

You will note that the yearly average pounds of coal per ton of ore is only 97.5 lbs. The monthly average is the lowest in the history of the mine. The year 1915 shows a lower average of pounds of coal per ton of ore, because the hoisting for a part of the year was all done on the day shift. The monthly average for the year 1918 is 44 tons less than that for 1915. The quality of the coal in 1915 was vastly superior to that furnished us in 1918.

The reduction in coal consumption was accomplished by making the following changes:-

Installation of generator at Water Power Plant, thereby closing down steam driven generator at No. 5 Plant.

Discontinuing the Sunday pumping with the air pumps which saved at least 20,000,000 cu. ft. of air per month, some of which had to be made by steam.

Discarding all the No. 7 Water Leyner Drills which consumed 140 cu. ft. of air per minute. No. 18 Ingersoll-Leyners were substituted using only 95 cu. ft. of air per minute. The No. 18 Machine drills more ground than the No. 7 also.

Two boilers were shut down, one at the Central Plant and another at No. 5 Plant.

Decreased air consumption from 160,000,000 to 90,000,000 cu. ft. per month.

HOISTING MACHINERY.

There were no changes made in the hoisting equipment. The only serious delay due to the hoist breaking down was the 8 hour delay at the No. 5 Plant, when the piston broke. We happened to have a spare on hand and repairs were completed so that we lost only one shift's hoisting. At the end of the year, the new signal cable for No. 9 Shaft was hung in the Shaft, but connections were not complete due to the absence of junction boxes.

PUMPS.

The maintenance on the pumps was low during 1918.

TOP TRAM EQUIPMENT.

The Pascoe Shaft Top Tram did not give us much trouble during the year. The No. 9 Top Tram car wore out a number of axles and roller bearings and it was discovered that the trouble was caused by fine ore falling onto the boxes from the chute leading the ore from the Picking Belt to the car. The chute was re-lined and conditions improved.

SKIPS & SKIP-ROADS.

The maintenance on the skip-roads was considerably reduced during 1918. Due to extensive repairs made in 1916 and 1917 on the Pascoe skip-road, we were able to keep this skip-road in shape with less expense. Considering the increase in wages and price of supplies, we only spent about half the time on the repairs that we did the year before. That the expenditure was justified, can be ascertained from the delays the last three years. During the years: 1916 - 1917 and 1918, we had the following delays directly due to poor condition of the skip-road:-

<u>YEAR</u>	<u>NO. DELAYS</u>
1916	11
1917	31
<u>1918</u>	<u>9</u>

You will note the large decrease in 1918. This will probably be still further reduced because in September, 1918, we took out the remaining section of concrete road between the 1950' and 2050' Levels. This concrete road was at the bottom of most of our troubles. The jarring of the skip on this part of the skip-road broke wheels and axles, causing the numerous skip derailments.

UNDERGROUND TRACKS & CARS.

The tracks on the 2082' Level, No. 9 Shaft, were rebuilt for motor haulage. In the cross-cut between the Pascoe and No. 9 Shafts, the sharp grade was eliminated by cutting down 3.5 feet of ground near the riggers shanty. The 20 lb. rail was taken up and 30 lb. put down. In the main drift running N.W. to the No. 9 ore bodies, all the light steel was taken up and heavier rail substituted. The old ties were spaced from 3 ft. to 4 ft. centers and new ties were set in between.

At the close of the year, six new cars were built for the motor haulage. These cars are equipped with link and pin couplings.

The new storage battery locomotive was received but has not yet been put into service.

WATER POWER PLANT.

The new generator was started up on January 12th. This machine has run continuously for a year without giving us a particle of trouble. The voltage is steadier because this machine has three times the capacity of the old No. 5 Plant.

The year 1918 was an exceptionally good water power year. Very little water was wasted over the dam in the spring because the spring rains did not materialize and the melting snow gave us plenty of water. In the fall and early winter, mild wet weather carried us through the year with plenty of water to operate both generator and air compressor to maximum capacity.

The new water driven generator saved us 1,950 tons of coal. I estimate that we saved the cost of the new equipment two and one-half times during the year, besides giving us better operating conditions. We could never operate the pumps and the Crushing Plant at the same time before, but since the new generator is in commission, all the motors together can not throw enough load onto the line to stall the generator.

COMPRESSOR.

The Allis Plant Compressor was operated more than usual due to the operation of the electric generator at the Water Power Plant. Under the old plan, two air compressors were run at the Water Power Plant, the steam compressor being held in reserve in case the water was low or break-downs occurred. All the electricity was made by steam. Under the new plan, all the electricity was made by water power, and the air compressor at the Allis Plant just run enough to keep the pressure up. That means about five hours running in twenty-four. The following table shows the air and electricity made by steam and water power for the years: 1917 and 1918:-

AIR MADE BY:

<u>YEAR</u>	<u>STEAM</u>	<u>WATER POWER</u>	<u>TOTAL</u>
1917	\$1250.00	\$6908.32	\$8,158.32
1918	4100.00	8436.92	12,536.92
			Increase, 4,378.60

ELECTRICITY MADE BY:

<u>YEAR</u>	<u>STEAM</u>	<u>WATER POWER</u>	<u>TOTAL</u>
1917	\$10,022.70		\$10,022.70
1918	192.56	\$2,333.30	2,525.86
			Decrease, 7,496.84

You will note that the net decrease shown above proves that the operation of the Water driven generator saved money. However, the saving is actually much greater than the difference shown because the consumption of coal for electricity was much greater than the coal consumed for the manufacture of air in 1917. If we had continued to operate under the old conditions with the increased price of coal, our expenses for the manufacture of electric current would have shown a large increase in 1918, whereas the exceptional flow of water in 1918 would have given us all the air we needed, so that the cost for fuel for compressed air for 1918 would have been very low. I am positive the actual saving that should be credited to the new electric generator is close to \$10,000.00.

The cost sheets for the last two years tend to show that the cost per unit for compressed air has doubled. While that is true the above statement shows that the cost per unit for electricity has decreased so much that the total cost per unit for both compressed air and electricity shows a large decrease.

SHAFT SINKING.

The No. 9 winze was sunk from the 2082' Level to the 2182' Level and plat cut out on the latter level in five months' time. This speeds up the development work rapidly because under the old system of sinking No. 9 Shaft and driving the long rock drifts to reach the ore measures, it took four years to open up a new level. At the close of the year, sinking had been resumed to carry us down to the 2282' Level.

The Pascoe Shaft was put down another lift also and at the end of the year, we find the men cutting out the 2370' Shaft station. The shaft was put down 150 feet in six months which is a record for this shaft. We plan on sinking another lift immediately. The ore developed on the 2270' Level warrants going down with the shaft.

ROCK DRIFTING.

The amount of rock drifting done in 1918 was smaller than usual. The total for the year was 960 feet compared with 2138 in 1917. This was due not to a slowing down of development work but the drifting was done in a different manner. For instance: the No. 9 Shaft ore measures are now being explored from the winze sunk close to the ore body. Instead of sinking No. 9 Shaft and drifting 1200' to 1500' to reach the ore, we only have to drift 20' to 25' to reach the same ore. In the Pascoe Shaft, we were fortunate in developing ore lenses right along the line of the development drifts, so that a large part of our drifting was in ore. The cost per foot was high due to the fact that practically all of the drifting was done in Jasper and due to the fact that all the rock had to be trammed by the

miners themselves due to shortage of trammers. For instance, it would take the miners two shifts to clean out thirty cars of rock from the breast. At \$6.00 per day, it would cost 80¢ per car to remove the dirt. If trammers could be put on that work, they would clean out the dirt in one shift at the contract rate of 48¢ per car, and the miners could go ahead and drill another round. There was absolutely no way to get away from the conditions as we only had from 18 to 20 trammers and they had to fill ore to keep the product up. The miners being older men, could not be expected to tram as many cars per day as the younger trammers. In 1917, we cut the average cost per foot of rock drifting from \$12.42 in 1916 to \$10.66. The shortage of trammers, however, in 1918, slowed up our rock drifting so that our unit costs increased considerably. If labor conditions get normal in 1919, we will decrease our unit costs materially.

BREAKING ORE.

The largest tonnage of ore was broken during the year 1918 since 1915 as shown on table:-

YEAR	ORE BROKEN	PRODUCT	P.C.OF PRODUCTION ACTUALLY BROKEN.	UNIT COST PER TON-BROKEN ORE
1915	150,241	185,187	81.2%	.657
1916	119,100	173,096	68.9%	1.042
1917	94,048	153,425	61.4%	1.302
Jan., 1918,	8,984	12,744	70.6%	1.390
Feb., "	9,112	11,602	78.5%	1.209
Mar., "	9,755	10,990	88.8%	1.370
Apr., "	10,117	11,670	86.5%	1.159
May, "	11,207	15,795	70.9%	1.452
Jun., "	11,332	10,572	107.2%	1.202
Jul., "	12,975	12,896	100.7%	1.114
Aug., "	14,603	11,923	122.6%	1.101
Sep., "	10,627	10,517	101.2%	1.355
Oct., "	12,078	12,278	98.4%	1.529
Nov., "	10,758	10,268	104.8%	1.491
Dec., "	13,572	11,222	120.9%	1.182
YEAR-1918,	135,140	142,476	94.8%	1.300

You will note that the unit cost of Breaking Ore is less than for last year and only 25% greater than 1916, regardless of the numerous increases in wages the last two years and the large increase in the cost of Supplies, especially Explosives. Out of a total expense of \$175,927.00 for breaking ore during 1918, \$35,946.00 is for explosives or a little over 20%. Explosives have increased in cost 52% during the last two years.

EXPLOSIVES USED FOR BREAKING ORE.

YEAR	TONS OF ORE BROKEN	LBS. OF POWDER PER TON ORE.	COST PER TON FOR POWDER	AVERAGE PRICE OF POWDER
1916	119,100	1.349	.2115	.1506
1917	94,048	1.745	.3195	.1923
1918	135,140	1.159	.2825	.2293

Although explosives have gone up in price, the unit cost has been decreased. This is principally due to the favorable working conditions in the No. 2 Stope on the bottom level, Pascoe Shaft.

If developments continue favorable during the coming year, I expect we will be able to reduce the unit cost of breaking ore.

The most gratifying thing about the previous statement is that we are at last breaking the major portion of the product; in fact, since July, we have added to our ore reserves.

TRAMMING.

The ore is all trammed by hand. As explained under the previous heading of "Trammers", our men have filled more cars per day than ever before in the history of the mine. The unit cost has increased in direct proportion to the increase in wages.

TIMBERING.

The timbering expense was heavier than last year due to the fact more square feet of stopes were opened up which had to be timbered.

The No. 2 Stope on the bottom level, Pascoe Shaft, was larger in cross-sectional area than all the aggregate of all the stopes put together in 1917. There were four stulls put side by side in this one stope whose lineal footage would be close onto 600 feet.

CAPTAIN & BOSSES.

The personnel of the bosses was unchanged during the year.

DRY HOUSE.

We are still using the old dry at No. 9 Shaft. This Dry is in bad condition and should be replaced with a new and modern building.

SORTING ORE.

Less money was spent for sorting ore than the year previous. The unit cost is just about the same for the two years. This was mainly due to the cleaner condition of the ore hoisted, requiring less labor to pick out the rock.

SWITCHING EXPENSE.

This expense was very heavy during the year. Due to our peculiar lay-out and position of the Crushing Plant, we require the services of an engine daily to switch the ore cars. The grade leading to the Crushing & Screening Plant is very heavy and consequently it requires a powerful switch engine to spot the cars.

NEW CONSTRUCTION.

NEW ENGINE HOUSE.

The new engine house for No. 9 Shaft is located 350 feet South-East of the Shaft on the top of the Jasper hill. It occupies a commanding position and will shorten the rope lines about 2,000 feet.

The building was started in September and was all enclosed by the end of the year. The hoist foundation excavation was started but not completed.

The transmission line running from the North Lake district to the new Engine House is all in place.

Some of the machinery has been received. All of the electric equipment is here, but the hoist proper had not been received at the close of the year.

The actual cost was kept within the estimate for all items except the transformers themselves. Their cost is about 60% more than we figured on.

UNDERGROUND HOISTS.

As the new electric hoist for No. 9 Shaft is planned to eventually handle all the product of this mine, it was necessary to provide some way of hoisting the ore and rock from the bottom levels of No. 9 and Pascoe Shafts.

A new 4' x 6' electric hoist was ordered for the No. 9 Shaft winze and a 5' x 5' electric hoist for the Pascoe Shaft.

The Pascoe Shaft hoist will be located on the 2050' level plat and the ore will have to be hauled to No. 9 Shaft by motor. The No. 9 winze which will be about 400 feet deep, four levels being planned at present, will be amply taken care of by the 4' x 6' hoist. The hoist foundation site was being cut out at the end of the year. Gravel for both foundations was taken underground during the fall so that we could put the concrete in place during the winter. As neither hoist had been received at the close of the year most of the expenditures still remain to be incurred.

STORAGE BATTERY LOCOMOTIVE.

The locomotive was received on November 20th. The batteries were removed and taken underground where there would be no danger of freezing. The Motor Generator Charging Set was installed and switchboard is in place. The power cable was hung from the 1153' to the 2082' levels and the new locomotive will go into service shortly.

SIGNAL CABLE.

The signal system in both No. 9 and Pascoe Shafts is a constant source of trouble. The bells go out of commission frequently and the telephones are useless most of the time.

As the ore will all have to be handled through No. 9 Shaft in the future, it was necessary to provide a new signal system. At present all the signal wires are ordinary wires strung along the shaft sets on knobs.

