger than the feasibility study designed pit if the restrictions on the west limits are removed. Therefore, the existing designed pit is constrained by physical limits, not necessarily economic limits.

Additional LG optimized pits are generated with copper prices at $2.00 /lb, $2.50 /lb, and $3.00 /lb, to compare against the base case of $1.75 /lb used in the feasibility study. Other metal prices remain unchanged. Tables 3 and 4 summarize the total ore and sulfides, respectively.

Also shown is the comparison of the designed ultimate pit compared to base case LG pit. The differences are due to pit wall smoothing and adding the in-pit haul road.
Table 3  Optimized Pits for Raised Cu Prices – Total Ore, ox and sulph

<table>
<thead>
<tr>
<th>RUN OF MINE (ktons)</th>
<th>WASTE TOTAL (ktons)</th>
<th>ROM S/R t/t</th>
<th>DILUTED GRADE NSR ($/ton)</th>
<th>DILUTED GRADE TCU (%)</th>
<th>DILUTED GRADE MO (%)</th>
<th>DILUTED GRADE AG (oz/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed Ultimate Pit</td>
<td>616,315</td>
<td>1,231,171</td>
<td>2.0</td>
<td>12.32</td>
<td>0.42</td>
<td>0.013</td>
</tr>
<tr>
<td>Base Case LG $1.75 /lb Cu</td>
<td>640,405</td>
<td>1,205,277</td>
<td>1.9</td>
<td>12.28</td>
<td>0.42</td>
<td>0.013</td>
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<tr>
<td>LG $2.00 /lb Cu</td>
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<td>1,229,188</td>
<td>1.8</td>
<td>13.54</td>
<td>0.41</td>
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<td>LG $2.50 /lb Cu</td>
<td>711,486</td>
<td>1,258,515</td>
<td>1.8</td>
<td>16.00</td>
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<td>LG $3.00 /lb Cu</td>
<td>756,231</td>
<td>1,391,481</td>
<td>1.8</td>
<td>18.41</td>
<td>0.38</td>
<td>0.012</td>
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</tbody>
</table>

Variance from Base Case LG $1.75 /lb Cu

| LG $2.00 /lb Cu       | 28,643              | 23,911      | 0.8                       | 41.58                 | 0.18                 | 0.006                   | 0.05                    |
| LG $2.50 /lb Cu       | 71,081              | 53,238      | 0.7                       | 49.53                 | 0.16                 | 0.006                   | 0.05                    |
| LG $3.00 /lb Cu       | 115,826             | 186,204     | 1.6                       | 52.31                 | 0.17                 | 0.006                   | 0.05                    |

Table 4  Optimized Pits for Raised Cu Prices – Sulfide Ore Only

<table>
<thead>
<tr>
<th>Sulfide Ores</th>
<th>RUN OF MINE (ktons)</th>
<th>DILUTED GRADE TCU (%)</th>
<th>DILUTED GRADE MO (%)</th>
<th>DILUTED GRADE AG (oz/ton)</th>
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</thead>
<tbody>
<tr>
<td>Designed Ultimate Pit</td>
<td>546,340</td>
<td>13.42</td>
<td>0.45</td>
<td>0.015</td>
</tr>
<tr>
<td>Base Case LG $1.75 /lb Cu</td>
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<td>0.45</td>
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<td>LG $2.00 /lb Cu</td>
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<td>14.76</td>
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<td>LG $2.50 /lb Cu</td>
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<td>LG $3.00 /lb Cu</td>
<td>659,370</td>
<td>20.29</td>
<td>0.42</td>
<td>0.014</td>
</tr>
</tbody>
</table>

Variance from Base Case LG $1.75 /lb Cu

| LG $2.00 /lb Cu       | 22,952              | 49.60                 | 0.20                 | 0.007                   | 0.06                    |
| LG $2.50 /lb Cu       | 53,815              | 62.42                 | 0.19                 | 0.007                   | 0.06                    |
| LG $3.00 /lb Cu       | 90,904              | 63.70                 | 0.19                 | 0.007                   | 0.05                    |

4.  Economic Pit and Pit Phases

As previously discussed in Part 1 of this document, the ultimate pit is designed around the selected economic pit shell from the pit optimization study. The financial analysis provided in the feasibility study document demonstrates that all reserves contained within the current ultimate pit design are economic.

