C U R R A G H R E S O U R C E S I N C .

FARO MINE

NEW MINE PLANNING AND DESIGN
FOR
VANGORDA AND GRUM DEPOSIT

AUGUST 1987 - AUGUST 1988

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August/88
/dlb

1.0 INTRODUCTION

1.1 SCOPE OF WORK

Mr. James P. Moore, [redacted], General Manager, Curragh Resources Inc., Faro, Yukon Territory, requested Mr. Ion Vintila, P.Eng., to review the Mine Planning and Design for Vangorda and Grum deposits, prepared by Kilborn Engineering (B.C.) Ltd., in April 1987, with the objective of finding areas of technological and economical improvement in the exploitation of these two new open pit mines.

1.2 SETTING

Curragh Resources Inc. owns an open pit mine near the community of Faro, approximately 200 air kilometers Northeast of Whitehorse, Yukon Territory (See Figure 1). The processing plant, with a daily capacity of 13,500 tonnes ore, produces selective concentrates of lead and zinc. The actual operating mine and plant are located approximately 20 kilometers Northwest of the Town of Faro at an elevation of +1100 to 1300 meters above the sea level.

The main access road to the area from Whitehorse, approximately 360 kilometers, travels through the town of Carmacks.

The electric power to the mine is brought parallel to the main access road from Whitehorse area, by a 138 Kv power line.

There is no electric power in the area of Vangorda and Grum deposits.

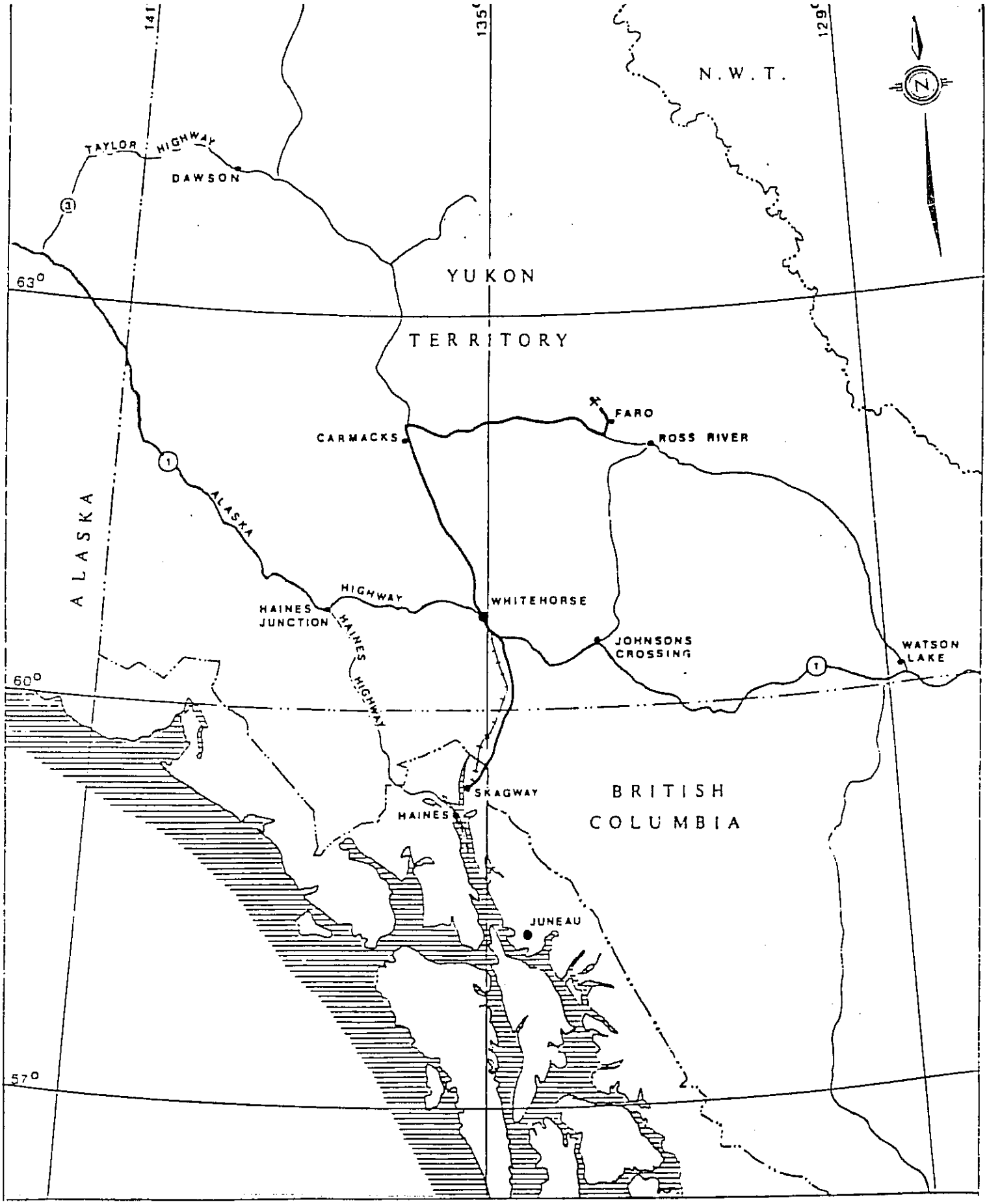

FIGURE 1 LOCATION PLAN

FARO, YUKON

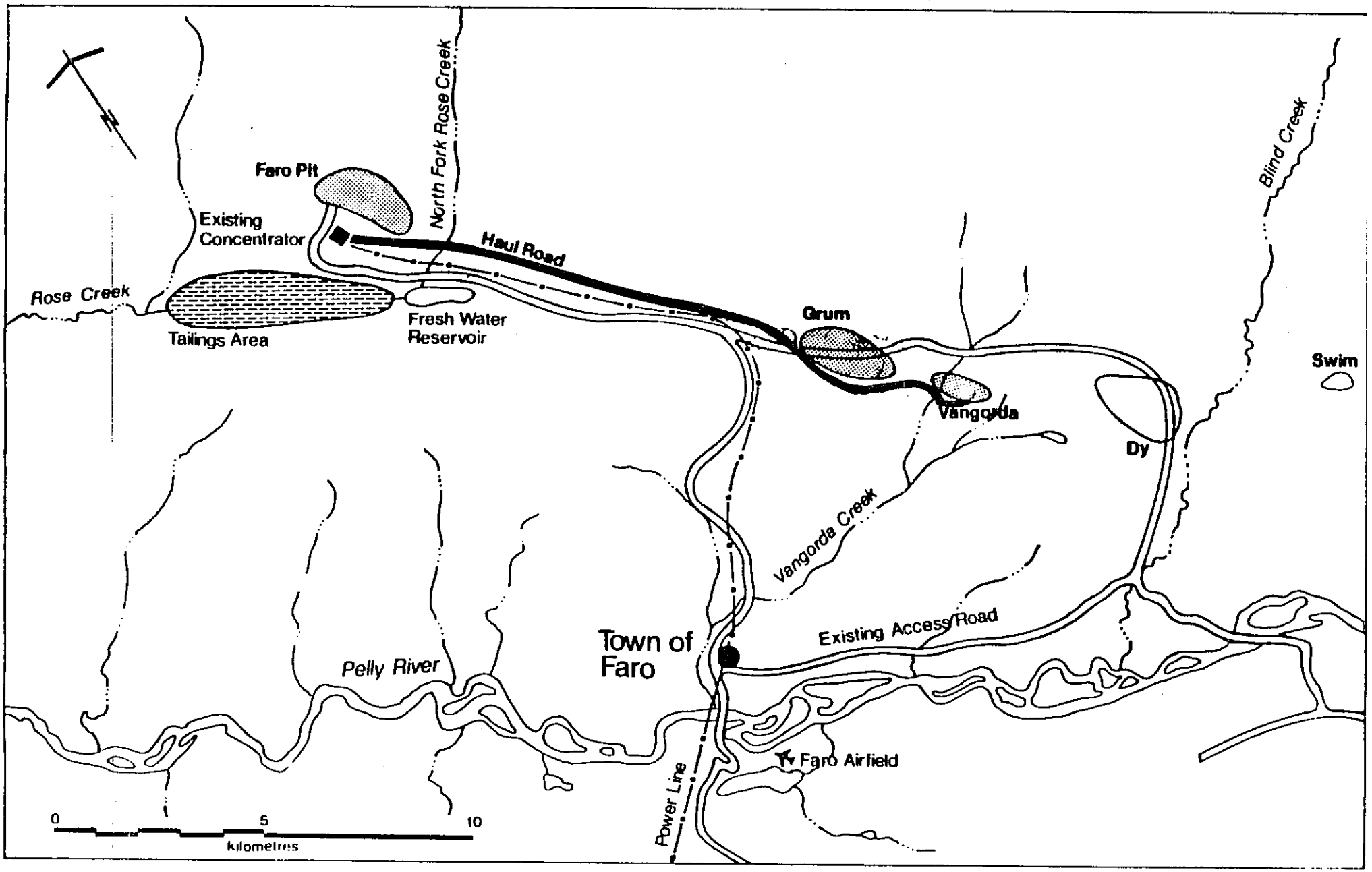

Figure 2

Faro, Vangorda and Grum Ore Deposits and Haul Road

The Vangorda and Grum deposits are located 8 - 10 kilometers East of the Town of Faro, and 12 - 14 kilometers Southeast of the Faro Mine.

