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808 BANK OF CANADA BUILDING
VANCOUVER I, B.C.

Mt. Nansen Mines Ltd.

Report on

ECONOMIC PERFORMANCE OF THE MT. NANSEN OPERATION

Feb. 11, 1969.

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INTRODUCTION

The purpose of this report is to provide an estimate of gross monthly revenue obtainable from the Mt. Nansen operation near Carmacks, Yukon. A comparison of the past and future performance of mining and milling is included and can be the basis, when combined with known and estimated costs, for determining operating revenues and potential profit.

To obtain the data presented in this report, the writers visited the Mt. Nansen operation on February 3 to 6 inclusive. In addition, Mr. Saunders has been familiar with the mine operation and geology through various visits to the mine during the past year. The mine staff and in particular, the manager, Mr. H. Johnson, and the mine engineer, Mr. P. Schultz, provided all available records and engaged in considerable and very informative discussion.

COMMENTS ON COSTS:

Although the object of this report does not include a detailed analysis of costs, the writers feel that a brief discussion on this subject is warranted to provide background for the body of the report.

Present operating costs include appreciable costs, which are in fact capital costs, for items not completed or improperly constructed during the plant construction period. Only if these costs are extracted from the normal operating costs is a relatively true operating cost determined. Examples of work completed since mill start-up or presently in progress which should not be included in the mine operating costs are:

1. Moving, assembly and set-up of bunkhouse trailers.
2. Set-up, insulate, partition, etc. of steel shop at H4100 portal.
3. Insulate and sheet doors of mill, crusher and warehouse.
4. Construction of offices in machine shop.
5. Redesigning and rebuilding of panfeeder.
6. Insulating and installing pyrotechnics on water line (18,000 ft.)
7. Installation of new water pumping system and insulate pump house.
8. Installation of plumbing for heating in recreation hall.
9. Relocation of 35,000 gal. tank for camp diesel supply.

Considerable work of a similar nature still remains to be done and if included in the mine operating costs will give an inflated picture of these figures. Examples of work yet to be completed are:

1. Assemble another 5-trailer bunkhouse complex.
2. Install sewer and water lines to assay office, administration building and recreation hall.
3. Complete numerous electrical installations as required by the electrical inspector.
4. Install a proper dust collecting system in the crusher house.
5. Install new drum feeders in the mill.
6. Install electrical wiring in recreation hall.
7. Replace starting mechanism on #1 compressor.
8. Install new pump and water line to "steady head" tank in mill for proper compressor cooling.
9. Internal construction in machine shop (steel benches, etc.)

As is usual in any newly producing mine there have been many operating problems not likely to reoccur and which will certainly not occur in such numbers at any one time again. These problems have increased the total operating costs considerably, thus influencing, adversely, opinions of the ultimate long-term operating costs at the mine. Almost invariably, operating costs decrease considerably during the first two years of production at a mine. Some examples of the operating problems encountered at Mt. Nansen are listed below:

- Lack of water until new lines and pump installed.
- Lack of accommodation for complete mine crew while construction crews on property.
- Potential ore zones which did not prove-up. (not a problem when there is more flexibility in the underground operation, i.e., other working places available).
- Lack of assays due to fire in the Webber camp.
- Numerous other minor problems which became serious in their cumulative effect, were encountered.

Construction and initial operating problems have thus resulted in apparently high costs for the Mt. Nansen operation and although no sudden decrease in these costs is immediately in sight it is expected that they will gradually decrease. Some foreseeable projects of appreciable cost would best be capitalized to separate them from normal operating costs thereby giving a truer picture of operating costs and a better budgeting of expenditures. Operating capital is essential until the mine isproducing a consistent profit.

This report is divided into two parts; the first part deals with the revenue production from the mine, to date and projected to July, 1969, and the second part does the same with the mill. The intention of this presentation is to establish a firm basis for future cash flow projections.

SUMMARY & RECOMMENDATIONS

The Mt. Nansen mining and milling operation near Carmacks, Yukon, has been beset by numerous operational problems since production start-up in late September, 1968. These problems have resulted in lower grade mill-feed than expected, low metal recoveries in the mill, and relatively high total operating costs.

Approximately 50% of the initial mine production has come from drift and stockpiled drift ore and has consequently been quite low grade. The major portion of future production will be from stopes with only a small percentage of drift muck supplementing this ore; as a result, the estimated mill-feed grade for the period February to July, 1969 will rise and gradually approach feasibility grade. The major increase in silver grade will take place when Webber ore is added to the mill-feed (coincident with start-up of cyanide plant).

Underground development and exploration has fallen behind calculated required footages and therefore, must be increased appreciably. The development is required to ensure an adequate ore supply to the mill, to develop new ore sources, and to explore potential ore-bearing areas. An average of 650 ft. per month is required to accomplish these objectives.

Mill performance to date has been poor as a result of the very low head grade, and an almost complete lack of control assays, together with the usual start-up problems. However, optimum flotation should be achieved by late March and optimum cyanide plant operation should be attainable approximately one month after initial operation of the cyanide plant. When these optimum conditions are achieved, the metal recoveries and concentrate grades should approximate those predicted in the feasibility study. Gold recovery will be approximately 90% and silver 95%.