A new 10 conductor armored cable was hung from surface to the 2082' level and this should be in service shortly.

SUPPLIES.

The expense for supplies was reduced compared with the previous year. The details follow:-

General Supplies:-

The cost for the year 1917 was \$14,882.20 and for 1918, \$16,811.10, the increase being due to the installation of the new 10 conductor signal cable.

Iron & Steel:-

The expense for the two years was \$7347.10 and \$8537.55; an increase of approximately 16%, due to higher price of materials.

Oil, Grease & Candles:-

The expense under this head was reduced from \$1994.72 to \$1913.76.

Machinery Supplies:-

We show a large decrease, notwithstanding the price increase. The total for 1917 was \$30,336.77 and for 1918, \$21097.91. This was due to fewer repair parts for our drilling machines due to purchase of new machines and scrapping the old No. 7 Water Leyners.

Explosives:-

The cost under this head increased due to large increase in price. The explosives for the years 1917 and 1918 used in breaking ore, rock drifting and shaft sinking, follow:-

<u>Shaft Sinking:-</u>			
YEAR	LBS. USED	COST	LBS. PER FOOT SHAFT SINKING
1917	6,600	\$1,079.77	44.6
1918	6,850	1,747.55	36.0
<u>Rock Drifting:-</u>			
1917	34,272	6,346.51	16.1
1918	19,000	4,470.74	19.8
<u>Breaking Ore:-</u>			LBS. PER TON OF ORE BROKEN
1917	164,141	28,002.25	1.745
1918	156,750	35,946.16	1.157

Average price for explosives in 1917, .1723
" " " " " 1918, .2293

The total consumption of explosives was less for 1918 than 1917. The shaft sinking and mining required less powder per unit but rock drifting consumption increased slightly. The 28% increase in price only increased the cost of powder per ton of ore from .280 to .316 or 13%, proving that the consumption was less.

Mine Timber:-

The mine timber used in 1917 cost us \$6385.23. In 1918, we spent \$7302.55, approximately 14% increase. This was due partially to price increase and to large amount of timber used in the Pascoe Shaft, 2272' Level Stopes.

Fuel:-

The cost for fuel was decreased from \$42,967.85 to \$41,280.30 or 4%, but the fuel consumption was decreased from 9183 tons to 7480 tons or 23%. The tonnage produced for 1918 was only 7% less than the product for 1917.

UNDERGROUND.

The prospects for ore improved wonderfully during the year. At the beginning of the year, we had only 100,926 tons of ore in place, the most of it in No. 9 Shaft under the 1935' Level. The 2082' or bottom level, No. 9 Shaft, did not look very encouraging while the 2172' Level or bottom of Pascoe Shaft was a decided disappointment. The new 2272' Level, however, proved a winner in that we discovered the largest stope of the very best Bessemer ore developed in recent years. At the close of the year, this one stope had produced 26,489 tons of ore, averaging 68.20 Iron and .026 Phosphorus. There were still over 21,000 tons left to be mined. The footwall stope on the same level proved up 43,000 tons of ore, making a total tonnage of over 90,000 tons in these two stopes. We have excellent prospects of proving up additional ore bodies on the same level. The Pascoe Shaft has been sunk to the elevation of the 2372' Level and in a short time we expect to be mining ore on the new level.

In No. 9 Shaft, a winze was sunk 100 feet below the 2082' Level and the ore was cut on the 2182' Level only about 20 feet from the side of the winze. Only a little mining had been done at the close of the year but enough to prove the downward extension of the 2082' Level, #1 and #2 Stopes. At the end of the year, we had 153,838 tons of ore in sight ready to be stoped, compared with 100,926 tons at the beginning of the year.

Another point that greatly affects the future of the mine is that we decreased our broken ore on stulls only 7,336 tons during the year. Up to June 1st, we decreased our stull ore 13826 tons, but from June 1st to December 31st, we increased the ore reserves 6,490 tons, leaving a net decrease of only 7,336 tons.

PASCOR SHAFT.

1335' LEVEL:-

There was considerable development work done at this elevation but the results were disappointing. Seven drill holes were drilled as follows:-

Hole #406 drilled from the breast of the old drift leading West from the Shaft, cut 22 feet of ore running 67.06 in Iron and .069 Phosphorus.

Hole #407 drilled from the same set-up to test the Southerly extension of the same ore encountered nothing but rock.

Hole #408 drilled to look for the possible Northerly extension of the stope cut only 2 feet of ore.

Hole #409 was drilled to test the footwall and showed no ore.

Holes Nos.:410, 411 & 412, were all drilled towards the hanging to look for possible ore bodies along the contact between the ore formation and the hanging Quartzite. They showed up nothing but lean ore or small stringers of good ore.

The West drift was extended 100 feet and the ore found in drill hole #406 was mined. The stope on the sill floor was of fair size but the ore only went up above the level a short distance before it pinched out. Every stope that has been opened up on this level has done the same thing; #1 Stope only went up 60 feet; #2 Stope pinched out at 50 feet and #3 Stope which is the one under discussion only went up about 35 feet.

1570' LEVEL:-

After #2 Stope had holed to the 1500' Level under the old #2 Hanging Stope, it was evident that there was still another lens on the 1570' that had not been discovered under the old #1 Hanging Stope on the 1500' Level.

1570' LEVEL:-

In the main drift running Southwest from the Pascoe Shaft, there was a small leader of ore 4 feet wide about 20 feet back from #2 Stope. This leader was followed and it soon opened up 10 feet wide. The length of the ore lens was 75 feet. This stope was up within 20 feet of the 1500' Level at the close of the year. After this ore is mined, this level will be abandoned.

1640' LEVEL:-

With the exception of a small pillar of ore left in place to protect the Pascoe Shaft, the ore lenses on this level are completely mined out. There was a floor of ore between the 1710' and 1640' Levels that was left in place to keep the travelling road open between the Pascoe and No. 9 Shafts. That pillar has now been mined out.

1710' LEVEL:-

At the beginning of the year, there were 12,515 tons of broken ore in #3 Stope underneath the Pascoe Shaft which can not be hoisted. There was also a shaft pillar which has been mined partially. We have mined all we dared to take without endangering the Shaft. It will not be possible to take any more ore from this part of the mine until we can abandon the Pascoe Shaft.

1780' LEVEL:-

A portion of the Pascoe Shaft pillar was mined during the year. A drift was driven through the pillar of ore just East of the Shaft and the ore mined out to a height of 16 feet. Nothing further can be done until the stull timber is installed. It will not be advisable to take much more ore until the Shaft can be abandoned.

1850' LEVEL:-

This level furnished a little tonnage during the year. North of the Shaft, there is a small stope about 40 feet in diameter that we found filled up with broken ore. A drift was driven from a point 20 feet West of the Shaft and at a distance of 15 feet, the cross-cut encountered the broken ore. The stope was cleaned out in a short time.

At the extreme South end of the level, we are doing some development work that has great possibilities. Two years ago, a drift was driven about 200 feet Southwest to try to find the top of #1 Stope from the 1950' Level. No ore was found. Then a new cross-cut was driven 100 feet South and a small stope opened up that quickly pinched out. Then another cross-cut was started to the West and another small lens discovered. A winze was sunk in ore in the second lens in order to locate the #1 Stope on the 1950' Level, but no trace of the latter was discovered. Then work was abandoned. In November, we examined this place carefully and discovered a leader which was followed. The leader opened up and at the close of the year, we had a breast of ore 15 feet wide and looking as if the ore might go considerably farther to the South. After the two unsuccessful attempts to find ore in this locality, we feel very fortunate in having finally found a seam of ore that will furnish considerable tonnage.

1950' LEVEL:-

No. 21 contract finished #7 Stope early in the year. This stope was carried up to the 1850' Level and the ore trammed out in July, August and September. After #7 Stope was exhausted, the trammers took out all the ore on the old stulls cleaning the level back to the Pascoe Shaft.

No. 22 contract also finished mining in #8 Stope which is over the back of the Pascoe Shaft. This stope was mined up to the 1850' Level and cleaned out by June 1918. This stope was a great disappointment. We expected to mine from 25,000 to 30,000 tons of ore but only secured about one-quarter of that tonnage. The reason being that the bulk of the ore formation was filled up with a big Soaprock dike, so that the area between the foot and hanging instead of showing a span of ore 75 feet wide, only showed up about 20 feet of ore.

In order to test the ground between #8 Stope and the main hanging drift for a possible downward extension of the large stope on the 1850' Level, Diamond Drill Hole #413 was drilled but cut nothing but Jasper and second class ore.

A raise was put up in ore near the North end of #3 Stope from the 1950' Level to the 1850' Level to dump the rock into that will be picked out of the ore that is now under the Pascoe Shaft. This will avoid hoisting the rock and will also fill up the #3 Stope with rock so that the back of ore left between the 1950' and 1850' Levels can be mined.

2050' LEVEL:-

A portion of the Pascoe Shaft pillar was mined out underneath the shaft. We took out all the ore within 10 feet of the bottom of the shaft and then had to stop due to the fact that the bottom of the skip-road started to give way. We were up against it for ore and had to take some chances.

You will note that we have partially mined the Shaft pillar on the 1640', 1710', 1780', 1850', 1950' and 2050' levels during the year.

2170' LEVEL:-

During the months of January and February, all the broken ore was trammed from #1 Stope.

A little ore remains in #2 Stope which must be left to keep the main hanging wall drift open. We did a little mining in #2 Stope during the year. The ore was taken up to within 25 feet of the 2050' Level, the balance being left as a floor pillar to protect the main travelling road between No. 9 and Pascoe Shafts.

2272' LEVEL:-

This level produced two stopes during the year that gave us renewed confidence for the future of the mine. One of these stopes is the largest body of high grade ore found in the Pascoe Shaft in twenty years. Drifting from the Shaft in a Northeasterly direction, we struck the extreme end of the stope in March. If the drift had been turned 10 feet one way or the other, we would have missed the ore. As it was, the drift was lined up exactly right. During April, May and June, the stope was being continually enlarged on the sill floor until finally the foot and hanging were exposed on all sides. The cross-sectional area on the sill floor was approximately 5,000 sq. ft. which is about twice the area of all the stopes combined a few months previous. The ore was extremely rich, -samples frequently running over 70.00% in Iron. The average Phosphorus was .022. The entire area was cut out 16 feet high and stulls put in. These stulls were built doubly strong anticipating the great weight that would rest on them. Three contracts were employed on the stull, -two at the West or wide end and one at the East end. The latter contract raised up to within 20 feet of the 2170' Level as soon as possible. They then were transferred to the latter level from which they sank a winze down to connect with the raise, providing better ventilation.

2272' LEVEL, (CONTINUED):-

At the end of the year, this stope was up just about half way to the upper level. This stope will turn out about 50,000 tons before it is exhausted. We add about 4,000 tons monthly onto our ore reserves in this stope.

It took from January to May to drift through the Jasper that lies between the Shaft and the #1 Stope. As in the case of #2 Stope, the cross-cut cut the ore at the extreme East end of the ore body. During the months of May, June, July and August, the ore was mined from foot to hanging and 16 feet high to permit putting up stull timber immediately.

The old system of mining and developing an ore body was to first drive a drift the full length of the ore. Then the ore was cut out full size and afterwards the back was mined. The next operation consisted of installing the timber stull. No ore would be trammed while the stull was being put up and none could be trammed until the stull was loaded and then only the surplus ore was available. The new system is to cut out the ore full size from the beginning and install the timber just as soon as there is room. Then as soon as 50 feet or more of stull is up, a gang can start mining while the rest of the stope is still being developed which provides a continuous product from the stope.

No. 1 Stope was up about 30 feet at the close of the year and at that point, was nearly twice as wide as on the sill floor.

At the North end of the #2 Stope, a drift was started Northeast along the hanging towards No. 9 Shaft. This drift was in about 200 feet at the close of the year. Three small bunches of ore were cut but none of them amounted to anything. The largest one of the three only produced ten cars. This drift will be driven perhaps 50 or 100 feet farther and then if no ore is found next to the hanging, a series of Diamond Drill Holes will be drilled into the foot wall. There should be some ore in this locality.

2272' LEVEL (CONTINUED):-

We had at least five small lenses of ore on the 2170' Level vertically over this drift and inasmuch as the big stope on the 2272' Level is the downward extension of a comparatively small ore seam on the 2170' Level, we might expect to find larger ore bodies underneath the five small stopes that should be near the hanging drift. The Diamond Drill holes will prove them up if they exist.

PASCOE SHAFT SINKING:-

The Shaft is now down to the elevation of the 2372' Level. We made good progress in the shaft having sunk the entire lift in only five months.

We will cut out the plat and start our drifts for the ore and then resume sinking again. I believe that it is advisable to continue sinking the Pascoe Shaft due to its close proximity to the ore. We can open up new levels pretty fast if the shaft sinking is continued without interruption.

NO. 9 SHAFT.

1815' LEVEL:-

The only mining done here was in taking the ore left under the floor of the old #1 Stope. Last year, #1 and #3 Stopes carried up from the 1935' Level holed into the North portion of the old #1 Stope on the 1815' elevation. It appeared that the South portion of this stope did not extend down to the 1935' Level. A Diamond Drill hole drilled up from the 1935' Level did not encounter any ore 50 feet below the sill floor of the 1815' Level. There was perhaps 15,000 or 20,000 tons of ore that lay underneath the latter level and so we decided to sink a winze.

