

ROSEBUD • SPECIFIC GRAVITY

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HECLA MINING COMPANY ROSEBUD PROJECT

July 1, 1996

Memorandum to: Ron Clayton
From: Charlie Muerhoff *Charlie*
RE: Rosebud Deposit Bulk Density / Tonnage Factors

The purpose of this memorandum is to address the bulk density / tonnage factor issue which has been brought up during the Santa Fe Pacific Gold due diligence.

There are three (3) data sets pertaining to bulk density measurements performed on material from the Rosebud Deposit:

1. From 1990 to 1992, LAC Minerals contracted McClelland Laboratories to perform bulk density measurements on 48 core samples taken from the South, North, and East zones. This test work was performed by using a volume displacement method, whereas the core pieces were oven-dried until no additional weight loss occurred, coated with acrylic enamel, re-weighed, and then subjected to bulk density measurements. Moisture contents were recorded, but are considered to be invalid due to the length of time between acquiring the sample and performing the lab tests.
2. From 1994 to 1995, Hecla performed specific gravity measurements in-house on 959 core samples from the South, North, and East zones. These measurements were also taken using the volume displacement method, but the core was not oven-dried. Some drying of the core had taken place prior to the specific gravity measurements, but no quantitative moisture content measurements were taken.
3. In June, 1996, Westec (engineering consulting firm), under the direction of Santa Fe Pacific Gold, completed 16 bulk density measurements in the cross-cut using a Troxler 3430 nuclear moisture/density gauge. Density and moisture content tests were performed in "general accordance" with ASTM D 2922 and ASTM D 3017 test procedures. Rock chip samples were taken from each nuclear gauge sample location for a more precise moisture content determination (test work performed at an independent laboratory). To my knowledge, these are the only tests performed to date to determine in-situ moisture content. The average moisture content recorded from the rock samples was 6.3 percent.

A comparison of results from the above three programs is outlined below:

Tonnage Factor Comparison

	South Zone (cubic feet/ton)	North Zone (cubic feet/ton)	East Zone (cubic feet/ton)
LAC / McClelland (dry)	14.4	13.8	13.4
Hecla (wet \pm)	13.4	12.9	12.9
SFPG / Westec (dry)	14.5 *	n/a	n/a

* measurements from 900N cross-cut only

If the 6.3% moisture content is applied to the Hecla bulk density figures currently being used, the resulting tonnage factors are 14.2, 13.7, and 13.7 for the South, North, and East zones, respectively. These tonnage factors are very close to those determined by the LAC / McClelland program. During Hecla's program, it appears that much of the interstitial water still remained in the samples during the specific gravity test work, thus biasing the sample towards the heavy side. Therefore, it is my recommendation that we use the LAC / McClelland tonnage factors in the new South Zone ore reserve currently in progress, and in the new mine planning/sequencing schedule for all three zones.

If the LAC / McClelland tonnage factors are applied to the existing ore reserve, the result is a loss of 6.0% of the total tonnage and a loss of 5.9% of the contained gold ounces (i.e., losses of 71,891 tons and 31,528 gold ounces).

cc: G. Johnson
L. Roberts
G. Pierson