It is estimated that the cyanide plant can be installedin two months at a total cost of $50,000. This plant is essential if good metal recoveries are to be obtained from Webber (oxidized) ore.

It is concluded that the Mt. Nansen mine has excellent potential to be a long term producer of gold and silver and will operate at a profit once initial operating difficulties are overcome. When operating efficiently it is estimated that gross monthly revenue will be in excess of $300,000. Net monthly revenue can be calculated by subtracting operating costs (which the writers do not possess except by estimation) from gross revenue.

To become, and remain, a viable operation it is essential that the following recommendations be undertaken at Mt. Nansen:

1. Reduce mining dilution in stopes.
2. Increase underground development to 650 ft. per month.
3. Follow detailed suggestions for improvements to crushing and milling operations and provide continuing consulting metallurgical assistance to the operators both for operating and experimentation purposes.
4. Install cyanide plant.
5. Have operating capital available until a regular operating profit is achieved.

PART I - MINE

(A) PRODUCTION TO DATE:

Approximately 50% of the total mill feed at Mt. Nansen since mill start-up in late September has come from stockpile of development ore, which is very low grade as a whole. The proportion of stockpile ore has dropped drastically in February, resulting in improved heads. The original underground sources of the stockpile ore are very difficult to accurately determine. Lack of assaying facilities, change of assayers and other key personnel, and in-complete records of early production (which went to stockpiles) have contributed to a paucity of good production-grade records. Consequently, a very minimum of grade information, combined with general knowledge and estimates by the mine staff, have been employed to determine past production grades for this report. In effect, these grades are qualified estimates rather than good historical records.

Present underground production tonnage records from individual working places are reasonably accurate although some discrepancies do exist. Correlation of monthly mine production with mill-head tonnage has been difficult because of probable inaccuracies in the determination of mill-head tonnage, mine-car tonnage factor, and ore tonnage factor. All of these problems can, and to some degree are, being overcome with more operating experience.

Table 1 indicates the underground sources of mill feed by individual working places since milling commenced. In some cases the total monthly tonnage exceeds the sum of the individual sources; this discrepancy is caused by lack of precise records for all ore sources. Because the cyanide plant is not yet available to treat Webber (oxide) ore all of the mill feed to date has come from the Huestis mine, the reserves of which are lower in grade than the feasibility average.

The total tonnage shown for each month is based on the mill-head tonnage (surveyed mine tonnage is pro-rated to this figure). It is suspected that these tonnages are high, with the true milled tonnage being somewhat lower. This discrepancy would have the effect of reducing the apparent mill recoveries and the per ton revenue although it does not affect total monthly revenues.

TABLE 1

SOURCES AND GRADE OF MILL FEED
(September, 1968-January, 1969)

Month	SOURCE (All Huestis)	Tons	GRADE oz/ton Au	GRADE oz/ton Ag
Sept. (23-29) 1968	41-12 Drift	470	.20	3.0
Oct.	43-12-585	260	.45	10.9
	41-12-593	1129	.39	9.1
	43 stockpile	300	.18	9.0
	41 "	1044	.20	3.0
	Sub-total:	2773	0.30	6.9
Nov.	43-12-585	280	.45	10.9
	43-12-590	607	.31	5.0
	43-12-594	580	.40	9.0
	43-Drift?	312		
	43 Stockpile	2290	.19	4.2
	Sub-total:	3469	0.26	5.6
Dec.	43-12-585	70	.45	10.9
	43-12-590	480	.31	5.0
	41-12-593	23	.39	9.1
	43-12-594	985	.40	9.0
	41-12-588	223	.35	6.0
	43 Stockpile	2848	.18	4.9
	Sub-total:	4846	0.25	5.9
Jan. (1969)	43-12-588 Rse.	75	.50	9.0
	43-12-585	125	.45	10.9
	43-12-590	625	.35	5.5
	43-12-594	1646	.30	7.0
	41-12-588	585	.50	8.0
	41-12-593	585	.39	9.1
	41-12-Drift	110	.15	2.0
	Sub-total:	5218	0.36	7.3
	TOTAL Sept.-Jan.:	16,776 tons	.29	6.4

The total monthly tonnage increased as more experience accrued in stoping the Huestis vein and as a larger crew was employed underground. Many operating problems not directly related to mining have adversely affected the mine production. Lack of accommodation when construction was in progress resulted in a reduced mine work force which affected both stoping and development. Reduced development has, in turn, resulted in fewer available stoping areas. Numerous minor problems were encountered but many of these are gradually being overcome.

The low production grade to the end of January, 1969, is the result of many problems. Almost half the total tonnage processed came from drift and stockpile (drift) ore. In the narrow Huestis ore veins, (3-4 ft.), the wider drifts (6-8 ft.) result in 50-100% grade dilution. Normally such muck would be used to supplement the total required production but to date at Mt. Nansen, this very low grade muck has been required to help achieve the planned rate of production. A lack of assay control in stopes has not aided the grade control and may have resulted in some very low grade, possibly uneconomic vein sections being mined for ore. Unavoidable dilution in stopes from mining too wide has also contributed to the general low grade. This problem can and is being overcome. It is not an unusual occurrence in a new underground mining operation and is only overcome by experience in mining the particular "ground" and by forceful education of those people responsible for the mining and those doing the mining.