1815' LEVEL (CONTINUED):-

This winze was put down 20 feet along the foot side and then we drifted out towards the hanging soon cutting the ore. A connection was then made with the main stope so that the ore could be blasted down instead of being handled up through the winze. We blasted about 8,000 tons of very cheap ore direct into the main stope. There is still about the same tonnage left to be mined.

The sub-level drift is running just about parallel with the bottom of the ore which shows how quickly a big stope of ore can cut out in the Republic Mine. The State Tax Commission frequently questions our method of estimating prospective ore because we usually assume that a known ore body will pinch out at a depth of 50 feet below a level. The above stope is proof that a large well defined ore body can cut out in 20 feet.

1935' LEVEL:-

The only mining done at this elevation was at the extreme North end of the level.

The Pascoe grade ore stope known as No. 4 was developed along the hanging for an additional 100 feet, making the total length of this stull 400 feet. At the end of the year, the North end of the stope was in rock and its height was 25 feet above the sill floor. The South end of the same stope had holed to the 1815' Level and the most of the ore between the sill floor and the hanging rock had been removed. There remains a wedge shaped piece of ore about 20 feet high at one end and 100 feet long that must be mined before the stope can be abandoned.

There were 1,500 tons of ore in #2 hanging stope, that was hoisted.

1935' LEVEL, (CONTINUED):-

Tramming was also carried on from #1 and #3 Stopes. The ore shown on the stull statement as being in stock on the 1665' Level, is actually being trammed from the #1 and #3 Stopes. All the intervening floors having been mined out. These two stopes furnished the bulk of the tonnage hoisted through No. 9 Shaft for the last three years. The filling places are now empty and as a result, the product from No. 9 Shaft has suffered. These two filling places were only 400 feet from the Shaft, whereas, the trammers at the close of the year had to travel 1,400 feet from the Shaft to reach the nearest ore. It obviously is not possible to get as many tons per man from the longer tram.

2082' LEVEL:-

Six contracts were employed here most of the year. Three of them, namely: #1, #2 and #15, mined out #1 and #2 Stopes. These stopes which showed up mixed ore on the sill floor improved in grade as the mining proceeded upwards. By the time the 1935' Level was reached, the ore was all high grade Bessemer. There is still a considerable quantity of ore left in the back of #1 Stope which is left as a floor pillar to protect the 1935' main haulage drift. As soon as the 1935' Level #4 Stope, has been exhausted, all this pillar will be mined.

No. 23 contract drove the North rock drift along the hanging contact until the #4 Stope was reached. This latter stope has been developed for a length of 225 feet along the hanging. The ore on the sill floor averages about 12 feet wide. The grade of the ore in this stope seems to be a little better than the corresponding ore on the upper level. Good progress was made with the stoping, contracts Nos.: 22 and 23 having mined out the ore halfway to the upper level in a short time.

2082' LEVEL:- (CONTINUED):-

No. 4 Contract extended the main sill floor drift for a short time and was then put to work driving a cross-cut to tap the ore on the main level halfway between #1 and #2 Stopes. At the end of the year, we find them cutting out an engine house for the new electric hoist at the winze.

During 1917, a cross-cut was driven into the hanging at the proposed site of the winze. Diamond Drill Hole #404 was then drilled vertically downwards to test the angle of the hanging wall. The winze was started in August and by the end of the year, we had the new 2180' Level opened up.

2180' LEVEL:-

At the close of the year, we find this new level at the bottom of the winze opened up, the ore having a width of 27 feet. This ore was followed a short distance each side of the winze, the South breast showing up a nice face of Bessemer ore. The North face had 7 feet of Bessemer ore, the rest being Pascoe grade.

The plat was cut out so that sinking can be resumed just as soon as the new electric hoist is installed. At present, all the dirt has to be handled with a bucket and progress is unavoidably slow.

Development work can be speeded up just as soon as the new hoist and cage are in commission. We plan on filling the two-ton motor cars right on the sill floor and then hoisting the cars up to the motor level.

ORE IN SIGHT.

The following statement shows the tonnage in sight on
December 31st, 1918:-

NO. 9 SHAFT.

LEVEL	ORE BROKEN ON STULLS		ORE IN PLACE	SHAFT PILLARS	PROSPECTIVE ORE.	TOTAL
	AVAILABLE	NOT AVAILABLE				
911'				2520		2520
1000'				3000		3000
1050'				6000		6000
1153'				3200		3200
1665'	10703					10703
1815'			6680			6680
1935'	13061		4235			17296
2082'	13143		55630			68773
2182'			26100		11195	37295
TOTAL,	36907		92645	14720	11195	155467

PASCOE SHAFT.

1335'	815					815
1570'	1950		3620			5570
1640'				2700		2700
1710'		12515		24000		36515
1780'		22000		21500		43500
1850'		2790	3000	13200	3000	21990
1950'				58570		58570
2050'	1295			18960		20255
2170'	605					605
2270'	12085		54573			66658
2370'					28500	28500
TOTAL,	16750	37305	61193	138930	31500	285678
GRAND TOTAL,	53,657	37305	153838	153650	42695	441145

The ore in sight exclusive of shaft pillars subdivided
into grades is as follows:-

GRADE	DEVELOPED	PROSPECTIVE	TOTAL
Bessemer,	117,771	29,700	147,471
Basic,	5,345	3,000	8,345
Pascoe,	84,379	9,995	94,374
TOTAL,	207,495	42,695	250,190

This shows an increase over the statement of ore reserves
made on January 1st, 1918. The latter showed only 234,367 tons in
sight.

The following table shows comparative figures for the last four years:-

	1915	1916	1917	1918
Ore in place, January 1st,	516,350	383,720	291,980	315,479
" on stulls, " "	250,830	216,884	171,580	112,203
Total ore in sight,	767,180	600,604	463,560	427,682
Product,	185,187	173,096	153,425	142,476
Balance,	581,993	427,508	310,135	285,206
Ore in place, December 31st,	383,720	291,980	315,479	350,183
" Broken " "	216,884	171,580	112,203	90,962
Total ore in sight,	600,604	463,560	427,682	441,145
Developed during year,	18,611	18,732	117,541	155,939

The ore in sight shown above includes shaft pillars and unavailable broken ore.

An analysis of the above shows that the tonnage developed during the year is the largest in the last four years. Although the tonnage of broken ore on stulls has decreased, the ore in place has increased. It begins to look as if we have turned the corner and instead of conditions looking worse each year, our progress from now on will be on the up-grade.

Our production will still be limited but if we develop several new lenses like those on the bottom level, Pascoe Shaft, we can increase the product in a short time.

Following is a statement showing ore on stulls on December 31st, 1918.

AVERAGE ANALYSIS OF ORE BROKEN ON STULLS DURING DECEMBER, 1918.

SHAFT	LEVEL	STOPE	TONS	IRON	PHOS.
Pascoe,	1335'	#3,	400	66.20	.064
"	1570'	#1,	1000	67.80	.036
"	2272'	#1,	2650	67.40	.033
"	"	#2,	4000	68.60	.027
		Pascoe Total,	<u>8050</u>		
No. 9,	1935'	#1,	1100	64.90	.034
"	"	#4,	1500	53.20	.062
"	2082'	#4,	1700	51.00	.050
		No. 9 Total,	<u>4300</u>		
		TOTAL BROKEN,	12350		

AVERAGE ANALYSIS OF ORE HOISTED FROM STULLS DURING DECEMBER, 1918.

Pascoe,	1335'	#3,	595	65.80	.059
"	1570'	#1,	235	67.50	.030
"	1710'	#1,	500	66.80	.086
"	1950'	#1,	110	64.00	.077
"	2272'	#1,	1670	67.50	.033
"	"	#2,	1090	68.20	.026
		Pascoe Total,	<u>4200</u>		
No. 9,	1665'	#5,	1000	55.00	.062
"	1935'	#1,	1100	64.90	.034
"	"	#4,	600	54.70	.054
"	2082'	#2,	2400	66.00	.044
"	"	#4,	700	51.00	.050
		No. 9 Total,	<u>5800</u>		
		Total Hoisted,	10000		

SUMMARY.

Ore broken,	12350
" hoisted,	<u>10000</u>
Increase,	<u>2350</u>

AVERAGE ANALYSIS OF ORE ON STULLS, DECEMBER 31ST, 1918.

SHAFT	LEVEL	STOPE	AVAILABLE			NOT AVAILABLE		
			TONS	IRON	PHOS.	TONS	IRON	PHOS.
No. 9,	1665'	#5, S. end,	10703	55.00	.062			
"	1935'	#4,	13061	54.70	.054			
"	2082'	#1,	7683	65.50	.047			
"	"	#2,	285	66.00	.044			
"	"	#4,	5175	51.00	.050			
		No. 9 Total,	36907					
Pascoe,	1335'	#3,	815	65.80	.059			
"	1570'	#1,	1950'	67.50	.030			
"	1710'	#3,				12515	65.00	.075
"	1780'	#3,				18900	66.00	.066
"	"	#4,				3100	64.00	.068
"	1850'	#3,				2790	66.00	.087
"	2050'	#1, Raise,	370	66.50	.047			
"	"	#3, North,	925	68.40	.092			
"	2172'	#2, East,	605	67.40	.057			
"	2272'	#1,	2180	67.50	.033			
"	"	#2,	9905	68.20	.026			
		Pascoe Total,	16750			37305		

SUMMARY.

	AVAILABLE	NOT AVAILABLE	TOTAL
No. 9,	36,907	-----	36,907
Pascoe,	16,750	37,305	54,055
TOTAL,	53,657	37,305	90,962

REPUBLIC MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

<u>GRADE</u>	<u>IRON</u>	<u>PHOS.</u>
Republic Bessemer,	65.88	.036
Republic Basic	64.62	.065
Republic Pascoe,	56.94	.046

Above grades went into mixed cargoes.

REPUBLIC MINE

ORE STATEMENT - DECEMBER 31st, 1918.

	RUN OF MINE			BESS.	BASIC	PASCOE	BESS.	BASIC	PASCOE	BESS.CR.	BASIC CR.	TOTAL	TOTAL LAST YEAR
	BESS.	BASIC	PASCOE	LUMP	LUMP	LUMP	CRUSHED	CRUSHED	CRUSHED	P.I.St.P.	P.I.St.P.		
On hand Jan. 1st, 1918,	9,690	1,765	15,617							226	189	27,487	42,312
Output for Year,	90,125	31,946	20,405									142,476	153,425
Transferred between grades,	87,688	30,463	33,020	33,499	19,186	13,395	48,074	18,020	18,997				
Total,	12,127	3,248	3,002	33,499	19,186	13,395	48,074	18,020	18,997	226	189	169,963	195,737
Shipments,				33,499	19,186	13,395	48,074	18,020	18,997	0	0	151,171	168,250
Balance on hand,	12,127	3,248	3,002							226	189	18,792	24,487
Decrease in output - 6%												10,949	
Decrease in ore on hand,												5,695	

1917 & 1918 - 2-8 Hr. Shifts

REPUBLIC MINE.

REPUBLIC MINE.

REPUBLIC MINE

SHIPMENTS FOR YEAR - 1918.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Republic Bessemer Lump,	21,356	12,143	33,499	31,746
Republic Basic Lump,	9,193	9,993	19,186	18,358
Republic Pascoe Lump,	5,255	8,140	13,395	14,260
Republic Bessemer Crushed,	30,445	17,629	48,074	59,518
Republic Basic Crushed,	7,493	10,527	18,020	18,634
Republic Pascoe Crushed,	6,858	12,139	18,997	25,734
Total,	80,600	70,571	151,171	168,250
Total last Year,	86,786	81,484	168,250	
Decrease - 10%			17,079	

407

REPUBLIC MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	142,476	153,425		10,949
General Expense	.175	.136	.049	
Maintenance	.309	.350		.041
Mining Expense	2.719	2.108	.611	
Cost of Production	3.203	2.594	.609	
Exploratory	.041	.149		.108
<u>DEPRECIATION.</u>				
Original Purchase	.454	.458		.004
Plant Account	.082	.100		.018
Equipment		.014		.014
Total Depreciation	.536	.572		.036
Taxes	.124	.090	.034	
Central Office	.131	.108	.023	
Supply Inventory	.018		.018	
Miscellaneous	.002		.002	
Sundry Expense	.035	.014	.021	
Cost on Stockpile	4.090	3.527	.563	
Loading & Shipping	.140	.092	.048	
Cost on Cars	4.230	3.619	.611	
No. Days Operating	301	303		2
No. Shifts and Hours	2-8hr	2-8hr		
Avg. Daily Product	473	506		33
<u>COST OF PRODUCTION.</u>				
Labor	2.220	1.698	.522	
Supplies	.983	.896	.087	
Total	3.203	2.594	.609	

REPUBLIC MINE.

COMPARATIVE WAGES AND PRODUCT.