1.3 INFORMATION BASE

The main documentation taken into consideration for the planning and design of Vangorda pit was:

- Geology sections (scale 1:500), for Vangorda deposit, 2W, 00, 2E, 4E, 6E, 8E, 10E, 12E, 14E, 16E, 18E, 20E, 22E, 26E and 28E, edited in Whitehorse office by Mr. Gregg Jilson and dated June, 1986;

- Computer printouts of Vangorda assay database from 28.08.1987;

- Geology sections (scale 1:500), for Grum deposit, 58 W to 88 W, even numbered, done by Cyprus Anvil Mining Corporation in 1982 and edited in Curragh Whitehorse Office in 1987;

- Surface maps scale 1:1000, for Vangorda and Grum Deposits with contour lines, drill holes and geology sections location;

- Surface maps scale 1:2000 and 1:5000 in the area;

- Maps scale 1:2000, with contour lines of the overburden-bedrock surface;

- Maps scale 1:2000, with contour lines of the overburden thickness;

- Various Geotechnical Studies done by Montreal Engineering and D.R. Piteau & Associates Ltd. in the area; and

- Long range plan for Faro, Vangorda and Grum deposits prepared by Kilborn Engineering (B.C.) Ltd., in April 1987.

1.4 COLLABORATION

This work was done in Curragh Faro Mine office, with the absolute support and collaboration of Mr. James P. Moore, General Manager and Mr. Kim Barrowman, Manager of Mining and direct involvement, assistance, cooperation and participation of Mr. Gregg Jilson, Vice-President of Exploration, Mr. Kresho Galovich, Chief Mine Engineer and Mr. John Huntley, Development Engineer.

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3.0 VANGORDA DEPOSIT

3.1 GENERAL

Vangorda is a small deposit with an extention of approximately 900 m length, 200 - 300 m width and under 100 m depth. The area was explored starting in 1953. Up to 1986, 45 rotary holes and 61 diamond drill holes were drilled.

The geological reserves with a grade over 4 % Pb & Zn were calculated using a computer model (V8607 model), constructed by Curragh personnel, with Block size 4.5 m high, 4.5 m across strike and 10.0 m along strike.

- Total reserves t 7,457,000
- Pb & Zn % - 8.71
- Pb % - 3.78
- Zn % - 4.92
- Ag g/t - 53.46
- Au g/t - .69

3.2 MINING CRITERIA

The general development of the pit assumed a truck and shovel operation.

a) The specific gravities used for the material excavated from the Vangorda Pit, were those existing in the computer model.

b) Bench Height

The computer block model existing at this date has a block height of 4.5 m. In this work, a 12 m bench in the waste and a 6 m bench in the ore were assumed.

c) Pit Slope

In the rock area the slope angle was maintained (as in the Kilborn Study) as follows:

- 40 ° in the area where the foliation is dipping into the pit and 45 ° in the other areas.

- For the overburden the angle was reduced from 35° to 30 °.

d) Pit Roads

The width of the roads was kept at 30 m and the maximum grade 8 % (exceptions 10 %).

3.3 PIT DESIGN

In the design of the pit, done on a map scale 1:1000 (10 m contour lines average slopes), the base documentation consisted of the geology sections scale 1:500, the computer database of the drillhole, and the maps containing the overburden data in the area.

A more detailed map 1:1000, showing the slope of the pit by 12 m bench, was produced. That map has to be taken into consideration for any surveying purposes in the area of the pit.

With the intention of reducing the volume of excavation two major changes were done in the design of the pit:

- The return road from the Southern highwall was moved outside of the pit, and

- The Northwestern highwall was removed to excavate as little waste as possible from the bottom of the main fault existing in this area.

3.4 MINING PLAN CONCEPT

Vangorda pit will be mined in one stage. The scheduling of excavations shown in the 14 phases is intended to postpone as late as possible the diversion of the Vangorda Creek which is crossing the area of the pit.

Most of the waste, overburden and rock will be deposited in one dump located over the southern area of the pit. Only a very small volume of excavation from the upper benches (+1152 m from the northern area of the pit) will be deposited in a small dump located in the northern side of the Vangorda Creek.

3.5 MINING PHASES

The excavations scheduled to be done in 1988 are shown in three maps, 1A, 1B, 1C, "Prestripping for 1988", scale 1:1000 representing a volume of overburden of approximately 240,000 m^3 or 500,000 tonnes.

All the material will be dumped along the main haul road, helping the construction of that road.

The area selected for excavation is dry, cleared of trees and bushes, and has an easy access road for the equipment.

It is necessary to build 300 m of temporary road from the elevation +1164 m to +1140 m to bring the waste to the area of the haul road.

Phase 1 - Overburden Stripping, scale 1:2000 shows the starting of the external dump, the stripping at the elevation +1152 and a temporary (250 m) road between the pit and the dump (elevation +1150 m). All the works are located in the southern side of Vangorda Creek.

On the same map are shown the areas needed to be cleared in 1987 and 1988, for excavation and dumping.

- The pit area to be cleared and burned represents 28 ha.

- Dumping area where big trees have to be cut is 49 ha.

At that date the program scheduled for 1987 is realized, 21 ha of trees and bushes were cleared and burned and 25 ha of trees were cut.

Phase 2 - Represents the starting of the stripping at the elevation +1140 m and ending the work at the elevation +1152 m.

The waste, mainly overburden, will be used for haul road construction and the remaining will be dumped in the main dump at the elevation +1140 and +1150 m.

Phase 3 - Overburden Stripping show bench +1140 m fully developed on the southern side of Vangorda Creek.

Phase 4 shows the starting of the bench +1128 m in one area close to Vangorda Creek and south of that, and stripping above the elevation +1152 m and the waste dump at the elevation +1160 m, on the northern side of Vangorda Creek.

The access at the bench +1128 will be done directly from the main haul road (elevation +1130 m).

Vangorda Creek will be kept mainly in its existing route with minor corrections.

To excavate bench +1140 in the northern side of the Creek it is necessary to use a temporary crossing over the Creek with one or two culverts.

Phase 5 Starting Bench +1116

This phase shows the opening of the bench +1116, the ending of the bench +1140 south of the Creek and the ending of the bench +1128 north of the Creek.

Vangorda Creek is still not diverted. In this period the southern side of the pit will have two access roads. The northern side will have only one.

Phase 6

Vangorda Creek will be diverted in a culvert on a berm on the north side of the pit, especially built for that purpose.

The pillar of the creek is removed at the elevation +1128 m making possible the development of the bench +1116 in the northern area of the pit.

Phase 7 Starting bench +1104

Bench +1104 will be started using the northern access road. There is high grade ore at the bottom of the southern road and this access will be cut for a short period of time to remove this ore, and backfill the hole.

Phase 8 Starting Bench +1092

In this phase the access road from the northern side of the pit will be cut and the pillar of the road between elevations +1116 m and +1128 m will be excavated.

From this time on, the only access in the pit will be the southern one.

Phase 9 Starting Bench +1080

With bench +1092 being in progress, a temporary road will be executed from that elevation to +1080 m in the southwestern side of the pit. The execution of the temporary road is justified because in the pillar of the final road, there is high grade ore which has to be excavated. The hole will be backfilled at the elevation of the final road. That operation can be seen in the next phases.

Phases 10 Starting Bench +1068

The temporary road will continue to the elevation +1068 m, and at that time the excavation on the bench +1080 will be in progress.

Phase 11 Mining Bench +1068 and Starting Backfilling

Part of the waste from the pit will be trucked to the elevation +1105 m and backfilled on the route of the main road, starting from the elevation +1092 m.

Phase 12 Access Road on Backfilling to Bench +1068

Once the access road is finished, the excavation of the pillar of the temporary road up to the elevation +1068 m will start.

Phase 13 Starting Bench +1056

A temporary access has to be provided to the elevation +1062 m and +1056 m, the last bench of the pit, to recover some high grade ore from the pillar of the final road.

Phase 14 Final Stage

This phase shows the ultimate pit and dumps of Vangorda Pit.

The pit will be filled with water becoming a lake with a volume of 4 million m^3. The elevation of the surface of the lake will be +1023 m.

3.6 PIT RESERVES

3.6.1 The in situ reserve calculation was done by computer using PC Mine software.

The minimum 5 % Pb + Zn for the high grade was assumed. An arbitrary minimum 4 % (Pb + Zn) was taken into consideration for the low grade ore.

In Table 1 the quantities of overburden, rock, low grade and high grade ore calculated by benches of 4.5 m are shown.

The total high grade ore in situ is:

4,980,000 t with 9.85 % Pb + Zn
4.29 % Pb
5.56 % Zn
61 g/t Ag
.685 g/t Au

3.6.2 Mining Reserves

The in situ reserves were diluted with 15 % waste (at 0 grade) and the losses were considered 5 %.