The ultimate pit is divided into pit phases for the purpose of providing an effective mining sequence and a balanced material schedule. In general terms, the mining sequence follows the order of the mining phases – Phase 1 is mined first, Phase 7 is mined at the end of the life of mine (LOM) production schedule. If the cashflow for the latter years of the LOM production schedule indicate negative cashflow, then Phase 7 would not be
economic. On the contrary, the cashflows are positive, and therefore Phase 7 contribute to the economics of the project.

To further demonstrate the viability of the feasibility study ultimate pit, following is a brief economic analysis on the increment ore between it and the Wasp Canyon restricted pit. The reserves that would be sterilized by the Wasp Canyon restriction are analyzed in isolation, assuming that it is similar to Phase 7 of the ultimate pit as far as the timing of when it will be mined.

A simplified net present value (NPV) calculation indicates a positive value for the 87 M-tons of incremental ore between the Wasp Canyon restricted pit and the ultimate pit. A production schedule for the incremental ore and waste is shown in Table 5. It is estimated that recovering the ore from this last increment would not commence until Year 17, with waste stripping five years in advance. Average costs are estimated from the LG inputs, and the revenues are estimated from the average NSR /t values of the calculated increment. These are design parameters and may not necessarily represent the actual economics that are used for the financial analysis.

The positive discounted cashflow, both undiscounted ($326,652 k) and discounted ($29,166 k), demonstrate the economic viability of the incremental ore.

### Table 5: NPV of Ore Sterilized under Wasp Canyon

<table>
<thead>
<tr>
<th></th>
<th>Yr 12</th>
<th>Yr 13</th>
<th>Yr 14</th>
<th>Yr 15</th>
<th>Yr 16</th>
<th>Yr 17</th>
<th>Yr 18</th>
<th>Yr 19</th>
<th>Yr 20</th>
<th>Yr 21</th>
<th>Totals</th>
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<tr>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Waste, ktons</td>
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<td>63,361</td>
<td>61,866</td>
<td>51,486</td>
<td>40,414</td>
<td>34,924</td>
<td>31,434</td>
<td>11,714</td>
<td>4,369</td>
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<tr>
<td>Revenue, k$</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>3.55</td>
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<td>$326,652</td>
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<td>NPV: Discounted, k$</td>
<td></td>
<td>$29,166</td>
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</table>
Reference documents:

- Memo_Wasp Canyon Restricted Pit-Rev2.pdf
- Rosemont Pit Optimization MS-EP Summary, Oct 24 08. XLS
- Flenote_Potential Ultimate Pit Expansion.PDF
- LGs Results Aug 16-2010.xlsx
1.0 Introduction

This Technical Memorandum summarizes the methods and computations employed to perform the hydrological analysis of the Wasp Canyon sub-basin at the proposed Rosemont Copper Project (Project) in Pima County, Arizona. The objective of this analysis was to assess the stormwater run-off response within the basin to a 100-year, 24-hour event associated with four (4) different scenarios as shown on Figures 1 through 4 in Attachment 1:

- Wasp Canyon sub-basin as natural terrain (Figure 1);
- Wasp Canyon sub-basin with a Modified Pit configuration with the Open Pit Diversion Channel (Figure 2);
- Wasp Canyon sub-basin with a Modified Pit configuration without the Open Pit Diversion Channel (Figure 3); and
- Wasp Canyon sub-basin with the existing P673 Pit configuration and Open Pit Diversion Channel (Figure 4).