	1918.	1917.	INCREASE.	DECREASE.
PRODUCT	142,476	153,425		10,949
No.Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	62	68		6
Underground	160	174		14
Total	222	242		20
AVERAGE WAGES PER DAY				
Surface	4.50	3.56	.94-26.4%	
Underground	5.01	3.92	1.19-31.1%	
Total	4.87	3.75	1.12-30. %	
WAGES PER MONTH OF 25 DAYS				
Surface	112.50	89.00	23.50	
Underground	125.25	95.50	29.75	
Total	121.75	93.75	28.00	
PRODUCT PER MAN PER DAY				
Surface	7.65	7.38	.27	
Underground	2.97	2.93	.04	
Total	2.14	2.10	.04	
LABOR COST PER TON				
Surface	.588	.482	.106	
Underground	1.689	1.306	.383	
Total	2.277	1.788	.489	
AVG. PRODUCT BRK'G & TRM'G	5.25	5.64		.39
" WAGES CONTRACT MINERS	5.095	3.83	1.245-32%	
" " " TRAMMERS	6.594	4.53	2.064-45%	
" " " LABOR	5.551	4.08	1.47 -36%	
TOTAL NUMBER OF DAYS				
Surface	18,630 $\frac{3}{4}$	20,782 $\frac{3}{4}$		2,152
Underground	48,006 $\frac{1}{2}$	52,399 $\frac{1}{2}$		4,393
Total	66,637 $\frac{1}{2}$	73,182 $\frac{1}{2}$		6,545
AMOUNT FOR LABOR				
Surface	83,763.08	73,994.68	9,768.40	
Underground	240,640.79	200,311.60	40,329.19	
Total	324,403.87	274,306.28	50,097.59	

Proportion Surface to Underground Men;

1918 - 1 to 2.58
 1917 - 1 to 2.56
 1916 - 1 to 3.02
 1915 - 1 to 3.
 1914 - 1 to 2.34

REPUBLIC MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1918.	AMOUNT 1917.
50% Powder, Red Cross	48,600	.2082	10120.45	11304.86
20% " Gelatine	108,150	.2388	25825.71	16697.39
Total Powder	156,750	.2293	35946.16	28002.25
Fuse	238,950	6.806	1626.36	1293.32
Caps	51,900	12.865	667.72	679.75
Cap Crimpers	1	.40	.40	3.94
Tamping Bags	11,473	2.52	28.91	66.55
Battery Caps	100	5.78	5.78	
Connecting Wire	6	.535	3.21	
Total Fuse, Etc.			2332.38	2043.56
Total Explosives			38278.54	30045.81
Product			142,476	153,425
Pounds Powder per ton Ore			1.10	1.07
Cost per ton for Powder			.2523	.1825
" " Fuse, Etc.			.0164	.0133
" " All Explosives			.2687	.1958
Avg. Price per Lb. for Powder			.2293	.1723

	TONS.	LBS. PER TON.
Actual tons of ore broken during 1916,	119,100	1.349
" " " 1917,	94,048	1.748
" " " 1918,	135,140	1.159

In the body of the statement pounds per ton of ore is figured on total product.

ANNUAL REPORT
OF THE
IMPERIAL MINE (1918)

Production and Shipments.

The Imperial Mine remained closed throughout the year. No shipments were made, and there is no ore in stock.

Estimate of Ore Reserves.

Level	Shaft Pillar Tons	Available Ore Tons †	Total Tons	Partly Developed Tons	Total Tons +
First	12,000	2,000	14,000		14,000
Second	23,000	28,000	51,000		51,000
Third	24,000	178,000	202,000		202,000
Fourth	45,000	200,000	245,000	80,000	325,000
Total	104,000	408,000	512,000	80,000	592,000
Less 10% loss Mining		41,000	41,000	8,000	49,000
Net Total	104,000	367,000	471,000	72,000	543,000

A factor of 13 cu.ft. per ton was used, and incidental rock was deducted on each level.

Surface.

All surplus supplies and usable material were gathered up and shipped to the Ishpeming District.

All scrap iron and steel was collected and two cars of it were sold, one to the Lake Superior Metal Company and the other to the Lake Shore Engine Works.

The compressor was removed late in the Fall and shipped to the Hard Ore for storage. The other compressor was shipped to the Mesabi Range in May.

Capt. Harry H. Marks left the mine on April 15, and
Gust Carlson took his place as watchman and care-taker.

SPIES MINE.

PRODUCTION:-

The product for the year 1918 totalled 122,408 tons. The product for the year 1917 was only 74,581 tons, due to the fact that the mine was not developed to produce much ore before July, 1917. The following table shows the comparative product for the two years:-

MONTH	YEAR 1917	YEAR 1918
Jan.,	1,004	9,273
Feb.,	1,282	9,955
Mar.,	2,068	11,095
Apr.,	2,374	9,380
May,	4,978	11,300
Jun.,	6,992	10,046
Jul.,	8,912	10,629
Aug.,	10,062	12,665
Sep.,	8,424	8,382
Oct.,	10,124	11,024
Nov.,	8,608	9,036
Dec.,	9,753	10,890
TOTAL,	74,581	122,408

Every month in 1918 shows an increase over the corresponding month in 1917 with the exception of September, during which month, the top tram equipment gave us endless trouble. The month of August, 1918, was the banner one for the year.

DELAYS:-

There was only one extraordinary delay that occurred on October 31st, and tied the mine up until November 6th. The hoisting engine pinion shaft broke in two. The break was inside the pinion and it took some time to locate the source of the trouble. The Master Mechanic of the Republic Mine and Superintendent arrived within two and one-half hours after being notified and immediately had the shaft removed and shipped to Republic by express. In the meantime, another piece of shafting, which luckily happened to be on hand at the Republic Mine, was being turned down to size.

The new shaft was completed on November 3rd and shipped to the Spies by the next train. On November 5th, Election Day, the shaft was installed, repairs being completed at 5:00 P.M. The hoist has given us no trouble since.

There were a number of minor delays, such as:-

Apr. 9,	3 hours,	Hoist broken down,
Apr. 20,	4 "	Crusher blocked,
Apr. 22,	8 "	Crusher Belt burnt-new one installed.
Jun. 21,	10 "	Crusher blocked by sledge,
Aug. 27,	4½ "	Skip derailed.

SHIPMENTS:-

Spies Crushed ore to Escanaba,	46,530 tons,
" Lump " to National Enameling & Stamping Co.,	<u>2,251 "</u>
Total Shipments,	<u>48,781 "</u>

ANALYSIS & SAMPLING:-

The average analysis of the Crushed ore shipped to Escanaba Docks was:- Iron 55.69 Phos. .460 Silica 5.91

The Lump shipments were made partially from ore stocked and partially from the mine hoist.

	IRON	PHOSPHORUS	SILICA
Spies Mine Lump from stockpile,	57.38	.456	4.45
" " " " hoist,	58.57	.411	4.73

The Lump ore shipped from the shaft was much better in grade than the Lump stocked and that shipped in 1917.

There was more or less trouble with the sampling all through the shipping season. The laboratory work was being done at the Rogers Mine. Invariably, the lower lake chemists reported higher Iron than the average calculated from the mine analysis. The cause of the discrepancy was finally laid to the Crusher room practice at the Rogers Mine. The mine samples were not ground and pulverized properly which caused the Iron analysis to vary in error up to a maximum of 3%. For instance, if the laboratory reported 53.00% Iron, the actual Iron content should have been 56.00.

On the average, I should estimate that all the mine results turned in up to the middle of August, averaged from 1% to 1½% too low.

During the latter part of August, September and October, duplicate samples were taken; one set being sent to the Rogers Mine laboratory and the other set to the Republic Mine laboratory. On checking over the results, it appeared that the Rogers Mine laboratory would be too high on some samples and too low on others, the average, however, being very nearly the same.

STOCKPILE:-

The West stocking ground area has been filled with ore. In order to provide room for 75,000 tons additional, a new stockpile ground was graded East of the railway tracks. An area 100 feet wide and 500 feet long was graded and a layer of lean ore 6" thick rolled down for a stockpile floor. If the stocking area had been planked, it would have been necessary to grade the ground first, so that the use of plank would only have been extra expense. A trestle was constructed 180 feet long leading to the new grounds. This was constructed by Proksch, the Iron River Contractor, who did a good job. The estimated expense of this improvement if plank had been used, would have been as follows:-

180 feet of permanent trestle,	3,600.00
150 M ft. of plank,	4,500.00
Clearing, grubbing & grading,	<u>1,000.00</u>
	<u>\$9,100.00</u>

Cost equals about 12.1% per ton of stocking capacity.

The following estimate was made to cover the cost in case lean ore was used for stockpile bottom:-

180 feet of permanent trestle,	3,600.00
Clearing, grading & filling with lean ore,	<u>2,000.00</u>
	<u>\$5,600.00</u>

The actual cost was as follows:-

Clearing, grading & filling,	1,152.17
Trestle,	<u>1,628.38</u>
	<u>\$2,780.55</u>

Cost equals about 3.7¢ per ton of stocking capacity.

You will note that the actual cost was only about half the estimate. This was partly due to the excellent work done by the contractor, the trestle only costing about \$9.00 per foot which is very reasonable for a permanent trestle. Preparing the site did not cost as much as estimated, because the ground was not leveled off or graded, the lean ore being used to fill in the hollows and then rolled until the stockpile floor was level.

TOP LANDING & TRAMMING:-

Several changes were made and contemplated which reduced the cost of handling the ore. When the product is stocked, all of the expenses are charged to Account No. 162, but when the product is shipped, the expense is charged to Account No. 182. The total cost of handling the ore in the shaft house for the two years is as follows. For sake of comparison, a few individual months are also given:-

	<u>TOP LANDING & TRAMMING</u>		<u>SHIPPING AT POCKET</u>	
	<u>TOTAL COST</u>	<u>COST PER TON</u>	<u>TOTAL COST</u>	<u>COST PER TON</u>
Year, 1917,	5,688.02	.076	808.57	.128
Year, 1918,	6,321.72	.051	1373.08	.029
June, 1918,			318.66	.032
July, "			183.87	.017
Aug., "			213.16	.017

You will note that the cost per ton of handling the ore on the top landing has decreased considerably, the largest saving being the reduction in the shipping expense, which was cut in two. This saving was accomplished by using only one top lander instead of two on each shift and by eliminating the sampler after July 1st. The sampling was done by the blacksmith's helper.

Another change that increased the efficiency of the top tram and thereby cut costs was the substitution of a side dump car that discharges its load automatically for the old type swivel dump cars. It takes from two to three men to dump the latter cars, the men riding out to the end of the pile on the car. With a side-dumper, only a puffer man is employed.

COSTS:-

The cost of production decreased during the year notwithstanding all the increases in wages and supplies. This was partially due to larger out-put and to economies effected in the coal consumption, top landing, laboratory expense, etc. The following table shows the cost of production for the two years:-

COST OF PRODUCTION.

MONTH	1917			1918			DECREASE OVER 1917.
	LABOR	SUPPLIES	TOTAL	LABOR	SUPPLIES	TOTAL	
Jan.,				.922	.432	1.354	
Feb.,				.842	.426	1.268	
Mar.,				.816	.437	1.253	
Apr.,				.877	.381	1.258	
May,	1.594	.942	2.536	.853	.329	1.182	1.354
Jun.,	1.236	1.052	2.288	.875	.391	1.266	1.022
Jul.,	1.059	.568	1.627	.861	.392	1.253	.374
Aug.,	.976	.642	1.618	.837	.289	1.126	.492
Sep.,	.896	.773	1.669	1.187	.570	1.757	.088
Oct.,	.920	.546	1.466	1.172	.485	1.657	.191
Nov.,	1.037	.782	1.819	1.117	.575	1.692	.127
Dec.,	.824	.499	1.323	1.154	.390	1.544	.221
TOTAL,	.933	.633	1.566	.954	.418	1.372	.194

The month of August, 1918, shows the lowest cost of production since the mine started operating. The cost for the year, 1918, is less than that for 1917, notwithstanding the numerous increases in wages. The cost per ton for labor has gone up but the cost of supplies has been kept down. The two large items of supplies are fuel and explosives. The fuel consumption has been reduced greatly which will be discussed later under the heading: "Boiler Plant", and the explosive cost has been reduced as shown under "Breaking Ore".

ANALYSIS:-

The various items on the Cost Sheet will be taken up under the individual headings:-

ENGINEERING.

This work is performed by men from the Ishpeming Office, once a month usually suffices to keep the maps posted to date. The expense for the year is small and notwithstanding the increase in wages, does not show an increase in the cost per ton.

ANALYSIS.

The cost of laboratory work has been cut in half. All the analyzing is done at the Rogers Mine Laboratory at 40¢ per determination. If the Iron, Phosphorus and Silica are wanted, it costs us \$1.20 per sample.

At the beginning of the shipping season, samples were taken from the tops of the railway cars and also from the underground cars at each level. If ore was being hoisted from all three levels, there were at least four samples taken on each shift. In addition, breast samples were taken from main level development drifts about twice a week.

At the Spies Mine, there is only one grade of ore shipped and consequently all the ore is dumped together into the same railway car. There is no object therefore in keeping the three level plat samples separate if one desires a check on the railway cars sampled on surface. So it was decided we could save the Company considerable money if a composite underground sample was made up each shift. As a result, the analysis expense per ton of ore was cut in half. The average monthly expense from June to December, 1918, inclusive, was only \$132.20, whereas it used to run \$251.05 monthly, showing a saving of approximately 50%.

PERSONAL INJURIES.

We were very fortunate with mine accidents, the expense being less than \$500.00 for the entire year. The Captain and bosses did their best to observe extreme caution and although accidents are to be expected as a mining hazard, the year passed with no accident of any consequence.

MINE OFFICE.

Notwithstanding the increase in wages and the hiring of an extra man during the month the regular Mine Clerk was laid up with a broken ankle, the average monthly cost increased only \$10.00, being \$605.00 for 1917 and \$615.00 for 1918. On account of the larger product for 1918, the cost per ton was of course reduced.

TRACKS & YARDS.

The most of the expense incurred under this head was the labor employed cleaning up the surface, moving the timber and piling it in one place and cleaning up the brush in the woods back of the Boiler House and Coal Dock to reduce the fire hazard.

DOCKS & TRETTLES.