It is also obvious that the low silver content of the ore is partially a result of obtaining all ore from the Huestis for which the feasibility silver grade is quoted as 11.8 oz/ton. At Webber the silver grade is 23.3 oz/ton.

All of the problems pertaining to mine grade can be overcome provided there are sufficient stopes to provide the required 200 TPD production. It is even conceivable that eventually the mine grade will be better than that calculated in the feasibility study. However, if development falls behind schedule (a minimum of 650 ft. per month is required) the result will be either a decrease in the daily production or more likely, a decrease in grade as a larger proportion of low grade development ore supplements stope ore to maintain the daily tonnage production.

(B) ESTIMATED PRODUCTION - FEB.-JULY, 1969:

A recommended program of mine production, with grade estimates, made by the writers in collaboration with the mine staff, is shown in Table 2. These estimates are based on the best information available but, as in the case of the "production to date" estimates, the grade estimates are based on limited assay data. The estimates are done for only a six month period and should be extended, by the mine staff, for another six months, with general mine production estimates extended even farther into the future. Such estimates are essential for planning ore extraction and mine development.

Based on the mine production calculations and estimates shown in Tables 1 and 2 the writers have compiled a graph of the past and future gross value of the Mt. Nansen mine production, projected to July, 1969. This graph is presented as Figure 1 and is used as a base for estimating the projected mill recoveries and estimated revenue.

It is feasible that the cyanide plant will be in operation by May 1, 1969 but a mid- to late-May start-up is considered more realistic. The earliest possible completion date of the cyanide plant is essential to ensure an uninterrupted flow of ore from the mine and to allow extraction of the higher grade oxidized Webber ore. A detailed production estimate extended beyond July, 1969, combined with required alterations to the present six month estimate (to eliminate Webber ore), would definitely indicate that the Huestis mine could not, by itself, supply muck for a 200 TPD operation for even one year. The longer that mill-feed comes only from Huestis, the closer comes the inevitable time when a production rate of 200 TPD cannot be maintained due to either a lack of ore, or a lack of flexibility in extracting the ore.

Development ore, primarily from drifting, should be used to supplement the total planned stope production, and for April this is essentially what has been shown to occur in Figure 1. However, in February and March the development muck is required to help achieve the planned rate of production. In May, June, and July it is expected that some development muck, not included in the estimates, will increase the total monthly tonnage above the planned 6000 tons although it may also reduce the grade somewhat.

In estimating the individual tonnages and grades, somewhat ideal operating conditions have been assumed. If adverse conditions arise, or if grade estimates, as based on very limited assay information, are too high, it will be difficult to achieve the total planned monthly production. However, it is expected that estimated grades will be obtained as better ore control is practiced in the mining operation and as control assays become available on a regular basis.