Except for the scenario containing the existing pit configuration, P673 Pit, all scenarios were evaluated at a “downstream common point”. Figure 1 shows the natural basin conditions without any Project development. Figure 2 shows this same elevation point (downstream common point) in the Wasp Canyon sub-basin with a Modified Pit configuration and with the Open Pit Diversion channel. The Open Pit Diversion channel diverts stormwater away from the Open Pit and from the Wasp Canyon sub-basin and into Barrel Canyon. Figure 3 shows the Wasp Canyon drainage sub-basin without the Open Pit Diversion channel. In this case, more stormwater reports to both the Open Pit and to the Wasp Canyon drainage (i.e., the “downstream common point”). The “downstream common point” is the point where Wasp Canyon is blocked by the Rosemont Ridge Landform (Dry Stack Tailings/Waste Rock).

Figure 4 shows the current P673 Open Pit outline and its interaction with Wasp Canyon. As shown, the final P673 pit configuration cuts through the Wasp Canyon drainage. For reference, the “downstream evaluation point” shown on Figures 1 through 3 is also indicated on Figure 4. The scenario shown on Figure 4 assumes construction of the Open Pit Diversion channel. Only
a small remaining portion of the watershed remains in the upper portion of the Wasp Canyon sub-basin, reporting to the “upper Wasp Canyon point”.

2.0 Methodology and Precipitation

The Natural Resource Conservation Service (NRCS) method was selected to perform the hydrologic calculations. The NRCS method described herein is based on two (2) components, the Curve Number procedure (to determine initial losses and excess precipitation) and the unit hydrograph method (to derive the hydrograph resulting from excess rainfall).

HEC-HMS, developed by the U.S. Army Corps of Engineers, incorporates the NRCS method and was selected to determine the discharge resulting from the basins considered in this analysis.

The NRCS has developed a widely used curve number procedure for estimating runoff from storm events. Rainfall initial losses depend primarily on soil characteristics and land use (surface cover). The NRCS method uses a combination of soil conditions and land use to assign runoff factors (curve numbers). Curve numbers represent the runoff potential of a soil type (i.e., the higher the curve number, the higher the runoff potential).

A detailed discussion of the NRCS method can be found in the Technical Memorandum titled Rosemont Hydrology Method Justification (Tetra Tech, 2010).

Precipitation data was acquired from the National Oceanic and Atmospheric Association (NOAA) Atlas 14 Point Precipitation website (NOAA, 2009).

3.0 Hydrology

The NRCS method was selected as the most appropriate for this level of analysis based on the information available and on the analysis expectations.

3.1 Rainfall Excess

The NRCS method determines rainfall runoff volume using the following relationship:

\[ Q = \frac{(P - 0.2S)^2}{P + 0.8S} \]

Where,

- \(Q\) is the accumulated runoff volume in inches;
- \(P\) is the accumulated precipitation in inches, (100-year, 24-hour rainfall depth = 4.75”);
- \(S\) is the maximum soil water retention parameter, \((S = \frac{1000}{CN} - 10)\) in inches; and
- \(CN\) is the curve number.
3.2 Curve Number
The Curve Number selected for the contributing basin is 85 based on previous study. The initial abstraction used was $0.2S = 0.35$.

3.3 Lag Time
The SCS lag time is defined as:

$$T_{LAG} = L^{0.3} \frac{(S+1)^{0.7}}{1900\sqrt{Y}}$$

Where:
- $T_{LAG} =$ lag time, in hours;
- $S =$ the maximum soil water retention parameter;
- $L =$ hydraulic length, in feet; and
- $Y =$ watershed slope in %.

Table 1 summarizes the hydrologic basin parameters for the four (4) Wasp Canyon analysis scenarios.

<table>
<thead>
<tr>
<th>Wasp Canyon Sub-basin</th>
<th>$A (\text{mi}^2)$</th>
<th>CN</th>
<th>$S$</th>
<th>$L (\text{ft})$</th>
<th>$Y (\text{ft/ft})$</th>
<th>Lag Time (min)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Terrain</td>
<td>1.251</td>
<td>85</td>
<td>1.765</td>
<td>10228</td>
<td>9.0</td>
<td>34.61</td>
</tr>
<tr>
<td>Modified Pit w/ Open Pit Diversion channel</td>
<td>0.240</td>
<td>85</td>
<td>1.765</td>
<td>5726</td>
<td>6.0</td>
<td>26.65</td>
</tr>
<tr>
<td>Modified Pit w/o Open Pit Diversion channel</td>
<td>0.491</td>
<td>85</td>
<td>1.785</td>
<td>9732</td>
<td>10.0</td>
<td>31.56</td>
</tr>
<tr>
<td>Current P673 Pit w/ Open Pit Diversion channel</td>
<td>0.073</td>
<td>85</td>
<td>1.785</td>
<td>2444</td>
<td>6.5</td>
<td>12.96</td>
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</table>