Although this account shows a decrease for the year, the expense includes the cost of 180 feet of new permanent stocking trestle erected just East of the Shops and leading to the new stockpile ground. This trestle was built by Contractor Proksch.

BUILDINGS.

A small building 12' x 20' was constructed to house the transformers that furnish current for the Pumps, Compressor and Crusher. The building is located just North of the Shops, is of frame construction with a concrete floor. It was built by Contractor Proksch.

A part of the Warehouse was partitioned off to provide an office for the Superintendent. The Captain, Superintendent and Mine Clerk were all crowded into one room and there was no privacy in case some one wanted to talk things over with the Superintendent. The expense was small and a nice room has been built.

BOILER PLANT.

Several important changes were made here during the year. The coal consumption appeared to be very heavy for the small distance the ore was hoisted and as the pumping was supposed to be done by electricity, I could not see but what we could save the Company considerable money and so the following changes were made:-

The steam line leading to the Shaft was cut off to stop condensation in the long pipe line leading to the 3rd Level Pump House. The only reason for having steam on this line was for the reserve pump and as it takes about four hours to fill the sump in case anything went wrong with the electric pump, we have ample time to get the steam pump into commission.

The valves on the hoisting engine were reset saving steam.

One boiler was closed down saving considerable heat radiation and making better combustion under the other boiler.

The flues were all taken out of the West boiler and repaired. They were leaking quite badly. The fact that we were able to shut one boiler down, made it easy to repair the other. Previous to June, 1918, if repairs were necessary, they had to be done on Sunday, entailing extra expense.

The coal consumed by months for the years: 1917 and 1918, follows:-

MONTH	1917	1918	DECREASE
Jan.,	563 tons	238 tons	325 tons
Feb.,	445 "	213 "	232 "
Mar.,	312 "	232 "	80 "
Apr.,	301 "	197 "	104 "
May,	310 "	188 "	122 "
Jun.,	300 "	180 "	120 "
Jul.,	310 "	171 "	139 "
Aug.,	310 "	139 "	171 "
Sep.,	232 "	135 "	97 "
Oct.,	308 "	155 "	153 "
Nov.,	186 "	150 "	36 "
Dec.,	222 "	170 "	52 "
TOTAL,	3799 "	2168 "	1631 "

Previous to September, 1917, the comparison between the two years is not fair, because all the compressed air was made by steam previous to that date. Since that month the operating conditions are unchanged.

I wish to call attention to the small coal consumption beginning with June, 1918. During August, we burned only 139 tons and hoisted the largest tonnage since the mine started operating, viz: 12,665 tons of ore.

This saving in coal was one of the most gratifying accomplishments of the year, because it not only lowered the cost of production and thereby saved the Company considerable money, but it helped out Uncle Sam. The Government issued an appeal to save coal and we tried to help out as much as possible.

HOIST.

The hoisting engine at this property has been a constant source of annoyance and delays. In the first place, it is too small for the work to be performed, and secondly, it is in a general run-down condition. Since the hoist was originally installed, a larger drum has been put into commission and over-size cylinders put on.

A careful examination was made during June and it was found that due to the lost motion in the valve gear and links that the valves themselves were not set properly; in fact, one side was out over an inch, which in a slide valve engine is a large amount. These valves were reset and new pins and valve stems put on which cut down the lost motion considerably. An entire new valve gear is now being built for this hoist which will make the engine run smoother and with less noise.

During the year, there were a series of delays ranging from a few minutes to two or three hours, that interfered with the product. The most serious delay, however, occurred on October 31st when the main pinion shaft broke in two. A new one was made at the Republic Mine and shipped to the Spies by express. This was installed in a few hours but the mine had to be closed down for three days.

COMPRESSOR.

The old steam compressor was moved out of the Engine House and placed near the Railway track during the winter. The Master Mechanic forgot to drain the water jacket and consequently the cylinder was cracked. A new one was purchased and charged out.

The new electric compressor is working fine, not having given us a particle of trouble.

PUMPS.

The sinking pumps that were used when putting down the shaft were repaired and sent to the Mesabi Range. Practically all of the expense under this head were repairs to the pumps.

TOP TRAM EQUIPMENT.

The expenses under this head were heavy due to the purchase of a new top tram rope, new wheels for two old cars and new side dump stocking car.

The cars in use were of the old swivel type. These gave considerable trouble and were constantly going over the dump because they are top heavy, and sometimes due to carelessness on the part of the landers.

The new side dump car also does away with four of the top landers because it dumps automatically.

SKIPS & SKIP-ROADS.

The skip was hoisted too high on one occasion tearing out a short section of runners in the shaft house and causing a delay of four and one-half hours.

UNDERGROUND CARS.

The underground cars are in pretty good shape; new axles were made and put into commission making the cars run as good as new.

AIR PIPES.

There was no extraordinary expense under this heading. The cost per ton was lower for 1918 than for 1917, due to the larger daily product.

COMPRESSOR.

The new electric compressor saved considerable coal and cut the unit cost for compressed air to one-quarter of what it was in 1917.

HOISTING.

The Cost Sheet indicates that it cost more to hoist a ton of ore in 1918 than it did in 1917, regardless of the larger daily tonnage. Some of this increase is labor due to increased wages. The real reason is the electric air compressor. Previous to September, 1917, a part of the boiler house expense, in fact the greatest part, was borne by the steam air compressor. Since that time, practically all the boiler house expense had to be charged to the hoist—only a small proportion being chargeable for heating. As a matter of fact, the hoist used less steam than a year ago, which is shown from the coal consumption table shown previously in this report. For instance: under like conditions, we burned 153 less tons of coal in October, 1918, than in October, 1917, or in other words, the hoist used that much less coal. The saving for November was 36 tons and for December 52 tons. During the same period, we hoisted 1465 more tons of ore. No comparisons can be made previous to October, due to the fact that this steam air compressor was still in commission during the month of September.

PUMPS.

All the water, except the drinking water for the mine location buildings, is pumped from the 3rd level by a Goulds Triplex Electric Pump. This pump has given us no trouble. There are three steam pumps held in reserve in the same pump-house. At the first level, there was a steam pump that lifted water to the tank in the location. Early in June, all the steam pumps were shut down and as a result, considerable coal was saved. The unit cost for pumping per ton of ore was .049 for 1918 and .056 for 1917.

Notwithstanding increased labor costs and higher rate for power, the average monthly expense was reduced from \$522.00 per month in 1917 to \$502.00 in 1918.

BREAKING ORE.

All of the miners employed in the stopes work on the day shift. They are supposed to break enough dirt to keep the trammers busy on both day and night shifts. The unit cost for breaking ore was reduced from .624 to .479 per ton and we have been working largely at the ends of the ore body where it takes more labor and powder to break the dirt.

We used nothing but 40% powder during the year. During 1917, 25% powder was used because it was cheaper but the ore would be broken into large masses and the chunks would block the chutes, so it was decided that it would actually be cheaper to use the higher grade of powder. The explosives used and product broken for the two years follow:-

	<u>1917</u>	<u>1918</u>
Lbs. explosives,	72,300	94,385
Ore broken,	<u>74,581</u>	<u>122,408</u>
Lbs. powder per ton of ore,	0.98	0.77

You will note an appreciable reduction in the amount of explosives used.

TRAMMING.

All of the ore is trammed by hand from chutes. The trammers operate on a bonus system, but the system does not seem to stimulate production very much. A gang of trammers will average about 20 cars per day when they ought to get out a great deal more. There is room for improvement here and just as soon as trammers become more plentiful, I believe we can reduce the tramping cost. The average cost per ton trammed increased about 40%, which is too high.

TIMBER.

There is no timber used underground for any purpose except for raises. The ground, both rock and ore, holds up well and as a result, our timber costs are low amounting to only about $3\frac{1}{2}$ ¢ per ton.

UNDERGROUND.

The general underground conditions have improved during the year. The ore reserves have been decreased but 41,000 tons during the year; our development work having proven up approximately 82,500 tons of ore. This is a good showing when one considers that the ore body was pretty thoroughly explored by Diamond Drills and that all this information was used in making the 1917 ore estimate.

ORE RESERVES:-

All of the ore in the mine is Non-Bessemer.

MAIN ORE BODY	NET TONS AVAILABLE	NET TONS UNAVAILABLE	PROBABLE
Ore above First Level,	102,452		
" " Second "	26,548		
" " Third "	1,901	2,502	
" below " "			1,184
<u>NORTH LENS:-</u>			
Ore above First Level,	45,584		
" " Second "	11,227		
" " Third "	19,314	500	
" below " "			2,728
Total,	207,026	3,002	3,912

For sake of comparison, the following is the 1917

estimate:

MAIN ORE BODY	NET TONS AVAILABLE	NET TONS UNAVAILABLE	PROBABLE
Total Main Ore Body,	184,373	3,343	
<u>NORTH LENS:-</u>			
Total North Lens,	63,654		3,984
Total,	248,027	3,343	3,984

This shows a decrease of Net Tons Available of only 41,001 tons.

NEW DEVELOPMENT WORK:-

At the close of the year, a drift was being driven in ore on the Third Level, Southwesterly towards hole No. 25, in order to test the possible Westward extension of the ore in the main stope. At the end of the year, the drift had been driven 50 feet to the West and the breast was still in ore. If the ore extends beyond 200 feet in this direction, it will be on the Virgil property.

The underground work accomplished during the year follows in detail:-

NORTH LENS.

825' Sub-Level:-

This sub was opened up during October. About half of the probable ore body at this elevation has been developed from foot to hanging. This ore will probably extend clean up to the sand. About 50 feet of ore capping will have to be left in place until all of the ore on the lower levels has been mined out and hoisted. After the lowest levels have been gutted, a raise could be put up to the sand to drain any water that may be lying on the ledge. It is probable that there will be an accumulation of water and quicksand at this point because this ore is directly under the old swampy area that extends from the base of the hill West to the railway tracks. This water will have to be tapped very carefully by keeping long holes drilled ahead of the breast of the raise.

First Level:-

During the year 1918, the North Lens deposit was opened up at this elevation by driving a drift to the North-West along the contact between the foot and the ore. This drift was driven 250 feet. The ore body was found to average about 25 feet in width.

First Level. (Continued):-

Nine raises were put up on the foot wall side of the drift to the elevation of the 825' Sub-level. These raises were coned out so that only a wedge shaped piece of ore is left between each raise.

Shrinkage Stope between First & Second Levels:-

This stope which was started during 1917 is still being worked. The ore which varies from 240 feet on the Second Level to 170 feet long on the First Level, has a width of from 20 feet to 40 feet. This stope was divided into two sections. The South portion was mined up to within 15 feet of the First Level, leaving a floor pillar to protect the First Level. This floor pillar can be blasted down into the stope as soon as the ore above the First Level has been mined out. The North portion of the same stope was up within 36 feet of the First Level at the end of the year.

Shrinkage Stope between Second & Third Levels:-

The North Portion of the ore that lies between the Second and Third Levels is being mined out by the shrinkage stope method. The ore seems to be a little wider than the corresponding ore on the Second Level. We have mined out approximately half of the distance between the two levels. The South portion of this same ore body will be developed next year.

THIRD LEVEL:-

A main level cross-cut has been driven both North and South from the main drift leading out from the shaft. On the North side of the main level drift, we drove 140 feet to the rock. Seven raises were then put up 20 feet and a sub-level opened up. On the South side of the main drift, the cross-cut was driven 90 feet in ore. The ore varies in width from 10 feet to 30 feet. The ore is the usual Spies Non-Bessemer in grade.

MAIN STOPE.

825' Sub-Level:-

This Sub was opened up just at the close of the year. Two branch raises were put up from the first level opposite #30 and #60 raises and drifts headed out towards the main stope. The floors of the drifts were then blasted down into the main stope. The North and South ends of the ore will be mined first.

First Level:-

Most of the ore that lay next to the hanging has been mined out. On the North side of the stope, an area has been stoped out from the North limits of the ore to the Jasper pillar on the South. Nearly half of the width of the ore has been taken out.

On the South side of the main stope, a strip 22 feet wide along the hanging has been taken from the South side of the Jasper pillar to a point opposite No. 18 drill hole. There is probably about 30 feet of ore left along the hanging that will have to be mined from #80 raise, which is now being put up from the Second Level.

784' Sub-Level:-

The ore at this elevation was mined by first driving drifts from #30 to #32 raise and then from #32 raise to the hanging. An opening was then made to the back of the main stope and all the ore between the drift and the rock on either side was blasted down into the stope. Another drift was driven Westerly from #60 raise to the hanging and practically all the ore has been mined out at this elevation except a pillar 40 feet long and 35 feet wide, at the extreme South end of the stope. This ore will be mined by driving a drift from #80 raise that is now being put up from the Second Level.

784' Sub-Level. (Continued):-

We attempted to get this ore by keeping a travelling road open along the East side of the stope, but falls of ore from the upper Sub tore out sections of the travelling road making the passage unsafe. We therefore adopted the more expensive but safer plan of raising from the Second to the First Levels and tapping all the subs between the two levels by cross-cuts.

764' Sub-Level:-

This is a new Sub opened up during the year 1918. The method of mining was similar to that adopted for the 784' Sub, -the only difference being that a connecting drift was driven between #30, #40 and #60 raises. With the exception of a small slice of ore left along the South end of the stope that will have to be mined from #80 raise, the only other ore left at this elevation is a pillar extending from the North to the South end of the stope varying in width from 15 feet to 22 feet. This strip of ore can not be mined until the First Level can be abandoned.