In Table 2 the quantities of overburden, rock, low grade ore and high grade ore are shown by 4.5 m benches:

High grade ore	5,440,000 t
Low grade ore	532,000 t
Total Ore	5,972,000 t
Overburden	7,596,000 t
Rock	8,000,000 t
Total Waste	15,596,000

Stripping Ratio - 2.61 t waste per t of total ore
- 2.96 t waste per t of high grade ore

High Grade Ore Quality:

Pb + Zn %	8.58
Pb %	3.74
Zn %	4.84
Ag g/t	53
Au g/t	.594

Low Grade Ore Quality:

Pb + Zn %	3.91
Pb %	1.71
Zn %	2.20
Ag g/t	23.5
Au g/t	.508

3.6.3 Comparison with Kilborn Study

Quantities in t x 10^3

Specification	New Data	Kilborn Data	+/-
Rock Waste	8,000	12,418	-4,418
Overburden	7,596	9,069	-1,473
Total Waste	15,596	21,487	-5,891
Highgrade Ore t	5,440	5,825	- 385
Lowgrade Ore t	532	634	- 102
Total Ore	5,972	6,459	- 487
Strip Ratio t/t			
Total Ore	2.61	3.33	12.10
High Grade Ore	2.96	3.80	15.57
High Grade Ore Quality			
Pb + Zn %	8.58	8.50	
Pb %	3.74	3.70	
Zn %	4.84	4.80	
Ag g/t	53.0	52.9	
Au g/t	.59	.51	

The above data shows a reduction of the quantity of waste from 21.5 million tonnes to 15.6 million tonnes (27 %) and ore from 6.45 million tonnes to 5.97 million tonnes (7.5 %).

The quality of the ore remains similar to that of the Kilborn data.

TABLE 1
V A N G O R D A P I T
INSITU RESERVES
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
> 1160	141	297	8	21									
1155.5	202	424	10	26									
1151	350	734	17	47									
1146.5	499	1,049	34	102	4	14	5	19	8.499	3.322	5.177	49	.449
1142	559	1,173	60	174	7	23	29	109	8.452	3.524	4.928	49	.585
1137.5	462	970	1,414	402	11	40	63	244	8.569	3.721	4.848	51	.576
1133	395	830	163	462	8	27	93	352	8.206	3.583	4.623	50	.607
1128.5	349	732	185	544	12	43	72	279	8.936	3.837	5.099	55	.678
1124	272	571	221	640	10	32	47	179	10.182	4.222	5.960	65	.728
1119.5	199	418	230	654	5	15	73	269	10.396	4.332	6.064	61	.621
1115	125	263	244	690	9	29	74	264	10.045	4.139	5.906	56	.569
1110.5	57	120	257	720	13	37	82	282	9.753	4.061	5.692	54	.588
1106	6	13	234	652	13	40	95	319	9.637	4.041	5.596	54	.649
1101.5	1	2	205	572	1	31	88	296	9.046	3.857	5.189	54	.781
1097			175	495	9	24	81	285	9.469	4.166	5.304	58	.747
1093.6			155	437	5	12	79	303	11.292	5.157	6.135	74	.688
1088			136	390	5	14	77	295	11.458	5.224	6.255	74	.711
1083.5			149	446	4	12	45	179	12.114	5.480	6.634	80	.663
1079			105	310	10	31	63	236	10.163	4.335	5.829	64	.687
1074.5			76	224	6	21	75	301	10.608	4.585	6.023	68	.740
1070			54	166	6	21	79	314	10.381	4.833	5.548	68	.769
1065.5			39	123	3	12	55	217	9.669	4.369	5.300	64	.744
1061			29	97	2	8	38	153	9.375	4.283	5.092	62	.799
< 1061			31	112	1	5	21	85	8.731	3.956	4.774	56	.877
TOTAL	3,617	7,596	2,958	8,506	154	487	1,334	4,980	9.849	4.291	5.558	61	.685

TABLE 2

MINING RESERVES

V A N G O R D A P I T

Diluted by 15 % at zero grade, 5 % mining loss

(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
> 1160	141	297	7	21									
1155.5	202	424	10	26									
1151	350	734	17	47									
1146.5	499	1,049	33	99	4	15	6	21	7.39	2.89	4.50	43	.390
1142	559	1,173	55	162	8	25	33	119	7.35	3.06	4.29	43	.509
1137.5	462	970	131	376	12	44	72	266	7.45	3.24	4.21	44	.501
1133	395	830	149	427	9	29	106	385	7.14	3.12	4.02	43	.528
1128.5	349	732	174	514	13	47	82	305	7.77	3.34	4.43	48	.590
1124	272	571	213	620	11	35	53	196	8.85	3.67	5.18	57	.677
1119.5	199	418	220	628	6	16	83	294	9.04	3.77	5.27	53	.540
1115	125	263	234	663	10	27	84	288	8.74	3.60	5.14	49	.495
1110.5	57	120	246	690	14	40	92	308	8.48	3.53	4.95	47	.511
1106	6	13	221	619	14	44	107	348	8.38	3.51	4.87	47	.564
1101.5	1	2	193	542	12	34	99	323	7.87	3.35	4.51	47	.679
1097			164	466	10	26	91	311	8.23	3.62	4.61	50	.650
1092.5			143	408	5	13	90	331	9.82	4.48	5.34	64	.598
1088			125	361	5	15	88	322	9.96	4.54	5.44	64	.618
1083.5			142	428	4	13	51	196	10.53	4.76	5.77	70	.576
1079			96	285	11	34	71	258	8.84	3.77	5.07	56	.597
1074.5			64	194	7	23	86	329	9.22	3.99	5.24	59	.643
1070			43	135	7	23	90	343	9.03	4.20	4.82	59	.669
1065.5			32	102	3	13	62	237	8.41	3.80	4.61	56	.649
1061			24	82	2	8	43	167	8.15	3.72	4.43	54	.695
< 1061			29	104	1	5	23	93	7.59	3.44	4.15	49	.763
TOTAL	3,617	7,596	2,761	8,000	170	532	1,512	5,440	8.58	3.74	4.84	53	.594

3.7 WASTE DUMPS

Vangorda pit will have two dumps. A small dump will be located in the northern side of the creek at the elevation +1160 m. This dump will receive non-acid waste from the northern area of the pit, above the elevation +1052 m. A 300 m access road will be needed.

The main dump will be located south of the limits of the pit. The top bench of this dump will be +1150 m (+1154). It is assumed a maximum 15 m height of the bench in overburden.

The surface of the dump will have an inclination of 0.5 % towards the pit and all the surface water will be directed into the pit when the mining is finished.

The waste will be dumped at three levels, +1130, +1140 and +1150 m.

A detailed design of the dump, and the sequence of dumping, was studied by Mr. John Huntley. An alternative of Phase 14 and four sections were produced showing the position of different types of waste in special cells, taking into consideration some government recommendations and requirements.

3.8 WATER MANAGEMENT (See maps 1:2000 by Phases)

a) Vangorda Creek crosses the area of the proposed pit, and has to be diverted to permit development of the mine.

Previous studies proposed the diversion of the creek by surface channels constructed in the northern or southern area around the pit.

Taking into consideration the very short life of the Vangorda Pit, a temporary alternative is considered acceptable. This alternative involves diverting the creek into culverts located on a berm on the northern highwall of the pit.

b) The surface water coming from the northeast (in the area of the pit and main dump) will be collected in two surface ditches (Vangorda E. Run-off Ditch and Vangorda SE Diversion Channel). The ditches were constructed in the winter of 1987 - 1988. The water is diverted into another tributary of Vangorda Creek south of the main waste dump.

c) The surface water coming from the north area of the pit will be collected in a ditch and diverted into Vangorda Creek (Vangorda N Run-off Ditch).

d) In the area of the main dump, for geotechnical reasons, two ditches are proposed to dewater one area, which actually is a swamp, before the first bench of waste is dumped.

e) The water pumped from the pit will be directed by pipes and a surface ditch to a water treatment pond and a treatment plant, located between the main waste dump and Vangorda Creek.

f) The surface water from the dump area will be directed to the pit. A contingency collector ditch will be built around the main dump if seepage of contaminated water appears, and will direct that to the treatment facilities.

4.0 GRUM DEPOSIT

4.1 GENERAL

Grum is a bigger and deeper deposit than Vangorda, having an extension of approximately 1000 m in length, 400 - 500 m in width and over 300 m in depth.

The area was explored starting in 1973 by surface drilling and underground drilling and mining works. Until 1986 there were executed 2,200 m of underground mining headings, 52,200 m of surface drilling and 15,000 m of underground drilling.

The evaluation of the geological reserves were done by a computer model, constructed by Curragh personnel, with block size 4.5 m high, 8.0 m across strike and 15 m along strike.

The geological reserve calculated with a grade over 4 % Pb + Zn were 30,649,000 t with:

Pb + Zn %	8.98
Zn %	5.58
Au g/t	.95
Pb %	3.40
Ag g/t	57.2

4.2 MINING CRITERIA

The development of the pit was done assuming a truck and shovel operation.

a) The specific gravities of the material excavated in Grum Pit are those existing in the computer model.

b) Bench Height

The existing computer block model at this date has a block height of 4.5 m. A 12 m bench for waste and 6 m bench for ore were taken into consideration for the design of the pit.

c) Pit Slope

There were no changes to the slope in the rock area from the Kilborn Study: in the areas where the foliation is dipping into the pit, 40 ° was assumed. In the other areas, 45 ° was used.