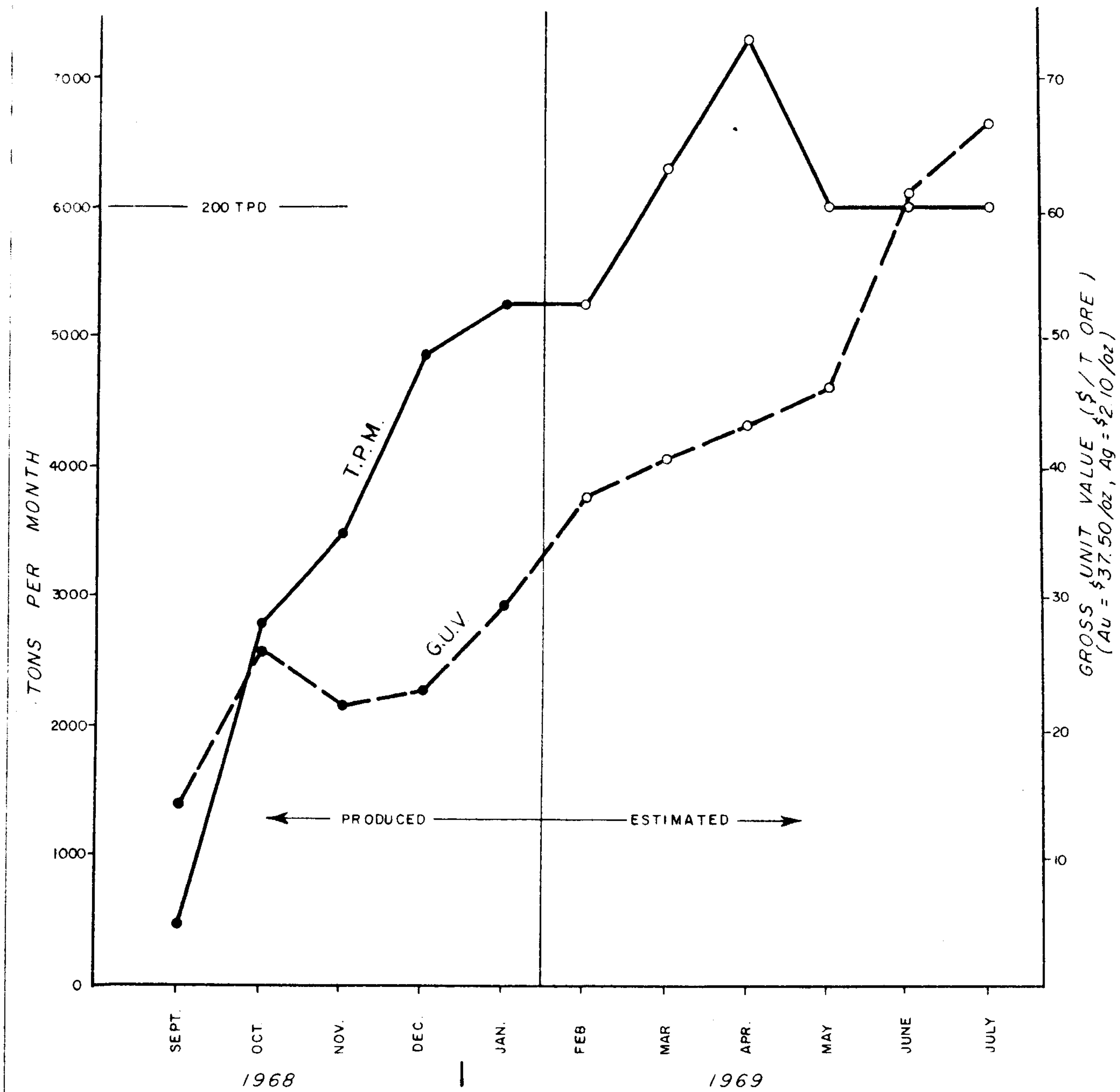
TABLE 2

ESTIMATED PRODUCTION
(February, 1969-July, 1969)

Month	Location	Tons	GRADE oz/ton Au	oz/ton Ag
February	43-12-585	800	.50	12.0
	-588			
	-590	600	.35	5.5
	-594	700	.36	8.4
	41-12-Dr.	700	.48	5.0
	-588	1200	.60	9.0
	-593	1000	.48	11.0
	-584	200	.96	10.1
	Total:	5200	0.50	8.9
March	43-12-585	800	.50	12.0
	-588	Possible stope timbering		
	-590	Pulled empty		
	-594	Pulled empty		
	-13-Dr.	700	.20	9.0
	41-12-584	900	.96	10.1
	-588	1600	.67	10.3
	-593	1600	.48	11.0
	13-Dr.	700	.20	3.0
	Total:	6300	0.54	9.7
April	43-12-585	800	.50	12.0
	-588	)		
	-590	)Potential only		
	-594	)		
	-13-Dr.	700	.20	9.0
	41-12-584	1900	.96	10.1
	-588	1600	.67	10.3
	-593	1600	.48	11.0
	-13-Dr.	700	.20	3.0
	Total:	7300	0.60	9.8

TABLE 2, continued

Month	Location	Tons		GRADE oz/ton Au	GRADE oz/ton Ag
May	43-12-585	800		.50	12.0
	-13-Dr. (stope)	400		.40	18.0
	41-12-584	-	Timbering		
	-588	2200		.67	10.3
	-593	1600		.48	11.0
	-13-Dr.	600		.20	3.0
	W43-2B-551	200		.49	32.4
	-2 -558	200		.41	54.2
	Total:	6000		.52	12.7
June	43-12-585	800		.50	12.0
	-13-Dr. (Stope)	400		.40	18.0
	41-12-584	800		.96	10.1
	-588	200		.67	10.3
	-593	1600		.48	11.0
	-13-Dr. (Stope)	600		.40	6.0
	W43-2B-551	800		.49	32.4
	-2 -558	800		.41	54.2
	Total:	6000		.53	19.6
July	43-12-585	800		.50	12.0
	-13-Dr. (Stope)	400		.40	18.0
	41-12-584	1200		.96	10.1
	-593	1600		.48	11.0
	-13-Dr. (Stope)	-	Timbering		
	W43-2B-551	1200		.49	32.4
	-2 -558	800		.41	54.2
	Total:	6000		.57	21.5
TOTAL FEB.-JULY:		36,800		.55	13.6



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TONS PER MONTH
GROSS UNIT VALUE

CURRENT & ESTIMATED MINE PRODUCTION

SCALE. —	FEB. 11, 1969	FIG. 1

PROPOSED DEVELOPMENT:

A report by Dolmage-Campbell & Associates Ltd., "Proposed Development Programme Huestis & Webber Mines", dated January 10, 1969, outlined an overall development programme for 1969. The programme was predicated on certain assumptions and calculated criteria and, as well, assumed that the proposals would be instituted immediately. The development proposals have not all been started and one important assumption, that the cyanide plant would be operational by March 1, 1969, is now obviously incorrect. Consequently, the proposed scheduling and sequence of development will have to be altered somewhat to attain the most important objective of keeping a continuous supply of ore flowing to the mill. However, the criteria used as the basis for the recommended development at Mt. Nansen are still valid. They are: (1) a minimum of 500 ft. of drifting is required per month to maintain ore reserves, and (2) approximately 1,500 ft. per month of diamond drilling is required for exploration and ore delineation. The amount of drilling will fluctuate considerably depending upon the amount and type of development drifting in progress.