744' Sub-Level:-

The ore at this elevation is practically all mined out; only a narrow strip, 12 feet wide along the foot remains. This is being left as a pillar to support the upper subs and the main First Level drift.

724' Sub-Level:-

This Sub which is the first above the Second Level is completely mined out except a triangular pillar 125 feet long. From the Diamond Drill hole sections, there appears to be some more ore at this elevation, about 50 feet Southwest of the main stope. This area is now being explored by driving a drift on the Third Level. If the ore is there, we can stope it from the bottom up.

Second Level:-

Two pillars were mined each 50 feet wide and extending from the first to the second cross-cut and from the second to the third cross-cut. There is a possibility of some ore being developed at the North end of the level. Diamond Drill Hole #8 showed up some ore about 50 feet West of the breast of the North drift. It will probably be advisable to drift Westerly along the dike that appears in the drift near the breast in order to test the ground.

682' Sub:-

During 1918 four pillars were mined cleaning out all the ore that there is any information about in this locality.

662' Sub.:-

The ore lying between the drift connecting #20 to #60 raises and the drift along the foot was taken out so that nothing remains to be worked out.

642' Sub.:-

The three small remaining pillars were mined. This Sub. level is now entirely worked out.

THIRD LEVEL:-

The only new work done in the main stope area was the driving of a cross-cut from the middle drift to the one along the foot. Another raise was put up tapping #60 raise so that some of the ore that would be trammed from #60 now goes into this raise. As the mining proceeds upwards in the subs around the first level, all the broken ore falls into four raises: #30, #40, #50 and #60. That means that practically all our out-put has to be trammed through one drift. That congests the trammers and limits the number of gangs we can work to advantage. For that reason part of the ore is now being diverted over into the middle drift.

THIRD LEVEL. (CONTINUED):-

If an ore body similar to the main stope is ever developed again, it would be advisable to drive the main level tramming drift wide enough for double tracks. Then if a raise becomes blocked, the Captain has some leeway and can keep up his product. As it is now, if we have four gangs tramming from one cross-cut and the chute nearest the shaft becomes blocked with chunks making it difficult to run the ore, all of the other gangs are delayed while the outside gang is trying to fill its car.

During November, a drift was started from the hanging wall cross-cut between #4 and #6 raises headed for Diamond Drill Hole #25. There is a possibility of developing a new ore body here and no chance is being overlooked, as the life of the mine is limited.

SPIES MINE.

SPIES MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

GRADE	IRON	PHOS.	SILICA
Spies,	55.98	.470	6.36
Spies Lump,	58.57	.411	4.73

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1918.

GRADE	IRON	Mine PHOS.	Lake Erie IRON	MOIST.
Spies,	55.65	.458	56.79	6.41

ORE STATEMENT AND SHIPMENTS FOR YEAR 1918.

	SPIES	SPIES LUMP	TOTAL	TOTAL LAST YEAR
On hand Jan. 1st, 1918,	66,915	1,620	68,535	314
Output for Year,	123,044	631	123,675	74,530
Total,	189,959	2,251	192,210	74,844
Shipments,	46,530	2,251	48,781	6,309
Balance on Hand,	143,429	0	143,429	68,535
Increase in output - 66%			49,145	
Increase in ore on hand,			74,894	

1918 - 1-8 Hr. Shift during year

1917 - 2-8 Hr. Shifts & Began operating May 1st

SPIES MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	123,675	74,530	49,145	
General Expense	.081	.149		.068
Maintenance	.092	.127		.035
Mining Expense	1.199	1.290		.091
Cost of Production	1.372	1.566		.194
Ore Produced in Development		.132		.132
<u>DEPRECIATION.</u>				
Original Purchase	.044	.085		.041
Plant	.564		.564	
Equipment		.001		.001
Construction		.400		.400
Total Depreciation	.608	.486	.122	
Taxes	.033	.042		.009
Central Office	.055	.051	.004	
Supply Inventory	.009		.009	
Sundry Expense	.038	.020	.018	
Cost on Stockpile	2.115	2.297		.182
Loading & Shipping	.053	.018	.035	
Total Cost on Cars	2.168	2.315		.147
No. Days Operating	299	205	94	
No. Shifts and Hours	1-8hr	2-8hr		
Avg. Daily Product	413	364	49	
<u>COST OF PRODUCTION.</u>				
Labor	.954	.933	.021	
Supplies	.418	.633		.215
Total	1.372	1.566		.194

SPIES MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	123,675	74,530	49,145	.
No. Shifts and Hours	1-8hr	1-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	22	14	8	
Underground	63	45	18	
Total	85	59	26	
AVERAGE WAGES PER DAY				
Surface	4.16	3.36	.70-21%	
Underground	4.80	3.87	.93-24%	
Total	4.64	3.74	.90-24%	
WAGES PER MO. OF 25 DAYS				
Surface	104.00	84.00	20.00	
Underground	120.00	96.75	23.25	
Total	116.00	93.50	22.50	
PRODUCT PER MAN PER DAY				
Surface	18.79	16.65	2.14	
Underground	6.46	5.41	1.05	
Total	4.81	4.09	.72	
LABOR COST PER TON				
Surface	.221	.202	.19	
Underground	.744	.715	.29	
Total	.965	.917	.48	
AVG. PRODUCT BRK'G & TRM'G	9.64	6.74	2.90	
" WAGES CONTRACT TRAMMERS	Co.Acct	3.68	-	
" " " LABOR	"	3.68	-	
TOTAL NUMBER OF DAYS				
Surface	6,580 $\frac{1}{4}$	4,477 $\frac{1}{4}$	2,103	
Underground	19,148	13,766 $\frac{1}{4}$	5,381 $\frac{1}{4}$	
Total	25,728 $\frac{1}{4}$	18,244	7,484 $\frac{1}{4}$	
AMOUNT FOR LABOR				
Surface	27,389.93	15,046.43	12,343.50	
Underground	91,979.35	53,260.74	38,718.61	
Total	119,369.28	68,307.17	51,062.11	

Proportion Surface to Underground Men:

1918 - 1 to 2.86

1917 - 1 to 3.2

SPIES MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 8.	AMOUNT 1 9 1 7.
25% Powder	4,150	15.65	649.47	4322.32
40% "	79,985	18.26	14603.33	6240.98
50% "				1176.61
Total Powder	84,135	18.13	15252.80	11739.91
Fuse	203,450	8.15	1657.51	1169.83
Caps	27,875	13.15	366.56	385.45
Cap Crimpers	2	.56	1.12	.56
Tamping Bags	5,000		8.40	30.04
Total Fuse, Etc	236,327		2033.59	1585.88
Total Explosives			17286.39	13325.79
Product			123,675	67,853
Pounds Powder per ton Ore			.68	1.06
Cost per ton for Powder			.124	.173
" Fuse, Etc.			.016	.023
" All Explosives			.139	.196
Avg. Price per lb. for Powder			.181	.162

SPIES MINE.

CROSBY MINE
ANNUAL REPORT FOR 1918.

The production of wash ore from the Crosby Mine during the year 1918 amounted to 262,234 tons, of which 53,006 tons came from underground operations and 209,228 tons from open pit activities. The washing plant was operated from April 21st. to October 19th, handling 298,265 tons of crude ore and turning out 185,558 tons of concentrates. We had on hand January 1st., 1918, 36,031 tons of crude ore, which had been mined underground and stockpiled during the months of November and December, 1917.

Mining activities were discontinued upon the completion of the shipping season, the work of repairing the equipment, sinking the shaft and opening and developing our second level, constituting our operations to January 1st. We have no ore in stock January 1st. and according to our schedule of work, we will not start mining and stocking operations until about March 1st. It will be necessary to extend our second level drifts out under the North pit and move our equipment from the first to the second level. Three of the four underground locomotives will be transferred to the second level, the fourth being left for tramping in the North pit. It is our intention to continue mining the North pit ore bank back to the stripping limits and to haul and dump this material into chutes, which will be put up from the second level to the pit bottom. According to our plans, there will be no motor haulage conducted through the first level drifts in future, the underground wash ore above the first level having been exhausted and it being deemed advisable to dump the open pit wash material, remaining at and above the elevation of the first level, to the second level. One of the Model "28" shovels will,

therefore, work on the North pit ore above the first level, whereas the second "28" and the Model "36" will operate on ore under the old first level.

The estimate of production, covering 1919 shipments, has been placed at 125,000 tons, 110,000 tons of which will be of Bessemer grade and 15,000 tons Non-Bessemer. The phosphorus content of the ore increases with depth and subsequent to 1919 the Crosby product will be entirely Non-Bessemer, the phosphorus averaging about .060.

The general labor situation in the Nashwauk District during the past year was less satisfactory than for 1917. While we were able to operate with practically a full crew at all times, the class of labor was much inferior. From the present outlook, the labor situation for 1919 should show a decided improvement.

ORE ESTIMATE OF JANUARY 1ST., 1919.

"MERCHANTABLE ORE"

No merchantable ore was developed or mined from the property during the past year and the estimate will be the same as reported January 1st., 1918. There is no likelihood of developing any additional merchantable ore in the property, in fact the silica content of this so-called merchantable ore is so high that it is very doubtful whether it will be possible to ship it direct.

In sight January 1st., 1919.

	<u>Tons</u>
East forty- - - - -	86,000
West forty- - - - -	<u>122,000</u>
TOTAL- - - - -	208,000

The bulk of this ore is tied up in the track and shaft pillar and will probably be mined after the other ore bodies are exhausted. The ore averages 56% iron, .040 phosphorus and 14% silica.

"WASH ORE"

	<u>Est. Jan. 1st. '18</u>	<u>Mined 1918.</u>	<u>Est. Jan. 1st. 1919</u>
Stripped & Above Main Level-----	450,000 Tons	186,588 Tons	263,000 Tons.
Stripped & Below Main Level-----	435,000 "	22,640 "	412,000 "
From Underground Operations-----	<u>675,000</u> "	<u>53,006</u> "	<u>622,000</u> "
TOTAL- - - - -	1,560,000 "	262,234 "	1,297,000 "

For the purpose of reporting to the State Tax Commission we should show the product to be shipped and include the 208,000 tons of so-called merchantable ore with our wash material. This material is of Bessemer grade and will bring our total reserves of Bessemer concentrates, with the 110,000 tons to be shipped during 1919, to 235,000 tons. We have assumed a gross recovery of 60% in estimating the concentrates to be derived from the treatment of our present ore reserves.

Following is an estimate of the quantity and analysis of concentrates to be shipped from the Crosby mine:

BESSEMER ORE
(Including Shaft Pillar.)

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe. Nat.</u>
235,000	60.40	.045	8.20	7.50	55.87

NON-BESSEMER ORE

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe. Nat.</u>
668,000	60.00	.058	8.50	7.75	55.35

We do not now anticipate the developing of any further Bessemer, Non-Bessemer or siliceous ore from the Crosby Mine.

With the exception of the test-pits, which were sunk from the bottom of the East pit, no exploratory or development work was undertaken during the past year and in the process of mining no factors were encountered, tending to alter the assumptions of our previous estimate. The estimate of January

1st., 1919, is, therefore, reduced from the figure of the previous year by the tonnage mined. The East pit test-pits were sunk principally to determine the quantity of Bessemer ore remaining, rather than with the idea of developing any additional tonnage. The quantity of ore has not been affected by the test-pitting.

Our estimate of Crosby ore on January 1st., 1918, was based on a 46.50 iron and .046 phosphorus. The average grade mined during the year showed 46.38 iron and .036 phosphorus and we have, therefore, raised appreciably the phosphorus in the remaining ore. From the information of our drill holes and test-pits, we will not be able to produce any appreciable tonnage of Bessemer concentrates, as it is necessary to hold the phosphorus in our crude ore to .040 to obtain this result. According to our estimate, we will turn out 110,000 tons of Bessemer concentrates during 1919. This will mean that we will mine practically all of our low phosphorus ore and the tonnage remaining will be entirely Non-Bessemer. Subsequent to 1919 the phosphorus content of our concentrates will run from .055 to .060.

We do not now anticipate undertaking any exploratory or development work during 1919, which will result in increasing our ore reserves.

GENERAL SURFACE

We had considerable difficulty in keeping our surface drainage ditch open during the severe weather of January and February and it was necessary to employ a force of men from time to time making dams and keeping a channel open for the water. Approximately 100 gallons per minute seeps from our storage dam and the small flow is not sufficient to keep a channel open. As we have had considerable trouble with these ditches during the past several years, it was considered advisable to carry our mine

water into a ditch running along the north side of our pits and connecting with the stream from the dam at the northwest corner of our property. We secured some 10" pipe from the Meadow Mine and by bushing down to 8" and using a short wooden launder, we are able to drain the mine water as desired. We have had no further difficulty here since this work was done.

A crew of from four to eight men was engaged on steam shovel and locomotive repair work during the months of January, February, March, November and December. The rough material handled in the pits is hard on our light Model "28" shovels and they require considerable overhauling at the completion of each season's operations. The Model "36" shovel is stronger and is not racked in handling large chunks of frost and taconite. The two Model "28" shovels have now operated three seasons and by overhauling them carefully once a year, they will undoubtedly last out the open pit operations at this property.

Cinders were dumped over the mine and washing plant wagon roads and considerable cleaning done around the surface. The rock, which had been sorted out and piled around the edges of the stockpile, was hauled and dumped into the caves, and the drainage tunnel, leading under the stockpile grounds, was retimbered where necessary. Our new shop building will be in commission early in 1919 and we will then have an opportunity of tearing down the old shells and erecting a garage from the salvaged material. An endeavor will be made during the Spring of 1919 to clean up around the Crosby Plant and decidedly improve its general appearance. The stockpile grounds are entirely free from piles of taconite and the headframe and trestle layout presents a decidedly better appearance than heretofore.