The overburden slope angle was taken as 30 ° and a berm 10 m wide was left at the contact between overburden and rock.

d) Pit Roads

The width of the roads was maintained at 30 m and the maximum grade for the permanent roads at 8 % (In some areas on the bottom of the pit a 10 % grade was accepted).

Construction of the permanent roads on the overburden highwall was considered prohibitive. All the roads were therefore built in rock or on rock backfill.

4.3 PIT DESIGN

The design of the pit was done on a map, with a scale of 1:1000 and a 10 m contour interval. The base documentation consisted of the geology sections (scale 1:500) showing the grade of the ore. As well, maps showing the overburden data in the area were used.

Detailed maps (scale 1:1000) showing the shape of the pit by 12 m bench, for the three stages of development of the pit were produced.

These are the only maps to be taken into consideration for any survey purpose in the area of the pit.

4.4 MINING PLAN CONCEPT

Grum pit will be mined in three stages:

- Stage 1 is intended to access the ore body as soon as possible, with the lowest pre-stripping volume possible.

- Stage 2 is intended to arrive and clean part of the bottom of the pit with the main intention of backfilling the area and building the final roads on backfilled material.

- Stage 3 will excavate everything to the final limits of the pit.

Most of the waste (95 %) will be deposited outside of the pit in three dumps. The volume of backfill will be approximately 9 million tonnes.

4.5 MINING PHASES

The area scheduled to be excavated in 1988 is shown in map 2 (scale 1:1000) representing a volume of overburden of approximately 335,000 m^3 or 700,000 tonnes from Stage I. The material excavated will be used for the construction of the main haul road.

The area is relatively dry but is not completely cleared of trees and bushes. Most of the area is covered with 1 - 3 m of gravel. It is necessary to build 300 m of road from the pit to the main haul road.

Stage I (see map Stage I Pit Limits and haul road and map 12 m benches) is planned to arrive at the elevation +1120 m. The eastern slope, mainly in overburden, will be the final highwall of the pit. The western slope will be mainly rock, bearing the haul road from the surface, elevation +1270 m, to the bottom elevation +1120 m.

The total volume of excavations in Stage I is 29.9 million m^3 or 74.5 million tonnes (including 12.5 million m^3 or 26.2 million tonnes of overburden from a total of 13.3 million m^3 or 28.0 million tonnes which has to be stripped over the life of the mine).

Stage I will be excavated in one phase, bench by bench and the waste will be deposited in three dumps: southeast dump for overburden; main dump for rock; and southwest dump for overburden and rock (from the upper benches of the pit).

Stage II (see map Stage IIA and map Stage II pit limits by 12 m benches) represent the extention of the pit to the west and in depth to the elevation +1040 m. The main haul road has to be rebuilt on the new highwall down to the elevation +1120 m. The bottom of the pit will be mined in two phases.

A temporary haul road will be built on the southwestern highwall from elevation +1120 m to +1070 m. This road will be used to recover the ore from the northern side of the pit to the elevation +1065 m. When all the ore in that area is mined, a backfilling operation will follow and the haul road removed over to the backfilled area (See Stage IIB). The total volume of excavation in Stage II is 30.5 million m^3 (or 84.1 million tonnes).

The rock and overburden from the upper benches will be deposited in the southwestern dump. The waste for the lower benches (rock) will go to the main dump.

Stage III. A next removal of the haul road has to be done on the final highwall of the pit. The mining will start from the surface and continue in one phase down to the elevation +1160 m. From that point a temporary road will be built on the western highwall to the elevation +1080 m (Map Stage IIIA). In that phase, 6.7 million tonnes of waste will be backfilled and the pit will look as shown in the map Stage IIIB.

The backfilling will be from the elevation +1150 m to the bottom of the pit. Two access roads will exist in a short period of time to the elevation +1080 m, one over the highwall and another on the backfilled dump. STAGE II

At that time the recovery of the temporary haul road pillar can start and the pit can continue to be mined until the final limits are reached, backfilling the material to the elevation +1180 m (map Stage IIIC and map Stage III, 12 m benches). Approximately 9 million tonnes of waste may be backfilled.

The final limits of the pit are shown on the map Stage III (final pit highwalls).

The total volume of excavation in Stage III will be 15.0 million m^3 or 41.3 million tonnes.

The total volume of excavation of the pit is 75.4 million m^3 or 200.0 million tonnes.

4.6 PIT RESERVES

4.6.1 The In Situ Reserves Calculation was done by computer using PC Mine Software. A minimum of 5 % Pb + Zn was considered for the high grade ore and an arbitrary 4 % Pb + Zn for the low grade ore.

Tables 3, 4, 5 and 6 show the quantities of overburden, rock, low grade and high grade ore calculated by 4.5 m benches and by stages.

The total high grade ore in situ is:

19,101,000 t with	Pb + Zn %	9.87
	Pb %	3.67
	Zn %	6.19
	Ag g/t	61.6
	Au g/t	.96

4.6.2 Mining Reserves

In situ reserves were diluted with 15 % waste at 0 grade and losses of 5 % were taken into consideration.

Tables 3, 7, 8 and 9 show the quantities of overburden, rock, low grade and high grade ore by 4.5 m benches and by stages resulting:

High Grade ore	20,869,000 t
Low Grade ore	3,109,000 t
Total Ore	23,978,000 t
Overburden	27,980,000 t
Rock	148,005,000 t
Total Waste	175,985,000 t

Stripping ratio - 7.34 t waste per t of total ore
- 8.58 t waste per t of highgrade ore

High Grade Ore Quality

Pb + Zn %	8.58
Pb %	3.19
Zn %	5.39
Ag g/t	53.6
Au g/t	.84

Low Grade Ore Quality

Pb + Zn %	3.89
Pb %	1.44
Zn %	2.45
Ag g/t	26.1
Au g/t	.61

4.6.3 Comparison with Kilborn Study

Quantities in t x 10^3

Specification	New Data	Kilborn Data	+/-
Rock Waste	148,005	199,082	-51,077
Overburden	27,980	31,580	- 3,600
Total Waste	175,985	230,662	-54,677
High grade Ore	20,868	21,740	- 872
Low grade Ore	3,109	3,253	- 144
Total Ore	23,977	24,993	-1,016
Strip Ratio t/t			
Total Ore	7.34	9.23	53.7
High Grade Ore	8.58	10.76	62.9

High Grade Ore Quality

Specification	New Data	Kilborn Data
Pb + Zn %	8.58	8.55
Pb %	3.19	3.17
Zn %	5.39	5.38
Ag g/t	53.6	54.0
Au g/t	.84	.84

The above data shows that the new design of the pit reduced the total waste by approximately 24 % (54.6 million tonnes) with only 1 million tonnes of ore lost.

The stripping ratio is reduced from 9.23 t/t to 7.34 t/t for total ore and from 10.76 t/t to 8.58 t/t for high grade ore. This represents a great improvement in the general economics of the mine.

The quality of the ore remains practically the same.

4.6.4 Champ Area

A possible extension of the limits of Grum Pit in Champ Area was studied and ore reserves were calculated by computer resulting:

	In Situ	Diluted
Overburden mil t	4.9	4.9
Rock mil t	5.5	5.4
High grade ore t	829,000	906,000
Low grade ore t	48,000	52,000

High Grade Ore Quality

	In Situ	Diluted
Pb + Zn %	9.98	8.68
Pb %	4.24	3.69
Zn %	5.74	4.99
Ag g/t	47	41
Au g/t	0.40	0.34

The stripping ratio is high, 10.8 t/t but if the mining is done at the end of the life of Grum Pit, all the waste could be dumped in the old pit with a very short hauling distance.

The area of Champ Pit is shown on the surface maps No. 3 (Scale 1:2000). The rough design of the pit with the average slope (10 m contour lines) was digitized in the computer in Whitehorse Office.

In 1987 a drilling program was executed in the champ area, and new data will be available soon. A new evaluation of the area has to be done at that time.

TABLE 3
G R U M P I T
(X 1000)

SUMMARY

	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
IN SITU													
Stage I	12,503	26,240	15,241	41,238	276	834	1,849	6,148	9.74	3.66	6.08	60.0	.890
Stage II	713	1,496	26,658	72,137	411	1,263	2,699	9,263	10.18	3.80	6.38	63.8	1.014
Stage III	116	244	13,556	36,661	250	749	1,109	3,690	9.27	3.38	5.92	58.7	.954
TOTAL	13,332	27,980	55,455	150,036	937	2,846	5,657	19,101	9.87	3.67	6.19	61.6	.962
DILUTED 15 % (0%) Loss 5 %													
Stage I	12,503	26,240	14,980	40,592	306	911	2,080	6,717	8.47	3.18	5.29	52.2	.774
Stage II	713	1,496	26,259	71,163	457	1,380	3,052	10,120	8.85	3.30	5.55	55.5	.882
Stage III	116	244	13,390	36,250	277	818	1,248	4,031	8.06	2.91	5.15	51.1	.830
TOTAL	13,332	27,980	54,629	148,005	1,042	3,109	6,380	20,868	8.58	3.19	5.39	53.6	.837