As noted in the development report by Dolmage-Campbell & Associates Ltd., the rate of development should be higher than normal during the next year or two at Mt. Nansen in order to extend rather than just replace ore reserves. Larger ore reserves will allow greater flexibility in mining and may eventually lead to a higher rate of production. Consequently, it was proposed that a total of 7350 ft. of drifting be completed during 1969. By the end of February only about 800 ft. will have been completed, leaving an average of approximately 650 ft. per month required to reach the proposed objective. This is the general footage target at which the mine should aim.

In detail, it is important that some initial drifting be done on expected ore zones in order to develop more stoping areas which will ensure a steady flow of ore to the mill and possibly allow some flexibility in mining sequence. The extension of the 12 vein on Huestis 4100 level, the highest priority target, is presently being drifted. Drifting of the 13 vein on Huestis 4300 level should be started immediately. There is a potential of 1200 ft. of drifting here on an ore-bearing vein structure. Following the H-41-12 vein drifting, the H-41-13 vein should be drifted. It also has a potential ore length of 1200 ft. These three drifts should add appreciable stoping areas to the mine and help ensure a continuous ore supply to the mill.

(D) RECOMMENDATIONS:

The Mt. Nansen mining operation has the potential to be a profitable operation for many years to come; however, it could falter and possibly fail during its early operational period unless critical requirements are recognized and fulfilled before they do serious damage to the operation. With respect to the underground operation, the following recommendations are of a critical nature.

1. Stope ore control must be improved to provide higher grade muck and reduce mining costs.

2. Monthly drift footage for the period March-December, 1969 should average 650 ft. If ore reserves are to be maintained, new ore developed and new areas explored.

3. Initial development (February, March, April) must be on ore structures in order to quickly provide more stoping areas.

PART 2 - MILL

The Mt. Nansen mill is a most satisfactory, well constructed an d equipped plant. It has had the various tune-up problems that are to be expected from such a plant, especially in severe winter conditions; however, most of the problems have been or are being taken care of and efficiencies and recoveries have steadily improved and will continue to do so.

In this report the performance of the mill to date is discussed briefly and illustrated in graphic form. The projected recoveries are then estimated and presented graphically. In addition the writer has included an estimate and recommendations for the completion of the cyanide plant and for various additions or changes that should be made to further increase the efficiency of the mill.

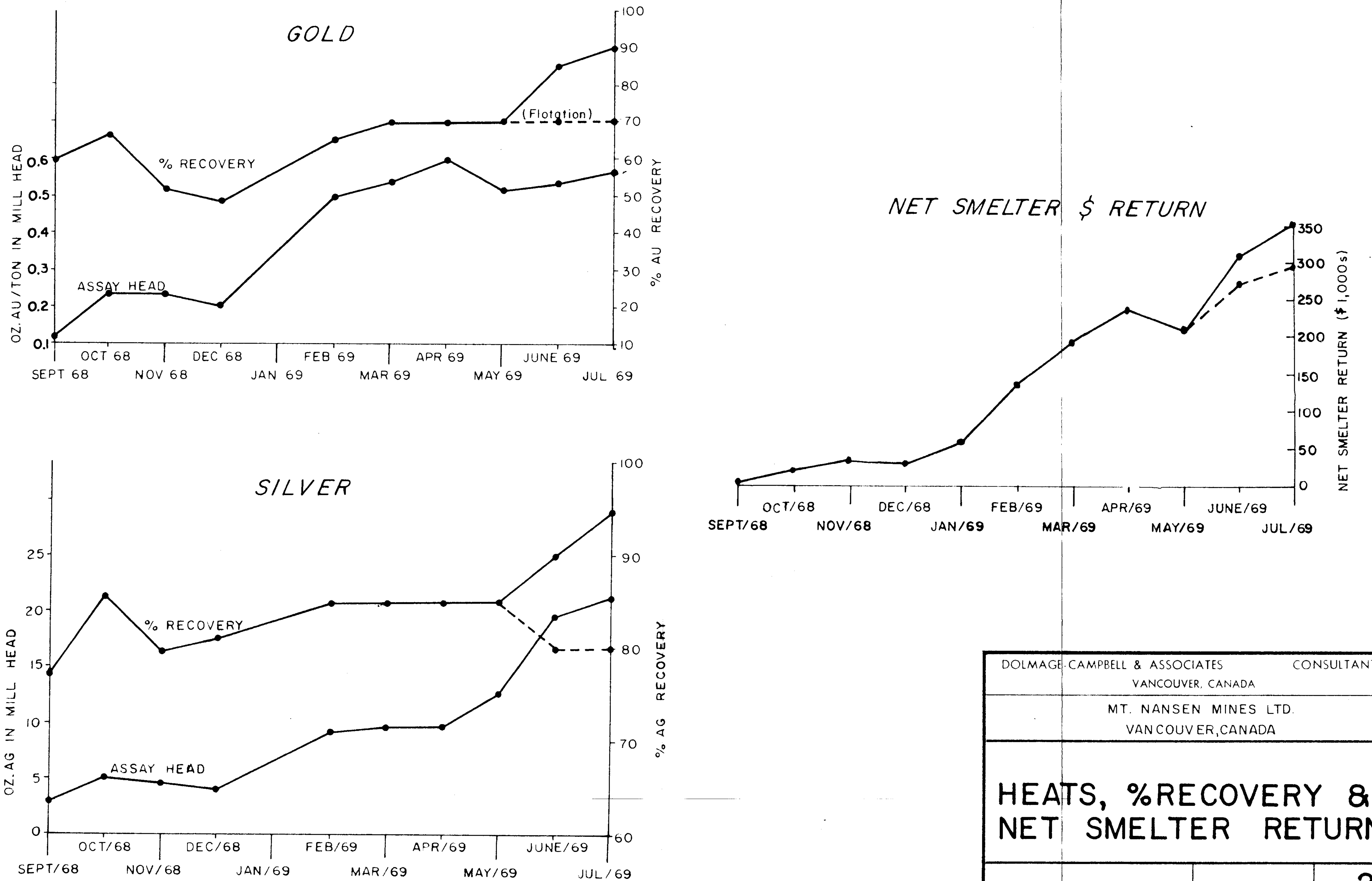
(A) PERFORMANCE TO DATE:

The mill personnel have been operating under a serious handicap because during much of the tune-up period no assays have been available to them on a day-to-day basis. This in effect is operating without sufficient guidance from experience, experiment or results.

The calculated head from Sept., 1968, to Dec., 1968, was found to be somewhat lower than the assayed head. It has been assumed from this that the reported tonnage milled was about 20-25% higher than was actually milled.

Reduced operating time up to mid-January has been largely due to ore shortages to the mill and problems with the water system. Both of these problems have been essentially remedied and the mill performance is improving markedly.

Despite the tune-up difficulties the recovery of gold and silver has been steadily increased despite the lack of the cyanide plant and the presence of generally low grade mill feed from stockpile. Percent recovery for the gold has risen from 50% to 65% and will probably be maintained at about 70% until the cyanide plant is in operation. Percent recovery for silver has risen from an initial 75% to 80% and will rise to about 95% with cyanidation.



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HEATS, %RECOVERY & NET SMELTER RETURN

SCALE	—	FEB. 11, 1969	FIG. 2

Considering the fact that the mill is attaining reasonable recoveries from this complex ore, without the benefit of the cyanide plant and despite the difficulties of a mid-winter tune-up, its performance to date is considered to be reasonable..

The production record from Sept., 1968 to January, 1969 is shown in Table 3.

(B) ESTIMATED PERFORMANCE TO JULY, 1969:

From the records of performance to date and from the mine production estimates for the next 6 months, (Part I of this report), plus the projected performance of the mill up to and including the operation of the cyanide plant, the writer has compiled Figure 2 showing the progressive increase in concentrate production from the Mt. Nansen mill. (The projected mill production figures are presented in Table 4).

These figures have been converted to a net smelter return for the operation and this is also presented graphically from Sept., 1968, to July, 1969, in Figure 2. From the net smelter return must be subtracted all costs in order to determine the net operating profit. As can be seen in Figure 2 a net smelter return of about $350,000. per month should be attained by July with the installation of the cyanide plant in June. Start-up dates of April and June are considered reasonable for the regrind mill and the cyanide plant respectively.

The gold and silver recoveries have been reduced by 5% from the expected for June, 1969, to allow for tune-up of the cyanide plant. The flotation recoveries are shown to decrease in June due to the introduction of oxidized Webber ore.

The effect of the cyanide plant on the mill performance is considerable and therefore the following section of this report is devoted to the discussion of that plant.

TABLE 3

MILL PRODUCTION - SEPT., 1968-JAN., 1969

	TONNAGES			ASSAYS						METAL CONTENTS				RECOVERIES					
				Head		Con		Tails		Con		Tails		Con		Tails		Calc. Head	
Month	Head	Con	Tails	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag
Sept./68	390	167		.121	2.45			.03	.43	16.7	314.0	11.2	91.4	59.9	77.5	40.1	22.5	.072	1.04
Oct./68	2265	175.6		.23	5.01			.061	.66	259.4	8406.3	127.5	1380.0	67.0	85.8	33.0	14.2	.171	4.32
Nov./68	3967	200.3		.23	4.76			.097	.79	392.5	11465.5	365.0	2975.0	51.8	79.3	48.2	19.7	.191	3.64
Dec./68	4146	209.1		.23	4.5			.096	.56	353.2	9437.5	378.0	2205.0	48.3	81.0	51.7	19.0	.167	2.58
Jan./69	5218	273.4								619.9	17935.0								

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TABLE 4

PROJECTED MILL PRODUCTION TO JULY, 1969

																Additional Cyanide Plant Recovery		
																Au	Ag	
Feb./69	5200	561	4639	.50	8.90	3.91	70.0	.195	1.50	1690.	39300.	910.	6950.	65.0	85.0			
Mar./69	6300	694	5706	.54	9.70	3.43	75.0	.179	1.60	2380.	52000.	1022.	9100.	70.0	85.0			
April/69	7300	715	6585	.60	9.80	4.29	85.0	.199	1.64	2070.	60700.	1310.	10800.	70.0	85.0			Start Regrind
May/69	6000	588	5412	.52	12.70	3.38	110.0	.173	2.12	2185.	64700.	935.	11500.	70.0	85.0			
June/69	6000	627	5373	.53	19.60	3.55	150.0	.178	4.37	2225.	94000.	955.	23500.	70.0	80.0	15.0	80.0	Start cyanide plant
July/69	6000	688	5312	.57	21.50	3.47	150.0	.194	4.86	2390.	103200.	1030.	25800.	70.0	80.0	20.0	15.0	

(C) CYANIDE PLANT:

From the cyanide test results achieved by the Department of Mines in Ottawa in September, 1968, it would appear that the installation of the cyanide plant is of great importance. The economic value of this installation will increase as the transition from the Huestis zone to the Webber zone proceeds. The oxidized nature of the latter zone will be detrimental to flotation recoveries but high recoveries can be achieved with a supplementary cyanide process.