One of the mule teams from the Meadow Mine was transferred to the Crosby during the Fall to replace the old team of horses. One of the horses died and the second became so lame

CROSBY MINE.

that he had to be shot.

A detailed account of the surface and general repair work will be taken up later under the caption of "Winter Work".

MINING OPERATIONS

Mining activities were confined to underground operations during the months of January, February, March and to the 14th of April and the product therefrom was placed in stock.

An average force of 18 contracts was employed underground during this period and an average monthly output of approximately 15,000 tons was maintained.

From two to three gangs were employed in the vicinity of Nos. 202 and 204 raises, gouging out seams of 50% ore, extending to the north thereof. The underground ore in this vicinity was entirely exhausted when open pit operations were resumed in April. One contract was employed gouging out narrow seams of ore from No. 188A raise. This ore was of fair wash grade, but the seams were very irregular and it was often necessary to blast rock in order to afford a wheelbarrow tramway.

Five contracts were employed on the 1475 Foot Sub Level at the north end of the property. These gangs, Nos. 10, 11, 12, 13 and 16, sliced and caved back the pillars to the west and north of Nos. 68 and 69 raises. The ground had been blocked out during the previous year's operations. The workings were carried in on rock and the deposit mined varied in thickness from 8' to 20'. There was some ore in the back that could not be taken on account of its mixed character. Wherever possible rock was sorted out and the ore recovered, but frequently the quantity of taconite and partly decomposed material was of such proportion that the cost of recovering the ore was prohibitive.

The 1475 foot sub was caved back close to the raises. There is a small tonnage of ore remaining here, which will be

mined and trammed to a second level chute when the development work at that elevation has progressed sufficiently.

From two to four gangs were employed in scrambling and gouging out the ore seams and old stopes under the east stripping bank. Some very fair material was secured here and considerable of it was drawn off without the use of timber. There is sufficient workable ground remaining to furnish employment to a small force for a period of several months.

Three contracts robbed and scrambled through the old workings to the east of Nos. 28, 30 and 32 raises. This ground was very heavy and the ore was gained with extreme difficulty, as the surface material had broken through in places and had to be boarded off.

One gang spent the months of January, February and March stoping out ore to the south of No. 16 crosscut. This room was carried up to the surface at the edge of the open pit and the sides were stoped out, undercutting the surface. This work had to be done while the ground was frozen and we were able to draw off all the ore before the March thaw made operations here dangerous.

A force of from three to five gangs were engaged in scrambling and robbing through the old workings in the neighborhood of Nos. 41, 42, 48 and 49 raises. These operations were conducted on the 1460 Foot Sub Level, one set above the main level, and the ground had been caved back to the raises by the opening of navigation. One contract can be employed robbing back along the main level when underground activities are resumed.

Prior to the inauguration of open pit operations, April 21st, a considerable quantity of rock was moved so as to allow the shovels free access to the ore banks and the loading tracks were put in good shape for haulage.

"West Pit Operations"

The No. 2, Model "28", shovel was engaged in digging along the north and east ore banks of this pit during April, May, June, July, August and a part of September. The ore face, which varied in height from 20' to 40', was extended to the solid rock wall along the north edge of the pit and to the stripping limits, from a point east of No. 140 raise, to the northeast corner of the pit. There is about 15 feet of ore along the bottom of the bank in the vicinity of Nos. 117 and 119 chutes, but it will be necessary to draw this ore off by an underground system of mining, as the pit wall now stands vertical and the top 20 feet is composed of partly decomposed taconite. We thought at one time that it might be advisable to extend our stripping somewhat to the east of the present pit limits, but the character of the ore is not such as to warrant this. The north one-half of the west pit has now been mined down to the bottom taconite. The No. 2 shovel extended its cuts on the bottom rock, casting undesirable material behind. When the accumulation of waste material had reached such proportions that it interfered with ore operations, the shovel would be used to cast the waste back from the face and the motor tracks would be relayed thereon. This shovel is capable of digging from five to six feet under the loading tracks.

The "36" shovel was used the latter part of the shipping season in digging from No. 141 chute to the caves at the south edge of the pit. This shovel had taken three cuts, approximately 300 feet in length, by the end of the season. It was possible to mine the ore down to the bottom rock as far south as No. 143 chute. From this point on a bench of ore was left in the bottom of the pit and the rock cast back along the east side of the cut. Most of the rock cast by the "36" shovel was loaded into tram cars and transferred to the waste dumps

to the north during November and December. On account of the severe weather this work was discontinued with the idea of cleaning out the balance of it during the coming Spring.

The Model "36" shovel will be engaged in mining the ore face toward the east during the coming season. The ore will be dumped into the second level chutes, thus doing away with tramming operations in the pit bottom. It will be possible to accomplish this by two casts at least and we will endeavor to mine the ore down to the rock as we progress, so that waste material can be cast back onto the cleaned up portions of the pit.

The ore remaining in the west pit is lower in iron content and higher in phosphorus than that mined during the past three years. In fact, the bulk of the wash ore mined since washing operations were inaugurated in 1916 has been derived from the West pit. The 1919 work will pretty well exhaust the clean ore here and we will be obliged to draw mostly from the East pit for our future supply. As the cuts are taken to the east, the number of taconite seams increase and it is questionable how far we will be able to progress with satisfactory results.

"East Pit Operations"

No hand milling was attempted here during 1918, although it was necessary to employ a small force from time to time in blasting the large chunks of frost and taconite. Approximately one-quarter of the material handled by the No. 1 shovel in this pit had to be sorted out on the headframe and sent to our waste dump. The sorting of this rock was often a serious item and resulted in slowing down our hoisting operations. In order to sort out the bulk of the rock, it is necessary to have the grizzly bars set $2\frac{1}{2}$ " apart and to satisfy the fee owners, the grizzly cannot be placed on much of an incline. This results in

considerable hand work in sorting a comparatively small tonnage. A considerable quantity of ore will be milled with the No. 1 shovel from the pit bottom during the coming summer. This ore is comparatively free from taconite and we will be able to handle it on the headframe to much better advantage than any ore thus far taken from the East pit. The product from the No. 1 shovel will be dumped into chutes from the second level.

The No. 1 shovel extended last year's ore banks to the North for 130 feet and to the East for 45 feet. The ore face averaged 30 feet in height and has been carried to the stripping limits for a distance of 100 feet. The No. 2 shovel was dismantled and transferred from the West to the East pit upon the conclusion of 1918 operations and will be used here during the coming season to cut back the present pit banks to the north and east stripping limits. This ore is somewhat mixed with taconite, but it will be possible to dump some of it along the west side of the pit, as the No. 1 shovel will mill down to the bottom rock within a short time after starting work. The ore dips at about five degrees to the southeast, and as we only have fifteen feet of ore along the west side, the sinking cuts will be started here. We have never had a place to store rock in the East pit heretofore, without being obliged to handle it a second time, but we will be able to dump to advantage at least a substantial part of our waste rock this year.

As most of the rock can be sorted and cast back from the Model "36" shovel's operations in the West pit, the quantity of material to be sorted on the headframe should be decidedly less than heretofore.

The East pit has now been mined down to the first level between the northwest and northeast drifts. The bottom of the open cut has an average of 160 feet and is 400 feet in length. There is a narrow channel of stripped ore, averaging 50 feet in width and 150 feet in length, extending north from the present

shovel pit. This deposit and the bench of ore, between the stripping limits and present pit bottom, will be mined with the No. 2 shovel during the coming season. It will be necessary to handle a quantity of taconite from the south end of the pit before steam shovel operations can be extended in this direction. It has been deemed advisable, however, to put off the handling of this rock until the ore to the north has been exhausted and to dump the waste material onto the mined out area.

WASHING OPERATIONS

The washing plant was started April 21st. and operated without interruption until the close of the season, October 19th. The weather conditions were very unsatisfactory for washing operations during the month of October 1917, but we could have continued to work into November the past season. It is not advisable, however, to attempt to wash ore when the temperature drops much below freezing, as the mill soon becomes a mass of ice and the tables especially are subjected to considerable straining. Further than this, the frozen ore cannot be dumped or washed to advantage and from the standpoint of mill practice the results are not at all satisfactory.

Numerous minor repairs were made at the mill during 1918, but no delays of a serious nature, due to break-downs, occurred. It was necessary to rebabbitt some of the bearings, replace log paddles and reline the waste rock, screen and log chutes.

We replaced the old trommel screen sections, which were perforated with 2" openings, by sections having $1\frac{1}{2}$ " perforations. This resulted in carrying a somewhat greater product to our picking belt and taking some of the load off from the log. The log motor used to run hot quite frequently, but since making this change it has not heated up to any extent. It was possible to sort out the rock on the picking belt to advantage, except in a

few instances when a considerable quantity of decomposed material was being sent to the mill. We do not anticipate handling any quantity of decomposed taconite this season.

It was not necessary to install the new conveyor belt, the one used during 1917 lasting out the 1918 season. This belt handled almost 600,000 tons of ore, the best record at the Hawkins Mine up to this year being 400,000 tons. We use a 30", 7 ply belt, whereas a 36", 9 ply belt has been used in the Hawkins mill. Our new belt has been stored in the heated power house so it will go through the winter with a minimum deterioration. We will have ample pieces of old belt- ing to serve for splicing and for picking belts during 1919.

The Great Northern Power Company's voltage was somewhat erratic and upon numerous occasions the switches would be thrown open and the machines stopped dead. As a result we were often obliged to clean out the log before starting up, especially was this the case when the machine was carrying a heavy load. No loss of production resulted, however, as our mill capacity is considerably in excess of that from the mine and we were always able to send through the mine's output.

The shortage of Great Northern ore cars was a serious item, however. We were often without cars for a half shift and after filling our railway bin, six cars and shaft pocket, it would be necessary to place the force in the mine and mill on repair and rock work.

The accumulation of rock under the chute at the top of the conveyor belt was spread over the ground between the mill and the receiving bin and the waste material from the picking belt was trammed and dumped onto the low ground to the north of the plant. The ground, available for dumping with a short tram, has now been filled and we contemplate erecting a new rock chute and trestle, so that the cars may be trammed out over the rail-

way tracks and a dump with an 18 foot head effected. This work will be undertaken when the weather moderates in the Spring. There was some space between the mouth of the rock chute and the top of the old bin and the material being dumped would often strike the edge of the hopper and glance off. The new arrangement will entirely do away with any danger of pieces of rock striking the men and will materially shorten the length of their tram.

An average crew of fifteen men per shift was employed at the mill during the past season.

Following is the tonnage treated during 1918, the concentrates produced therefrom and the analysis of same as obtained from mine and Lake Erie sampling:

<u>CRUDE ORE</u>					
<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>
298,265	46.30	.036	27.95	----	-----

<u>CONCENTRATES</u> (Mine Sampling.)					
<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>
185,558	60.41	.043	8.18	----	-----

<u>CONCENTRATES</u> (Lake Erie Sampling)					
<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>
183,681	60.43	.041	----	7.08	56.209

The ratio of gross recovery for the season of 1918 was 62.2 per cent and compares with 63.43 for 1917 and 61.2 per cent for 1916. The iron content of the crude ore treated during 1917 was over two points higher than that for 1918, whereas the iron content of the concentrates was but .4 percent lower for 1918. This partly explains the decrease in the ratio of recovery, the larger quantity of partly decomposed material encountered in the pits also being a factor.

The recovery of iron units for 1918 was 81.20 per cent and compares with 79.41 per cent for 1917 and 79.04 per cent for

1916. This increased recovery of iron units is due to improved methods at our washing plant.

The approximate percentage of product obtained from the several machines was as follows:- screen or picking belt 17.5, log 62.7, turbo 15.3 and tables 4.5.

The average analysis of the product from the machines for the past three seasons was as follows:

1 9 1 6 .

	<u>Fe.</u>	<u>Phos</u>	<u>Silica</u>
Screen-----	56.43	.049	12.23
Log-----	60.33	.044	8.03
Turbo-----	59.63	.033	9.22
Tables-----	64.13	.022	7.84
Tailings-----	22.70	---	----

1 9 1 7 .

	<u>Fe.</u>	<u>Phos</u>	<u>Silica</u>
Screen-----	53.73	.042	16.14
Log-----	61.16	.038	7.34
Turbo-----	60.62	.029	9.49
Tables-----	65.47	.019	4.45
Tailings-----	24.60	---	----

1 9 1 8 .