TABLE 4
GRUM PIT - STAGE I
IN SITU
RESERVES

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324													
1312													
1300	325	681	8	23									
1295.5	749	1,572	57	155									
1291	806	1,691	104	281									
1286.5	841	1,765	174	470			1	2	5.88	2.25	3.68	35	.486
1282	867	1,819	244	658			2	5	5.88	2.23	3.65	35	.488
1277.5	917	1,925	275	744			3	10	7.21	2.70	4.51	44.9	.559
1273	1,083	2,273	289	782			9	28	7.13	2.71	4.42	45.2	.566
1268.5	1,101	2,311	343	926	1	3	13	38	6.32	2.27	4.05	38.3	.703
1264	1,022	2,145	413	1,117	2	7	15	43	6.12	2.11	4.02	36.1	.786
1259.5	925	1,943	465	1,254	7	21	14	42	6.21	2.11	4.10	36.1	.825
1255	798	1,676	512	1,383	2	5	22	64	6.50	2.22	4.28	38.3	.811
1250.5	697	1,462	542	1,464	9	26	32	93	7.11	2.43	4.68	42.4	.753
1246	575	1,207	581	1,573	15	43	41	124	8.18	2.96	5.24	50.3	.806
1241.5	470	987	610	1,650	19	58	50	155	8.28	3.06	5.22	50.9	.827
1237	368	772	636	1,721	22	64	64	200	9.29	3.51	5.78	57.1	.840
1232.5	292	612	655	1,771	19	56	67	211	9.31	3.44	5.88	55.9	.808
1228	223	469	662	1,791	10	29	80	252	9.26	3.39	5.88	54.4	.783
1223.5	164	343	650	1,760	9	26	96	307	9.10	3.35	5.75	53.5	.775
1219.0	114	239	643	1,741	19	56	90	295	9.57	3.58	5.99	56.8	.824
1214.5	66	139	650	1,762	18	56	77	251	9.73	3.54	6.20	57.2	.844
1210	46	96	635	1,720	18	51	66	215	9.85	3.49	6.36	57.6	.875
1205.5	32	67	599	1,622	14	41	66	212	9.41	3.33	6.08	55.0	.866

Cont'd...

TABLE 4

GRUM PIT - STAGE I

IN SITU

RESERVES

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1201	18	38	564	1,526	13	40	72	237	9.79	3.59	6.20	58.4	.892
1196.5	4	8	530	1,434	8	24	79	266	10.68	4.01	6.67	64.4	.962
1192.0			500	1,351	6	20	76	260	10.95	4.12	6.83	67.3	.999
1187.5			476	1,287	7	21	66	223	10.23	3.76	6.47	62.7	.970
1183			442	1,199	15	45	57	188	9.48	3.45	6.04	58.5	.886
1178.5			404	1,095	12	38	62	203	8.94	3.29	5.66	55.3	.880
1174			373	1,011	6	19	63	210	9.08	3.43	5.65	57.6	.931
1169.5			343	927	3	8	65	218	9.68	3.67	6.02	60.7	.945
1165			304	823	4	13	65	222	10.35	3.88	6.47	63.6	.934
1160.5			272	739	4	13	62	209	9.82	3.75	6.07	61.4	.894
1156			244	658	3	9	59	158	10.00	3.72	6.28	62.2	.920
1151.5			216	584	2	7	56	194	10.41	3.89	6.51	66.0	.955
1147			194	523	1	3	52	191	11.48	4.46	7.02	73.6	1.008
1142.5			167	452	1	3	50	191	12.23	4.94	7.29	80.7	1.033
1138			141	381	2	6	43	164	12.18	4.92	7.26	80.8	1.037
1133.5			113	305	2	5	36	134	10.63	4.40	6.23	71.92	.972
1129			96	261	1	4	26	94	9.45	4.02	5.43	62.9	.855
1124.5			68	185	1	2	26	99	9.67	4.11	5.56	62.6	.872
1120			47	129	1	4	26	100	10.67	4.52	6.15	69.1	.889
1115.5													
1111													
1106.5													
1102													
1097.5													
TOTAL	12,503	2,040	15,241	41,238	276	834	1,849	6,148	9.74	3.66	6.08	60.0	.890

TABLE 5

GRUM PIT - STAGE II

IN SITU

RESERVES

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324													
1312	188	394	145	391									
1300	245	514	1,260	3,402									
1295.5	72	152	643	1,736									
1291	41	85	708	1,912									
1286.5	19	39	770	2,079									
1282	20	42	814	2,197									
1277.5	36	76	823	2,222									
1273	45	95	826	2,231									
1268.5	34	72	829	2,239									
1264	6	14	840	2,268			1	1	5.87	2.19	3.68	35.0	.525
1259.5	2	4	819	2,211			1	4	5.94	2.16	3.78	35.3	.534
1255	2	5	795	2,147			2	6	6.06	2.20	3.86	36.2	.573
1250.5	1	2	782	2,111			5	13	6.65	2.37	4.28	39.8	.585
1246			767	2,071			9	25	7.26	2.47	4.79	42.2	.569
1241.5			753	2,032	1	2	13	38	7.29	2.49	4.80	41.8	.558
1237			732	1,977	5	14	15	42	7.28	2.49	4.79	41.2	.562
1232.5			712	1,923	9	27	17	48	7.29	2.47	4.82	41.2	.568
1228			688	1,859	12	36	22	67	7.25	2.35	4.90	41.3	.529
1223.5			658	1,777	13	39	36	110	7.18	2.31	4.87	41.0	.528
1219.0			637	1,720	10	30	46	136	7.18	2.38	4.80	41.4	.533
1214.5			620	1,676	8	22	48	144	6.88	2.32	4.56	40.3	.521
1210			599	1,618	11	32	54	160	6.64	2.30	4.34	38.6	.527
1205.5			581	1,569	6	20	68	203	6.60	2.35	4.25	38.1	.570

Cont'd...

TABLE 5
GRUM PIT - STAGE II
IN SITU
RESERVES

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1201			565	1,526	5	15	73	215	6.62	2.30	4.32	37.0	.543
1196.5			556	1,503	8	25	63	188	6.79	2.34	4.44	38.1	.574
1192.0			544	1,472	11	35	55	174	7.66	2.75	4.91	45.2	.644
1187.5			532	1,439	11	33	53	175	8.78	3.36	5.42	53.8	.675
1183			514	1,390	6	19	60	192	8.32	3.28	5.09	52.3	.664
1178.5			491	1,328	6	19	63	203	8.94	3.41	5.53	57.2	.716
1174			454	1,229	10	33	65	212	9.33	3.54	5.79	59.0	.761
1169.5			438	1,185	12	37	64	213	9.50	3.67	5.83	60.7	.824
1165			424	1,146	10	32	65	223	10.19	4.04	6.15	66.1	.845
1160.5			398	1,075	16	50	77	265	10.73	4.16	6.58	67.6	.989
1156			374	1,014	11	34	93	318	10.48	4.04	6.44	66.6	1.117
1151.5			356	963	12	38	97	331	10.84	4.00	6.84	67.6	1.132
1147			330	893	16	47	103	351	10.69	3.94	6.75	66.9	1.104
1142.5			307	834	21	64	103	348	10.18	3.73	6.44	63.6	1.092
1138			289	790	28	84	100	339	10.19	3.74	6.45	63.2	1.120
1133.5			291	799	37	82	90	316	11.57	4.26	7.31	71.5	1.187
1129			284	779	21	64	90	318	12.01	4.42	7.60	74.1	1.172
1124.5			260	709	20	60	93	321	11.04	4.03	7.02	68.1	1.152
1120			247	672	17	52	96	325	10.19	3.70	6.48	63.2	1.090
1115.5			289	786	13	44	99	346	10.45	3.92	6.52	65.1	1.046
1111			278	755	16	53	79	283	11.85	4.38	7.47	74.0	1.124
1106.5			250	682	8	26	81	303	12.85	4.72	8.12	80.2	1.191
1102			229	625	4	13	83	313	13.70	5.03	8.67	85.0	1.286
1097.5			213	579	2	8	77	288	13.16	4.90	8.26	83.3	1.277

Cont'd...

TABLE 5

G R U M P I T - S T A G E I I

IN SITU

RESERVES

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1093			195	531	2	5	68	254	12.07	4.67	7.40	78.9	1.154
1088.5			170	462	2	6	58	216	11.88	4.53	6.85	77.1	1.139
1084			143	385	8	23	46	174	10.96	4.54	6.42	75.5	1.223
1079.5			123	336	5	14	48	184	10.21	4.23	5.98	71.0	1.135
1075.0			104	285	1	3	49	192	9.83	4.04	5.79	67.5	1.248
1070.5			87	242	1	3	40	159	10.36	4.09	6.27	69.5	1.291
1066			51	145	2	5	25	101	10.83	4.03	6.80	71.0	1.408
1061.5			34	96	2	8	21	84	10.26	3.81	6.45	66.9	1.390
1057			16	46	2	6	20	80	9.88	3.62	6.26	63.7	1.316
1052.5			9	25	1	3	21	84	10.21	3.81	6.40	65.3	1.409
1048			6	16			20	81	10.41	3.93	6.48	64.4	1.520
1043.5			5	13			16	65	10.91	4.12	6.79	65.3	1.554
1039			5	13			8	33	11.75	4.27	7.48	67.0	1.533
1034.5													
TOTAL	713	1,496	26,658	72,137	411	1,263	2,699	9,263	10.18	3.80	6.38	63.8	1.014

TABLE 6

G R U M P I T - S T A G E I I I

INSITU RESERVES

(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324	9	20											
1312	66	138	519	1,401									
1300	16	34	841	2,270									
1295.5	2	4	315	851									
1291	2	4	316	853									
1286.5	2	4	317	856									
1282	2	4	315	850									
1277.5	2	4	312	842									
1273	2	4	308	832									
1268.5	2	4	304	821									
1264	2	6	301	813									
1259.5	1	2	298	805									
1255	0	1	300	809									
1250.5	1	2	294	794									
1246	1	2	288	776									
1241.5	1	1	286	771									
1237	0	1	281	758									
1232.5	1	1	277	747									
1228	0	1	272	735									
1223.5	1	1	269	726									
1219.0	0	1	268	724									
1214.5	1	1	270	729									
1210	0	1	266	718									
1205.5	1	1	261	706									

Cont'd....