"mi" = square miles, "min = minutes

4.0 Results
Peak flow and the flow volume produced by the 100-year, 24-hour event was obtained from the hydrological analysis using the HEC-HMS and was applied to the four (4) scenarios. A summary of the results is shown in Table 2. Except for the current P673 Pit configuration, stormwater volumes and peak flows were taken at the "downstream common point" shown on the figures. Values for the current P673 Pit configuration were taken at the "upper Wasp Canyon point" as shown on Figure 4.
### Table 2 Hydrologic Results

<table>
<thead>
<tr>
<th>Wasp Canyon Sub-basin Description</th>
<th>Peak (cfs)³</th>
<th>Volume (ac-ft)⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Terrain</td>
<td>1184</td>
<td>209.40</td>
</tr>
<tr>
<td>Modified Pit w/Open Pit Diversion channel</td>
<td>321</td>
<td>40.17</td>
</tr>
<tr>
<td>Modified Pit w/o Open Pit Diversion channel</td>
<td>588</td>
<td>82.20</td>
</tr>
<tr>
<td>Current P673 Pit w/Open Pit Diversion channel</td>
<td>146</td>
<td>12.17</td>
</tr>
</tbody>
</table>

³cfs = cubic feet per second, ⁴ac-ft = acre-feet

Detailed results from the HEC-HMS model output are provided in Attachment 2.
REFERENCES


EXISTING CONTURS
TOWARDS RANGE LINE
SECTION LINE
MOLLY CANYON DRAINAGE BASIN
LOWER BARREL CANYON DRAINAGE BASIN
BARREL CANYON DRAINAGE BASIN
WASP CANYON DRAINAGE SUB-BASIN
EXISTING COURTS
TOWNSHIP/ RANGE LINE
SECTION LINE
PROPOSED CENTURY
PIT
WASP CANYON SUB-BASIN

WASP CANYON SUB-BASIN ANALYSIS
MODIFIED PIT WITHOUT OPEN PIT DIVERSION CHANNEL

WASP CANYON SUB-BASIN
MODIFIED PIT WITHOUT OPEN PIT DIVERSION CHANNEL

TETRA TECH
3301 W 30th Street
Minneapolis, MN 55407
(612) 297-7298

ROoseMont COPPER PROJECT
Pima County, Arizona

Figure no: 3
Project: ROoseMont COPPER PROJECT
Page: 3 of 10
Project no: 39401
**Computed Results**

- Peak Discharge: 1404.39 (CFS)  
  Date/Time of Peak Discharge: 14Aug2010, 00:30
- Total Precipitation: 316.92 (AC·FT)  
  Total Direct Runoff: 209.53 (AC·FT)
- Total Loss: 107.39 (AC·FT)  
  Total Baseflow: 0.00 (AC·FT)
- Total Excess: 209.53 (AC·FT)  
  Discharge: 209.53 (AC·FT)
Project: Was Canyon Analysis
Simulation Run: Run With Pit Channel Subbasin: Subbasin w/ Pit Chnnl
Start of Run: 13Aug2010, 12:00 Basin Model: Basin Modif Pit with Chn
End of Run: 15Aug2010, 12:05 Meteorologic Model: Met 1
Compute Time: 17Aug2010, 11:08:48 Control Specifications: Control 1