The cyanide plant can be erected in two months once the ground is thawed and all equipment is on site. The probable costs are:

Labour and rentals	$35,000.
Electrics, piping, heaters, lumber, etc.	15,000.
Total:-	$50,000.

Thawing this ground may be difficult but the mine personnel can experiment with space heaters and determine if this is feasible.

The following operating profit to be expected from the cyanide plant is based on projected mill heads for July, 1969:

Net smelter return/month	$58,000.
Operating costs/month	12,000.
Net operating profit/month:	$46,000.

On the basis of these figures it can be seen that the cyanide plant will pay for itself well before the end of the year.

The recommendation to conduct cyanide tests on the present tailings is important, for the results of these tests will enable the following questions to be answered more accurately:

1. What economic gain will result from operating the cyanide plant on the present low heads and in this ore where the flotation process is fairly efficient.

2. If the cyanide plant is economically viable on these tails then plans must be made to stockpile tails from the cyanide plant in another area while the old tails are pumped to the cyanide plant for treatment.

3. If the tests show that these tails require further treatment then the need to bring the cyanide plant into production immediately, despite costly adverse weather conditions, may not be quite so urgent as no losses are occurring that will not be recovered later. However, the capacity of the cyanide plant is limited and the less tails to be processed over and above the regular mill run the better. The return of these tailings will represent a significant operating cost.

APPENDIX

MILL OPERATING RECOMMENDATIONS

1. The mine cars dump ore through a grizzly onto a pan conveyor that is currently operating with a conveyor belt instead of the proper pans. This is undoubtedly a temporary measure and this unit will operate with less maintenance and attendance when the proper pans are installed.

2. The pan feeder discharge chute has a supporting "I" beam that is located too close to No. 1 conveyor and will cause blockage and spills that are time consuming delays as well as a constant rip hazard. Raising this member well above the flow of material is a simple operation and will eliminate this problem. This feeder and conveyor unit should operate satisfactorily without constant attendance.

3. The discharge opening from the coarse ore bin requires some heavy anchor chains or similar weights to control the flow of ore from the vibrating feeder. These weights will enable the crusher operator to feed steadily rather than intermittently as is presently done.

4. No. 2 conveyor transports ore from the vibrating feeder over a grizzly and into a Jaw crusher. The grizzly is presently not in operation due to the presence of frozen muck in the fines chute. The jaw crusher is apparently operating satisfactorily with this arrangement. The jaw crusher appears to be doing very little work and is only crushing a small proportion of the time compared to the cone crusher. This crusher should be kept at the minimum jaw setting at all times. The use of a grizzly before the Jaw crusher is important for two reasons: (1) it greatly reduces the chances of stalling the crusher (especially when wet fines are present) which could result in a mechanical failure. (2) it allows a greater tonnage throughput at the minimum jaw setting. The fines chutes from the grizzly is located too close to the crusher and causes inconvenience and lost time when adjusting the setting of the jaws.

5. The Jaw crusher discharges into no. 3 conveyor and onto no. 4 conveyor to a double deck vibrating screen. The top deck screen has 1" openings and the bottom deck screen has 3/4" openings. The screen is in closed circuit with a 3 ft. standard cone crusher. When dry ore is crushed there is no problem in the plant. If wet sticky ore is ever encountered there will be a serious problem with the chute at the end of no. 3 conveyor and the chute from the screen undersize to the no. 4 conveyor. These chutes are too flat for the free flow of wet ore. This condition is caused by no. 4 conveyor being installed too far away from no. 5 conveyor. There are two remedies for the chute at no. 3 conveyor: (1) install a high density nylon lining in the chute to reduce the friction, (2) if (1) is not satisfactory then nos. 3 and 4 conveyors can be extended a few feet until a satisfactory chute angle is attained. The fines chute from the screen could be lined with nylon. This would be a more effective application than the use of this material in the coarser no. 3 chute.

6. I would recommend that all conveyors that are not under the direct surveillance of the operator be equipped with a set of guidlers at the tail and head pulleys for positive belt training. This would cost approximately $65.00 per conveyor.

7. The most serious fault with the crushing plant is the lack of dust control. When crushing frozen ore the conditions are intolerable and will result in closure of the plant if observed by the inspector. Costly repairs and down time can be expected soon because electric motors are not designed to operate in such conditions.

8. There are two discharge openings on each of the fine ore bins that feed onto nos. 7 & 8 conveyors. Both these conveyors are running 2-3 times faster than they should. The condition necessitates pulling from one chute instead of two, thus producing less ore blending effect. This also increases the chance of the mill running empty for a period if one chute plugs. At present these conveyors need creep only a fraction of an inch to cause a spill. This can easily be rectified by reducing the width between the skirt boards and installing a set of guidlers on each conveyor. The present wooden boards used to adjust the flow of ore from the feeder should be replaced with a vertical metal gate with ascrew adjustment.