TABLE 6
GRUM PIT - STAGE III
INSITU RESERVES
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1201	1	2	257	693			1	2	6.28	2.27	4.01	35.9	.241
1196.5			249	673			7	20	6.30	2.21	4.09	35.8	.397
1192.0			244	658	1	4	8	22	6.31	2.24	4.07	37.1	.493
1187.5			240	647	4	11	6	18	6.65	2.37	4.28	41.0	.551
1183			234	632	4	11	9	27	6.81	2.39	4.43	42.3	.549
1178.5			233	628	2	5	14	42	6.80	2.44	4.36	36.9	.328
1174			243	657	1	1	18	54	7.08	2.52	4.56	38.4	.331
1169.5			242	654	2	7	16	47	7.07	2.50	4.57	40.8	.462
1165			235	636	8	25	12	37	6.65	2.28	4.57	36.7	.451
1160.5			231	624	7	20	17	49	6.57	2.21	4.36	36.8	.378
1156			225	609	4	13	16	47	6.52	2.20	432	36.8	.392
1151.5			226	609	4	12	13	41	7.41	2.77	4.64	44.9	.620
1147			229	621	1	3	13	40	7.70	2.97	4.73	47.4	.736
1142.5			236	638			13	41	7.35	2.83	4.52	45.4	.719
1138			239	647	1	2	11	33	7.46	2.69	4.77	44.3	.671
1133.5			237	642	1	2	14	43	8.52	3.06	5.46	50.9	.920
1129			230	625	3	10	17	56	9.32	3.38	5.94	56.4	1.007
1124.5			222	607	8	23	26	84	9.42	3.39	6.03	56.9	1.004
1120			201	546	21	61	34	113	10.02	3.52	6.50	60.1	1.036
1115.5			175	475	22	63	54	175	9.59	3.41	6.18	58.9	1.003
1111			159	432	17	47	64	208	9.36	3.38	5.98	57.9	.979
1106.5			148	405	17	48	63	204	9.08	3.31	5.77	57.1	1.015
1102			147	400	16	46	54	178	9.356	3.34	6.00	58.8	1.042
1097.5			132	359	16	48	55	180	9.55	3.36	6.19	59.9	1.042

Cont'd....

TABLE 6
G R U M P I T - S T A G E I I I
INSITU RESERVES
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1093			120	328	13	41	61	199	9.41	3.36	6.05	59.8	1.034
1088.5			102	281	13	40	67	221	9.50	3.47	6.02	61.1	1.022
1084			91	246	12	38	67	222	9.79	3.54	6.25	62.2	1.024
1079.5			87	236	10	30	61	202	9.72	3.50	6.22	61.9	1.016
1075.0			88	245	11	33	46	159	9.87	3.57	6.30	63.6	1.071
1070.5			90	249	8	22	37	127	9.28	3.42	5.86	60.3	.990
1066			80	218	5	16	31	108	8.46	3.06	5.40	53.7	.821
1061.5			71	193	3	11	27	95	8.29	3.00	5.29	53.0	.746
1057			50	138	5	18	25	91	9.45	3.40	6.05	63.0	.878
1052.5			32	89	3	11	32	117	10.10	3.65	6.45	69.7	1.066
1048			21	57	4	13	33	127	10.53	3.89	6.64	74.1	1.204
1043.5			13	37	1	4	32	130	11.81	4.36	7.45	84.3	1.294
1039			12	32	3	10	22	89	10.47	3.97	6.50	68.5	1.277
1034.5			2	6	2	5	10	40	12.35	4.67	7.68	72.6	1.218
TOTAL	116	244	13,557	36,661	250	749	1,109	3,690	9.27	3.35	5.92	58.7	.954

TABLE 7
MINING RESERVES
G R U M P I T - S T A G E I
Diluted 15 %, Loss 5 %
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1201	18	38	554	1,500	14	44	81	259	851	3.12	5.39	50.8	.775
1196.5	4	8	519	1,407	9	26	89	291	9.29	3.49	5.80	56.0	.837
1192.0			489	1,325	7	22	86	284	9.52	3.58	5.94	58.5	.869
1187.5			467	1,264	8	23	74	244	8.90	3.27	5.63	54.5	.843
1183			433	1,177	17	49	64	205	8.24	3.00	5.25	50.9	.770
1178.5			395	1,073	13	42	70	222	7.77	2.86	4.92	48.1	.765
1174			364	990	7	21	71	229	7.90	2.98	4.91	50.1	.809
1169.5			334	906	3	9	73	238	8.42	3.19	5.23	52.8	.822
1165			295	801	4	14	73	243	9.00	3.37	5.63	55.3	.812
1160.5			264	718	4	14	70	228	8.54	3.26	5.28	53.4	.777
1156			236	639	3	10	67	216	8.70	3.23	5.47	54.1	.800
1151.5			208	566	2	7	63	212	9.05	3.38	5.67	57.4	.830
1147			186	505	1	3	59	209	9.98	3.88	6.10	64.0	.876
1142.5			159	434	1	3	58	209	10.63	4.30	6.34	70.2	.898
1138			134	365	2	7	49	179	10.59	4.28	6.31	70.3	.902
1133.5			108	292	2	5	41	146	9.24	3.83	5.41	62.5	.845
1129			92	252	1	4	30	103	8.22	3.50	4.72	54.7	.743
1124.5			64	176	1	2	30	108	8.41	3.57	4.83	54.4	.758
1120			43	119	1	4	30	109	9.28	3.93	5.35	60.1	.773
1115.5													
1111													
1106.5													
1102													
1097.5													
TOTAL	12,503	26,240	14,980	40,592	306	911	2,080	6,717	8.47	3.18	5.29	52.2	.774

TABLE 7
MINING RESERVES
G R U M P I T - S T A G E I
Diluted 15 %, Loss 5 %
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324													
1312													
1300	325	681	8	23									
1295.5	749	1,572	57	155									
1291	806	1,691	104	281									
1286.5	841	1,765	174	471			1	2	5.11	1.96	3.16	30.4	.423
1282	867	1,819	244	658			2	5	5.11	1.94	3.17	30.4	.424
1277.5	917	1,925	275	743			3	11	6.27	2.35	3.93	39.0	.486
1273	1,083	2,273	288	779			10	31	6.20	2.36	3.84	39.3	.492
1268.5	1,101	2,311	342	922	1	3	14	42	5.50	1.97	3.52	33.3	.611
1264	1,022	2,145	411	1,112	2	8	17	47	5.35	1.83	3.50	31.4	.683
1259.5	925	1,943	463	1,248	8	23	16	46	5.40	1.83	3.57	31.4	.717
1255	798	1,676	510	1,377	2	5	24	70	5.65	1.93	3.72	33.3	.705
1250.5	697	1,462	538	1,453	10	28	35	102	6.18	2.11	4.07	36.9	.655
1246	575	1,207	575	1,558	17	47	45	135	7.11	2.57	4.56	43.7	.701
1241.5	470	987	602	1,630	21	63	56	169	7.20	2.66	4.54	44.3	.719
1237	368	772	626	1,697	24	70	71	219	8.08	3.05	5.03	49.7	.730
1232.5	292	612	645	1,746	21	61	75	231	8.10	2.99	5.11	48.6	703
1228	223	469	652	1,765	11	32	89	275	8.05	2.95	5.11	47.4	.681
1223.5	164	343	638	1,729	10	28	107	335	7.91	2.91	5.00	46.5	.673
1219.0	114	239	630	1,709	21	61	101	322	8.32	3.11	5.21	49.4	.717
1214.5	66	139	639	1,734	20	61	86	274	8.46	3.08	5.39	49.7	.734
1210	46	96	625	1,695	20	56	74	235	8.57	3.03	5.54	50.1	.761
1205.5	32	67	590	1,599	15	45	74	132	8.18	2.90	5.28	47.8	.753

Cont'd...