Volume Units: AC-FT

Computed Results

<table>
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<th>Description</th>
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<td>Total Loss</td>
<td>20.59 (AC-FT)</td>
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<td>Total Excess</td>
<td>40.17 (AC-FT)</td>
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<td>Date/Time of Peak Discharge</td>
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<tr>
<td>Total Direct Runoff</td>
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<td>Total Baseflow</td>
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<tr>
<td>Discharge</td>
<td>40.17 (AC-FT)</td>
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Project: Was Canyon Analysis
Simulation Run: Run Wasp Without Pit Channel Subbasin: Subbasin w/o Pit Chnnl
Start of Run: 13Aug2010, 12:00 Basin Model: Basin Moldf Pit NO Chann
End of Run: 15Aug2010, 12:05 Meteorologic Model: Met 1
Compute Time: 19Aug2010, 10:20:59 Control Specifications: Control 1
Volume Units: AC-FT

Computed Results
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<td>Total Excess</td>
<td>82.20 (AC-FT)</td>
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<tr>
<td>Discharge</td>
<td>82.20 (AC-FT)</td>
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**Project:** Was Canyon Analysis  
**Simulation Run:** Run Original Pit  
**Subbasin:** Subbasin Original Pit  

- **Start of Run:** 13Aug2010, 12:00  
- **End of Run:** 15Aug2010, 12:05  
- **Compute Time:** 17Aug2010, 11:08:35  
- **Basin Model:** Basin Original Pit  
- **Meteorologic Model:** Met 1  
- **Control Specifications:** Control 1  
- **Volume Units:** AC-FT

### Computed Results

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<td>Total Direct Runoff</td>
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<td>Total Baseflow</td>
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<tr>
<td>Discharge</td>
<td>12.17 (AC-FT)</td>
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MEMORANDUM

To: Mr. Fermin Samorano / Rosemont Copper Company

From: Mr. Robert Pratt, P.E.
Mr. David Nicholas, P.E.

Date: 23 August 2010

Subject: Rosemont Wasp Canyon Restricted Pit Slope Stability

This memorandum presents results of Call & Nicholas, Inc.’s (CNI) review of Rosemont Copper Company’s Wasp Canyon restricted ultimate pit. This pit was constructed with the limitation of avoiding disruption to Wasp Canyon, which has resulted in an offset of the ultimate pit crest on the southeastern side of the pit, as shown on Figure 1. The remaining portion of the pit is unchanged from the original feasibility pit design. CNI reviewed modifications to the pit for any potential slope stability issues.

The geology projected onto the Wasp Canyon restricted pit is similar to that of the nonrestricted ultimate pit, and therefore slope stability issues will not change from those identified as part of CNI’s feasibility study (Feasibility-Level Geotechnical Study for the Rosemont Deposit, February 2008). No change is needed to the interramp slope angles recommended for the southeast wall as part of CNI’s 2008 feasibility study (28 degrees for the alluvium, 33 to 35 degrees for Willow Canyon, and 45 to 48 degrees for Paleozoic rocks in the lower portion of the slope). These slope angles were determined based on typical mine design criteria.

Due to the easterly dip of the Paleozoic rocks and change in pit location, the height of the upper alluvium and Willow Canyon slope decreases, as shown on Figure 2. This reduction in height of the upper portion of the slope in relatively low-strength materials is expected to improve the slope design reliability. It may also be possible to steepen the slope angle while maintaining slightly lower, but acceptable slope-design reliability typical for mine slopes.

Geological Engineering  Slope Stability  Rock Mechanics
The primary issue with respect to slope stability in the southeastern portion of the pit will be the success of dewatering efforts. To stabilize the upper portion of the slope, which consists of relatively low-strength Willow Canyon arkose and alluvium (Figure 2), dewatering from the 5,100-foot level to an elevation of approximately 4,400 feet will be required to achieve slope angles recommended as part of CNI's feasibility study.

CNI recommends future reevaluation of final pit slope angles in the alluvium and Willow Canyon slopes after the startup of mining. Slope angles determined for these materials are based on a nominal amount of information obtained from drill cores. With data gathered from mine benches, an improved assessment of slope angles could be performed. CNI also recommends pump testing and an evaluation of dewatering feasibility in the southeastern alluvium.