9. The feed chutes to the mills will always be a costly maintenance item unless they are redesigned. A sand box should be built to absorb the energy of the cyclone underflow and a skirt installed around the apex to direct this flow into the sand box. Ore from the conveyor should drop onto a bed of ore. (These concepts are demonstrated in a sketch left in the mill office. The balls can then be fed into a curved 4" plastic pipe as shown in that sketch). The above chutes should be used in conjunction with drum feeders which will be much superior to the present spout type of feeder but also more expensive. The above modifications will eliminate the excessive cleanup problem that is presently encountered.

10. The most serious defect in the flotation circuit is in the froth launders. They are quite inadequate and should be discarded as soon as new ones are made. (Drawings for new ones have been left in the mill office by the writer). These launders create a great deal of unnecessary work for the operator and make it impossible for them to maintain any semblance of density control. No able flotation operator would tolerate this condition for long.

11. The flotation circuit consists of two banks of cells and two conditioners. One side is called a sulphide circuit and the other is called an oxide circuit. The concentrates from both banks of cells discharge to a 14' x 9' thickener. The thickener underflow is filtered and the overflow goes to waste during the winter months but is rerouted to the sulphide conditioner when freezing conditions are less severe. The thickener overflow is quite dirty and represents a significant unrecorded loss. This loss is aggravated by the excess water required on the flotation launders. The addition of about 10-15 pounds of flocculant per month would produce a clear overflow on this thickener if it is fed correctly.

12. A pumping problem presently exists between the thickener and filter and is caused by the segregation of sands and slimes in the thickener and an incorrect pump speed. This can be corrected by ensuring that the thickener underflow is adequately flocculated and by slowing the pump to a speed that will produce slightly more feed to the thickener than it can handle. If line sanding problems are encountered the present two inch pipe size should be reduced to one and a half inches. With proper thickening and a regular filter bag changing schedule it should be possible to filter ten to twelve boxes of concentrate per shift. If adequate storage can't be attained in one thickener then the other thickener should be utilized.

13. The present loading system will probably be altered this year when the 25 ton containers will be introduced by White Pass and Yukon Route. The present loading system should have the following modifications made: (1) The roller conveyor leading from the filter discharge to the scale should be inclined enough so that one man can readily push the full box to the scale, (2) The present concentrate box hoist should be motorized so that one man can readily transport the boxes to the storage area. Because of the location of the thickener and the tailings pump box there is little that can be done about providing transportation and storage of the empty 150 pound containers to the area of the filter discharge. However, it is relatively easy to organize the personnel so that there are two men available for moving boxes when required. There should be no difficulty experienced for one man making up, loading, sampling and stacking twelve to fourteen boxes of concentrate per shift. This man should be under the mill supervisers. The loading of trucks would require an additional man or two for about an hour. The present slings used for hoisting the loaded boxes of concentrate are poor and tend to damage the boxes. An arrangement similar to the sketch left in the mill office can be made up easily and cheaply.

SAMPLING & METALLURGICAL CONTROL:

The personnel of this plant were operating under a serious handicap when no assays were available to them on a day-to-day basis. Now that the assay office is functioning normally it is most important to have the metallurgical accounting system set up so the maximum amount of information is obtained as soon as possible. The following daily samples are necessary for proper mill control:

1. Head sample from the cyclone overflow.
2. Tail sample from sulphide cells.
3. Concentrate sample from sulphide cells.
4. Concentrate sample from oxide cells.
5. Tail sample from oxide cells.
6. Concentrate sample from boxes.

The results from these samples should be calculated each day as shown on the example forms left at the mill office. The present practice of assaying each box of concentrate is not necessary and is very time consuming when such a backlog of assays remain to be done. These samples should be composited into one day's production with one assay for each day's production.

The mill sampling schedule must be organized so that the results of a day's production is known the following day. At present there is only one drier on the property and that is located at the assay office. The daily sample cutoff should coincide with the end of day shift when the filtering of the day's concentrate production has been completed and transportation is available for taking the samples to the assay office.

Sampling for metallurgical control in the mill is of paramount importance and is the key to the gathering of useful information that is necessary to operate at maximum economic levels. Great care is required in setting up the sampling points so that the correct sampling technique can be used. Strict supervision must be maintained at all times.

There is need of a continuous program of mill testing and some of the most important points are listed below:

1. The quantity of copper sulphate in no. 2 bank.
2. The use of R404 collector in no. 2 bank.
3. The use of sodium sulphide in no. 2 bank.
4. The effect of pH with soda ash in no. 1 bank.
5. Screen analyses on tails and concentrates.
6. Determination of recovery at coarser grinds.
7. Laboratory cyanide tests on nos. 1 and 2 bank tails and mill heads.

The determination of the maximum capacity of the mill or the minimum grind at which recovery can be maintained in the rougher flotation is important information that is required for mill operation and mine planning. A coarse grind will reduce the grade of rougher concentrate but the regrind mill could upgrade this product 20-25% when installation is complete.