TABLE 8
MINING RESERVES
G R U M P I T - S T A G E I I
Diluted 15 %, Loss 5 %
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324													
1312	188	394	145	391									
1300	245	514	1,260	3,402									
1295.5	72	152	643	1,736									
1291	41	85	708	1,912									
1286.5	19	39	770	2,079									
1282	20	42	814	2,197									
1277.5	36	76	823	2,222									
1273	45	95	826	2,231									
1268.5	34	72	829	2,239									
1264	6	14	840	2,268			1	1	5.10	1.90	3.20	30.4	.456
1259.5	2	4	819	2,211			1	4	5.17	1.88	3.29	30.7	.464
1255	2	5	795	2,146			2	7	5.27	1.91	3.36	31.5	.498
1250.5	1	2	782	2,110			5	14	5.78	2.06	3.72	34.6	.509
1246			766	2,069			10	27	6.31	2.15	4.17	36.7	.495
1241.5			752	2,028	1	2	14	42	6.34	2.17	4.17	36.4	.485
1237			730	1,972	5	15	16	46	6.33	2.17	4.17	35.8	.489
1232.5			709	1,916	10	29	19	52	6.34	2.15	4.19	35.8	.494
1228			684	1,849	13	39	24	73	6.30	2.04	4.26	35.9	.460
1223.5			653	1,763	14	43	40	120	6.24	2.01	4.23	35.7	.459
1219.0			631	1,705	11	33	51	149	6.24	2.07	4.17	36.0	.463
1214.5			614	1,661	9	24	53	157	5.98	2.02	3.97	35.0	.453
1210			592	1,600	12	35	60	175	5.77	2.00	3.77	33.6	.458
1205.5			573	1,548	7	22	75	222	5.74	2.04	3.70	33.1	.496

Cont'd...

TABLE 8
MINING RESERVES
G R U M P I T - S T A G E I I
Diluted 15 %, Loss 5 %
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1201			557	1,505	6	16	81	235	5.76	2.00	3.76	32.2	.472
1196.5			548	1,483	9	27	70	205	5.90	2.03	3.86	33.1	.500
1192.0			536	1,453	12	38	61	190	6.66	2.39	4.27	39.3	.560
1187.5			524	1,420	12	36	60	191	7.64	2.92	4.71	46.8	.587
1183			506	1,370	7	21	67	210.5	7.23	2.81	4.43	45.5	.577
1178.5			483	1,307	7	21	71	222	7.77	2.97	4.81	49.7	.623
1174			445	1,206	11	36	73	232	8.11	3.08	5.03	51.3	.662
1169.5			429	1,162	13	40	72	233	8.26	3.19	5.07	52.8	.716
1165			414	1,122	11	35	74	244	8.86	3.51	5.35	57.5	.735
1160.5			386	1,046	18	55	87	290	9.33	3.62	5.72	58.8	.860
1156			361	981	12	37	105	347	9.11	3.51	5.60	57.9	.971
1151.5			342	929	13	42	110	362	9.43	3.48	5.95	58.8	.984
1147			315	856	18	51	116	383	9.29	3.43	5.87	58.2	.960
1142.5			292	796	23	70	116	380	8.85	3.24	5.60	55.3	.950
1138			273	751	31	92	113	370	8.86	3.25	5.61	55.0	.974
1133.5			276	762	30	90	102	345	10.06	3.70	6.36	62.2	1.032
1129			270	744	23	70	102	347	10.44	3.84	6.61	64.4	1.019
1124.5			246	674	22	66	105	351	9.60	3.50	6.10	59.2	1.002
1120			233	637	19	57	108	355	8.85	3.22	5.63	55.0	.948
1115.6			274	750	15	48	112	378	9.09	3.41	5.67	56.6	.910
1111			265	724	18	58	90	309	10.30	3.81	6.50	64.4	.977
1106.5			237	652	9	28	93	331	11.17	4.10	7.06	69.7	1.036
1102			216	595	4	14	95	342	11.91	4.37	7.54	73.9	1.118
1097.5			201	852	2	9	88	315	11.44	4.26	7.10	72.4	1.110

Cont'd...

TABLE 8
MINING RESERVES
G R U M P I T - S T A G E I I
Diluted 15 %, Loss 5 %
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	HIGH GRADE ORE				
									Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1093			185	507	2	5	78	277	10.50	4.06	6.44	68.6	1.003
1088.5			161	441	2	7	66	236	9.90	3.94	5.96	67.0	.990
1084			136	369	9	25	51	190	9.53	3.95	5.58	65.6	1.063
1079.5			116	318	6	15	54	201	8.88	3.68	5.20	65.7	1.074
1075.0			96	267	1	3	57	210	8.55	3.51	5.03	58.7	1.085
1070.5			81	227	1	3	46	174	9.01	3.56	5.45	60.4	1.123
1066			47	135	2	5	29	110	9.42	3.50	5.91	61.7	1.224
1061.5			30	87	3	9	24	92	8.92	3.31	5.61	58.2	1.209
1057			13	38	2	7	23	87	8.59	3.15	5.44	55.4	1.144
1052.5			6	17	1	3	24	92	8.88	3.31	5.57	56.8	1.225
1048			3	9			23	88	9.05	3.42	5.63	56.0	1.322
1043.5			2	7			19	71	9.49	3.58	5.90	56.8	1.351
1039			4	10			9	36	10.22	3.71	6.50	58.3	1.333
1034.5													
TOTAL	713	1,496	26,259	71,163	457	1,380	3,052	10,120	8.85	3.30	5.55	55.5	.882

TABLE 9
MINING RESERVES
GRUM PIT - STAGE III
Diluted by 15 % at zero grade, 5 % mining loss
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1324	10	20	0	0					0.00	0.00	0.00	00.0	0.00
1312	66	138	519	1,401					0.00	0.00	0.00	00.0	0.00
1300	16	34	841	2,270					0.00	0.00	0.00	00.0	0.00
1295.5	2	4	315	851					0.00	0.00	0.00	00.0	0.00
1291.0	2	4	316	853					0.00	0.00	0.00	00.0	0.00
1286.5	2	4	317	856					0.00	0.00	0.00	00.0	0.00
1282.0	2	4	315	850					0.00	0.00	0.00	00.0	0.00
1277.5	2	5	312	842					0.00	0.00	0.00	00.0	0.00
1273.0	2	4	308	832					0.00	0.00	0.00	00.0	0.00
1268.5	2	4	304	821					0.00	0.00	0.00	00.0	0.00
1264.0	3	6	301	813					0.00	0.00	0.00	00.0	0.00
1259.5	1	2	298	805					0.00	0.00	0.00	00.0	0.00
1255.0	1	1	300	809					0.00	0.00	0.00	00.0	0.00
1250.5	1	1	294	794					0.00	0.00	0.00	00.0	0.00
1246.0	1	1	288	776					0.00	0.00	0.00	00.0	0.00
1241.5	1	1	286	771					0.00	0.00	0.00	00.0	0.00
1237.0	0	1	281	758					0.00	0.00	0.00	00.0	0.00
1232.5	1	1	277	747					0.00	0.00	0.00	00.0	0.00
1228.0	1	1	272	735					0.00	0.00	0.00	00.0	0.00
1223.5	1	1	269	726					0.00	0.00	0.00	00.0	0.00
1219.0	1	1	268	724					0.00	0.00	0.00	00.0	0.00
1214.5	0	1	269	728					0.00	0.00	0.00	00.0	0.00
1210.0	1	1	266	718				1	7.96	2.51	5.44	42.3	0.26
1205.5	0	1	261	706					7.56	2.54	5.02	41.7	0.26
1201.0	1	1	257	693			1	2	0.00	0.00	0.00	00.0	0.00
1196.5			249	671			8	22	5.46	1.97	3.49	31.2	0.21
1192.0			243	655	1	4	9	25	5.48	1.92	3.56	31.1	0.35
1187.5			239	645	4	11	7	20	5.49	1.95	3.54	32.3	0.43
1183.0			233	629	4	11	10	29	5.78	2.06	3.72	35.7	0.48
									5.93	2.07	3.85	36.8	0.48

Cont'd...

TABLE 9
MINING RESERVES
GRUM PIT - STAGE III
Diluted by 15 % at zero grade, 5 % mining loss
(X 1000)

BENCH ELEVATION	OBDN. Cu. M.	OBDN. Tn.	ROCK Cu. M.	ROCK Tn.	LOW GRADE Cu. M.	LOW GRADE Tn.	HIGH GRADE Cu. M.	HIGH GRADE Tn.	Pb + Zn (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
1178.5			231	625	2	5	16	46	5.91	2.12	3.79	32.1	0.29
1174.0			241	652	0	1	20	59	6.15	2.19	3.97	33.4	0.29
1169.5			241	650	2	7	17	52	6.15	2.17	3.98	35.5	0.40
1165.0			235	634	8	23	14	40	5.78	1.98	3.80	31.9	0.39
1160.5			229	620	7	20	18	54	5.71	1.92	3.79	32.0	0.33
1156.0			224	605	4	13	17	51	5.67	1.92	3.76	32.0	0.34
1151.5			224	606	4	11	15	45	6.44	2.41	4.03	39.0	0.54
1147.0			229	618	1	3	14	44	6.70	2.59	4.11	41.2	0.64
1142.5			235	635	0	0	15	45	6.39	2.46	3.93	39.5	0.63
1138.0			238	644	1	2	12	36	6.49	2.34	4.15	38.5	0.58
1133.5			235	638	1	2	15	47	7.41	2.66	4.75	44.3	0.80
1129.0			227	620	3	10	20	61	8.11	2.94	5.17	49.0	0.88
1124.5			219	600	8	23	29	92	8.19	2.94	5.24	49.5	0.87
1120.0			197	536	21	61	39	123	8.71	3.06	5.65	52.3	0.90
1115.5			168	459	22	63	60	191	8.34	2.96	5.37	51.2	0.87
1111.0			151	412	16	47	72	227	8.14	2.94	5.20	50.3	0.85
1106.5			142	386	16	48	70	223	7.90	2.88	5.02	49.7	0.88
1102.0			140	383	16	46	61	194	8.13	2.91	5.22	51.1	0.91
1097.5			125	342	16	48	62	197	8.30	2.92	5.38	52.1	0.91
1093.0			113	309	13	41	68	217	8.18	2.93	5.26	52.0	0.90
1088.5			95	260	13	40	75	242	8.26	3.02	5.24	53.1	0.89
1084.0			82	226	12	38	76	243	8.51	3.08	5.43	54.1	0.89
1079.5			79	218	10	30	68	221	8.45	3.04	5.41	53.8	0.88
1075.0			84	230	11	33	52	174	8.58	3.11	5.48	55.3	0.93
1070.5			87	237	8	23	42	139	8.07	2.97	5.10	52.4	0.86
1066.0			76	208	5	16	36	118	7.36	2.66	4.70	46.7	0.71
1061.5			68	184	3	11	31	104	7.21	2.61	4.60	46.1	0.65
1057.0			47	130	5	18	28	100	8.22	2.95	5.27	54.8	0.76
1052.5			28	78	3	11	36	128	8.78	3.17	5.61	60.6	0.93
1048.0			16	45	4	13	38	138	9.16	3.38	5.77	64.4	1.05
1043.5			8	25	1	4	37	142	10.27	3.79	6.48	73.3	1.13
1039.0			8	24	3	10	25	95	9.10	3.45	5.65	59.6	1.11
1034.5			1	2	2	5	12	44	10.74	4.06	6.68	63.1	1.06
TOTAL	116	244	13,419	36,320	250	749	1,246	4,031	8.06	2.91	5.15	51.1	0.83

4.7 WASTE DUMPS

The waste from the Grum pit will be deposited in three dumps. THe dump areas were selected to be as close as possible to the exit of the pit, in order to minimize hauling outside of the pit.

At the beginning of stripping the waste will be used to build the haul road and the platform for the ore transfer located north of the final pit limits.

The overburden from the upper benches in Stage I will be deposited in the southeast dump, in not more than four benches of a maximum 15 m. A 26 ° - 27 ° angle for each bench was used and a berm of 20 - 25 m was left between two benches. The average angle of the slope is approximately 17 °.

The total volume of the dump is 8.5 mil m^3, or approximately 6.8 million m^3 bank. The access haul roads from the mine to the dump are shown in the surface maps 3 and 5, Stage I.

The overburden from the lower benches of Stage I and some rock from the upper benches (over +1288 m) will be deposited in the southwest dump at the elevation +1290 m, +1300 m and +1315 m. The maximum height of the bench will be 15 m and the angle by bench 26 - 27 °. The dumping will continue in Stage II and III with rock and overburden from the upper benches. The total volume of the dump is approximately 14 million m^3 and will receive 10.5 million m^3 bank.

The main dump will receive mainly rock waste. In Stage I the dump will be built between elevation +1270 m and

elevation +1220 m (in the southern end of the dump). An intermediate bench has to be built at the elevation +1170 m to ensure the stability of the dump (see map 4 Stage I and cross-sections).

Some overburden will be dumped over the slopes and berms of the main dump in Stage III.

In Stage II, the elevation of the dump will arrive at +1260 m to +1270 m and in Stage III the final elevation will be +1300 m.

The slope angle by bench is 35 ° and a berm of 25 - 30 m is kept on every bench.

The average angle of the dump is approximately 25 °. The total volume of the dump is 58 - 60 million m^3 and has to receive 46.4 million m^3 in bank.

A volume of approximatly 3.6 million m^3 bank of rock waste will be backfilled in the pit.

Table 10 shows the partition of different materials by stages and dumps.

The quantity of the acid generating waste in Grum pit is very small approximately 3 million tonnes from a total of approximately 148 million tonnes of rock. This can be dumped and diluted in the entire dump, in seams between the benches, etc. without additional expenses.

GRUM PIT

TABLE 10

		Dumps (m^3 x 10^3 Bank)					
		Main	Southwest	Southeast	Backfill	Roads	TOTAL
STAGE I	Rock	14,600	400	-	-	-	15,000
	Overburden	-	5,000	6,800	-	700	12,500
STAGE II	Rock	23,200	2,800	-	300	-	26,300
	Overburden	-	700	-	-	-	700
STAGE III	Rock	8,500	1,600	-	3,300	-	13,400
	Overburden	100	-	-	-	-	100
TOTAL	Rock	46,300	4,800	-	3,600	-	54,700
	Overburden	100	5,700	6,800	-	700	13,300
	TOTAL	46,400	10,500	6,800	3,600	700	68,000

4.8 WATER MANAGEMENT (See Surface Maps Stage I to III)

a) Over the area of the pit there was a small lake (Doal Lake) which in the winter of 1987-88 was drained.

b) To keep the surface water out of the area of the pit a ditch was constructed (600 m) in the spring of 1988 at the northeast limits of the pit. This ditch must be continued (800 m) southward between the pit and the southeast overburden dump (east ditch). At the same time, it is necessary to dig a 1000 m ditch parallel with the main haul road to Vangorda starting from the pit exit and finishing south of overburden dump which will divert the water from the main dump area.

The water from the ditches will be directed to the Vangorda Creek.

Small quantities of water will be directed by the surrounding road ditches out of the pit.

c) The water pumped from the pit will be directed by pipes in the southeastern side of the pit in a water treatment pond and a treatment plant. The treated water will be directed to east ditch.

d) To ensure the stability of the eastern slope of the pit in overburden (which in some areas is up to 100 m thick), it will be necessary to execute a line of dewatering wells. The water will be pumped to the northeastern ditch.

5.0 SURFACE FACILITIES

5.1 HAUL ROADS

The ore from Vangorda and Grum pits will be transported by 120 and 170 T trucks directly to a transfer point located in the northern side of Grum Pit.

The transfer area will be approximately 9 ha and will be built with overburden and non-acid generating rock from the upper benches of the pit Stage I.

The length of the haul road from the transfer point to the Grum pit exit is 1.3 Km and to the Vangorda Pit exit 4.0 Km. From the transfer point the ore will be transported to the actual preparation plant by trucks. The length of the haul road from the ore transfer point to the plant is 13.0 Km.

Other secondary haul roads have to be built between the pits and the main haul road and between the pits and the waste dumps in different phases of the development of the mines.

5.2 PUBLIC ROADS

There is a public road crossing the area of Grum Pit which has to be removed to the northern side of the pit, out of the area of operation of the mine. The proposed new public road is located on the northern limit of the ore transfer platform and follows the 138 Kv electric power line in the northeastern side of the pit. The length of the new road will be 2 Km.

5.3 POWER DISTRIBUTION

The electric power needed for the development and operation of the new mines will feed off the 138 KV powerline which goes to the mine.

The new line will be built at the northeastern limits of the Grum Pit and a transformer substation (138 KV to 4160 V) will be installed.

From that substation a line will go to Vangorda Pit and another to Grum camp. Power cables will go directly to the Grum Pit in Stage I. For Stages II and III a 4160 V power line will run around the ultimate pit limits.

In Vangorda area, a secondary line will go to the water treatment plant.

The 4160 V line to Vangorda has to be built on the same type of poles and with the same insulators. This will allow voltage to be boosted in in the eventuality of continuation of the 138 KV power line to Dy mine sometime in the future.

6.0 CONCLUSIONS AND RECOMMENDATIONS

- The new mine plan and design of Vangorda Pit reduces the volume of waste by 27 %, from 21.5 million tonnes to 15.6 million tonnes, the stripping ratio is also reduced from 3.33 to 2.61 t/t.

- In Grum Pit the volume of waste was reduced by 24 %, from 230.6 million tonnes to 176.0 million tonnes. The stripping ratio was lowered from 9.23 to 7.34 t/t.

- The reduction of the volume of waste will bring a very significant improvement in the economics of both new open pit mines.

- A general map, scale 1:2000, was produced for the three stages of development. This map shows pit limits, waste dumps, haul roads, ditches, power lines, etc. The map is intended to be used as the main guide for the development of the Vangorda-Grum area.

- These maps must be referred to for all surface surveying.

- Only the maps (scale 1:1000) with 12 m benches should be taken into consideration for surveying purposes in the area of the pits.

- Actual geological drillings in Vangorda could bring some changes in the southern limits of the pit.

- In Grum Pit the actual program of drilling probably will not alter the established limits of the pit.

- In the northern area of Grum it is necessary to have a detailed program of exploration. The ore blocks are not well defined from a dimensional and qualitative point of view.

- A re-evaluation of the Champ Area has to be done once the new data from the 1987 - 1988 drilling program is obtained and the geological interpretation in the area is completed.

- Priority has to be given to overburden dewatering in the southeastern area of Stage I in Grum Pit. Water there could create slope stability problems.

- Some geotechnical work must be done in the area of Grum waste dumps, especially in the lower elevations of the main dump.

- The clearing (cutting and burning of trees and bushes) of the Grum Stage I area has to be done completely during the winter of 1988 - 1989.

- Some big trees have to be cut in the area of southeastern and southwestern dumps in the same winter to ensure the normal starting of the dumping benches.

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