	<u>Fe.</u>	<u>Phos</u>	<u>Silica</u>
Screen-----	56.69	.049	12.96
Log-----	60.61	.045	8.17
Turbo-----	59.03	.032	11.52
Tables-----	65.53	.019	4.54
Tailings-----	26.00	---	----

Following is a detailed statement showing the charges against "Winter Work". Since wash ore operations were suspended on October 19th, the work at the Crosby Mine was conducted under a special estimate. A discussion of the work will follow the tabulation:

<u>GENERAL EXPENSE</u>	<u>ESTIMATE</u>	<u>CHARGES TO JANUARY 1ST. '19.</u>	<u>UNEXPENDED BALANCE.</u>
b. Engineering,		253.10	
c. Analysis,		267.74	
d. Mine Office,		1751.91	
h. Mining Captain,		530.00	
j. Personal Injury,		60.00	
TOTAL,	\$ 4,000.00	\$2862.75	\$ 1137.25
<u>NEW SHOP BUILDING</u>	\$ 5,000.00	\$ 593.89	\$ 4406.11
<u>REPAIRS TO EQUIPMENT</u>			
Steam shovels,		1696.51	
Locomotive & Cars,		662.56	
TOTAL,	\$ 7,500.00	\$2359.07	\$ 5140.93
<u>WASHING PLANT EQUIPMENT</u>			
Conveyor,		511.80	
Bins, screens, log & turbo,		2672.48	
Motors,		60.68	
TOTAL,	\$ 8,500.00	\$3244.96	\$ 5255.04
<u>TEST-PITTING EAST PIT</u>	2,500.00	\$2046.81	\$ 453.19
<u>HANDLING ROCK</u>			
East Pit, Yr. 5324)	--\$16,500.00	\$8381.97	\$ 7118.03
West Pit, Yr. 8536)			
<u>SINKING SHAFT</u>	\$ 4,250.00	\$3892.02	\$ 357.98
<u>PLAT AND POCKET</u>	\$ 3,700.00	\$ 820.18	\$ 2879.82
<u>PUMPHOUSE & SUMP</u>	\$ 3,500.00	\$1202.43	\$ 2297.57

	<u>ESTIMATE</u>	<u>CHARGES TO JANUARY 1ST. '19.</u>	<u>UNEXPENDED BALANCE.</u>
<u>DRIFTING 900' IN ROCK</u>	\$18,000.00	-----	\$18,000.00
	-----	-----	-----
	-----	-----	-----
<u>STRIPPING DRIFT</u>	\$ 6,000.00	-----	\$ 6,000.00
	-----	-----	-----
<u>PUMPING</u>	-----	\$4318.69	-----
	-----	-----	-----

"New Shop Building"

Contractor Proksch had made good progress on our new brick shop building by the end of the year. This is our standard building and is a duplicate of the one constructed for the Wade Mine. The Blacksmith Shop and Carpenter Shop are situated at either end of the building and the Machine Shop, occupying better than one-third of the building, located in the center. When we have moved into this structure the old buildings will be torn down and the salvage therefrom used in the construction of a four car garage. Our new structure will be of great assistance in speeding up the repair work and the appearance of the plant will be greatly benefited when the old shells are torn down.

"Repairs to Mine Equipment"

The bulk of the repairs on the two Model "28" steam shovels had been completed by the end of the year and all the necessary parts, covering replacements, received for the three shovels. The steam locomotive will be overhauled as soon as the steam shovel repairs are completed.

"Repairing Washing Plant Equipment"

The conveyor belt at the mill was taken off and stored in the washer building. The carriers were all taken apart, cleaned and repairs made where necessary. Some lining plates were placed

in the receiving bin and the hopper plates straightened. The carpenters repaired the rock, screen and log chutes and replaced a number of the worn out lining plates in the launders. The log, turbo and tables were dismantled and good progress had been made in the repairs.

It will be necessary to replace one bent shaft on the turbo and to straighten and rebabbitt all the bearings on the two machines.

The two new Deister tables will be installed next Spring. This will increase appreciably our capacity for handling fine material, as experiments have shown that a Deister tables is capable of treating a 50% greater feed than our Overstrom tables.

The mill will be cleaned carefully, rewired and the outside sheeting painted.

"Test-Pitting"

In order to demonstrate the character and analysis of the ore below our East pit bottom 19 test-pits were sunk. The depth of the pits varied from 15 feet along the West side of the pit to 30 feet along the east side. This test-pitting did not result in altering our tonnage estimates, but they did bring out the fact that we can expect to secure but a comparatively small tonnage of Bessemer ore, from a treatment of the ore lying below the present pit bottom.

The results of this test-pitting are as follows:

Test-pit No. 1	Footage	Fe.	Phos.	Silica	Mn.
	0- 5	41.41	.034	34.48	--
	5-10	50.17	.046	20.88	--
	10-15	43.68	.045	31.97	--
	15-20	43.79	.040	31.30	--
	20-25	46.55	.041	23.83	--
	25-29	43.51	.076	24.54	--
	29-30	Taconite.			

	<u>Footage</u>	<u>Fe.</u>	<u>Phos</u>	<u>Silica</u>	<u>Mn.</u>
Test-pit No. 2	0-5	46.25	.054	27.07	--
	5-10	43.16	.041	28.67	2.20
	10-15	43.01	.045	31.51	--
	15-20	43.28	.059	25.50	3.32
	20-26	41.78	.081	21.59	6.00
	26-27.5	Taconite.			
Test-pit No. 3	0-5	37.93	.027	38.29	--
	5-10	39.06	.034	38.13	--
	10-15	41.49	.093	30.06	--
	15-17	Taconite.			
Test-pit No. 4	0-5	43.27	.029	33.70	--
	5-10	43.43	.047	30.38	--
	10-15	43.27	.069	28.63	--
	15-18	Taconite.			
Test-pit No. 5	0-5	40.54	.047	36.07	--
	5-10	42.77	.048	31.51	--
	10-15	34.54	.036	42.50	--
	15-20	46.87	.064	25.24	--
	20-24	49.95	.125	7.98	
	Taconite.				
Test-pit No. 6	0-5	48.67	.054	23.86	--
	5-10	47.38	.050	25.21	--
	10-15	43.98	.045	30.53	--
	15-20	41.94	.042	31.65	--
	20-25	47.05	.069	22.15	1.00
	25-28	45.50	.135	12.23	9.20
	Taconite.				
Test-pit No. 7	0-5	43.23	.041	31.35	--
	5-10	41.73	.037	33.22	--
	10-15	43.55	.061	30.07	--
	15-18.6	50.02	.121	13.82	3.10
	18-21	Taconite.			
Test-pit No. 8	0-5	41.71	.054	34.10	--
	5-10	41.03	.049	34.84	--
	10-15	43.34	.043	33.10	--
	15-20	45.85	.102	14.16	5.68
	20-24	Taconite.			
Test-pit No. 9	0-5	53.11	.074	19.68	--
	5-10	38.48	.039	37.41	--
	10-15	40.00	.038	36.07	--
	15-20	41.97	.044	32.60	--
	20-25	45.90	.117	21.58	--
	25-30	45.16	.048	28.89	--
	Taconite.				
Test-pit No. 10	0-5	39.06	.037	37.93	--
	5-10	40.92	.031	35.00	--
	10-17	45.81	.054	25.33	--
	17-18	Taconite.			
Test-pit No. 11	0-5	43.68	.026	31.28	--
	5-10	39.81	.036	32.85	--
	10-15	39.97	.039	34.59	--
	15-20	39.75	.038	35.75	--
	20-24	47.68	.111	20.57	--
	Taconite.				

	<u>Footage</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>
Test-Pit No. 12	0- 5	45.74	.043	27.30	--
	5-10	48.49	.046	22.87	--
	10-15	49.82	.079	17.96	--
	15-16	Taconite.			
Test-Pit No. 13	0- 5	42.65	.033	32.13	--
	5-10	38.23	.033	39.73	--
	10-15	49.66	.075	18.64	--
	15-18	46.91	.053	24.97	--
		Taconite.			
Test-Pit No. 14	0- 5	42.38	.045	28.00	--
	5-10	43.11	.047	29.52	--
	10-15	43.97	.071	22.32	5.04
	15-20	45.70	.051	27.28	--
	20-27	38.77	.029	38.88	--
	27-29	Taconite.			
Test-Pit No. 15	0- 5	42.38	.043	32.51	--
	5-10	44.32	.044	28.74	--
	10-15	41.16	.041	34.17	--
	15-21	45.64	.093	20.69	2.94
Test-Pit No. 16	0- 5	39.45	.025	36.90	--
	5-10	40.32	.030	34.52	--
	10-15	38.80	.029	38.95	--
	15-22	41.65	.045	27.95	2.98
	22-25	Taconite.			
Test-Pit No. 17	0- 5	39.84	.041	35.66	--
	5-10	41.47	.032	32.20	--
	10-15	42.81	.043	29.96	--
	15-20	50.63	.085	14.95	2.00
		Taconite.			
Test-Pit No. 18	0- 5	43.68	.050	31.70	--
	5-10	40.77	.034	36.14	--
	10-15	47.70	.128	21.89	--
	15-18	51.68	.210	13.78	1.46
Test-Pit No. 19	0- 5	42.83	.056	31.40	--
	5-10	45.99	.040	25.69	--
	10-15	46.73	.095	21.22	2.16
	15-18	Taconite.			

"Handling Rock in Open Pits"

We loaded 5,324 tons of rock in the East pit, tramping and dumping same onto the West pit waste dump. This rock had been cast back of the shovel during the last two months that mining operations were conducted here. The clearing away of this material will aid operations during the coming summer to a considerable extent. The Model "36" shovel cast and loaded into cars 8,536 tons of rock in the West pit. This material was

either cast onto the mined out portions of the pit or trammed and placed on the waste dump with the rock from the East pit. The rock work in the East pit has been completed, but we still have a considerable pile to move with the Model "36" shovel. The work was discontinued the first of the year on account of the badly frozen condition of the ground.

"Sinking and Stripping Shaft"

Stripping and sinking operations in the Main Shaft were conducted on three 8-hour shifts, the work being completed by the middle of December. The shaft was stripped to full size from the old skip pits to the second level, a distance of 16 feet, and it was sunk in rock and timbered 36 feet below the second level.

"Plat & Pocket"

The second level plat was cut and timbered and a start made on cleaning up the drifts to the North and South by the end of the year. It will be necessary to complete our new pump sump on the second level before starting the pocket, otherwise the men would be obliged to work under wet conditions.

"Pumphouse and Sump"

A good start had been made on the excavation of the new sump, which is to be 8 feet wide, 10 feet deep and 40 feet in length and will extend along the south drift near the pumphouse. The pumphouse is protected by a concrete dam and the suction pipes will be carried through the concrete and furnished with gate valves on the pump side of the dam. We will thus be protected from a rush of flood water from the open pits, as the water would have to flood the second level workings and raise in the shaft to the first level before our electric pumps would be in danger. Our pumping capacity is such that there should be no apprehension on this score.

Following are the cargoes of Crosby concentrates shipped during the 1918 season and the analysis of same as obtained at the Mine and by the Lower Lake Chemists:

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>	<u>Tons</u>
<u>SCHOONMAKER</u> - - - - -						12,284
Mine-----	59.52	.045	8.92	----	-----	
Crowell & Murray---	60.48	.043	----	7.10	56.186	
Cremer & Case-----	59.90	.041	----	7.03	55.689	
<u>GRAND ISLAND</u> - - - - -						8,545
Mine-----	59.74	.045	8.64	----	-----	
Emmerton-----	59.55	.050	----	7.51	55.078	
Textor-----	59.35	.050	----	8.23	54.465	
<u>W. G. MATHER</u> - - - - -						10,386
Mine-----	59.86	.042	8.71	----	-----	
Rattle-----	59.70	.038	----	6.87	55.599	
Cremer & Case-----	60.70	.037	----	6.76	56.597	
<u>ANGELINE</u> - - - - -						6,780
Mine-----	60.82	.042	8.48	----	-----	
Rattle-----	59.50	.037	----	6.90	55.395	
Textor-----	61.05	.039	----	7.26	56.618	
<u>ISHPEMING</u> - - - - -						-7,008
Mine-----	60.44	.039	8.45	----	-----	
Rattle-----	59.60	.034	----	6.60	55.666	
Cremer & Case-----	59.70	.034	----	6.34	55.915	
<u>MARQUETTE</u> - - - - -						-7,778
Mine-----	60.60	.035	7.87	----	-----	
Crowell & Murray---	60.24	.039	----	6.43	56.367	
Rattle-----	59.60	.033	----	6.50	55.726	
<u>PIONEER</u> - - - - -						10,126
Mine-----	61.14	.042	8.15	----	-----	
Textor-----	61.20	.041	----	6.73	57.081	
Rattle-----	61.20	.043	----	7.18	56.806	
<u>TRUESDALE</u> - - - - -						2,067
Mine-----	60.78	.045	7.49	----	-----	
Crowell & Murray---	61.97	.041	----	6.76	57.781	
Cremer & Case-----	61.10	.043	----	6.65	57.037	
<u>PIONEER</u> - - - - -						10,171
Mine-----	60.47	.046	7.03	----	-----	
Textor-----	59.27	.046	----	7.55	55.193	
Rattle-----	60.20	.041	----	7.90	55.444	

GROSBY MINE.

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>	<u>Tons</u>
<u>CRAWFORD</u> - - - - -						2,737
Mine-----	60.77	.046	7.61	----	-----	
Cremer & Case----	60.60	.045	----	6.93	56.400	
Crowell & Murray--	61.40	.042	----	6.94	57.139	
<u>MARQUETTE</u> - - - - -						7,863
Mine-----	60.84	.045	7.78	----	-----	
Textor-----	61.40	.045	----	6.51	57.403	
Emmerton-----	60.60	.042	----	7.11	56.291	
<u>PONTIAC</u> - - - - -						2,981
Mine-----	61.80	.039	7.63	----	-----	
Cremer & Case----	61.60	.038	----	6.44	57.633	
Rattle-----	61.70	.040	----	6.87	57.461	
<u>NEGAUNEE</u> - - - - -						3,523
Mine-----	61.66	.038	7.95	----	-----	
Emmerton-----	61.58	.036	----	7.24	57.122	
Rattle-----	61.30	.038	----	7.40	56.764	
<u>E. B. MORRIS</u> - - - - -						3,879
Mine-----	60.23	.038	8.58	----	-----	
Cremer & Case----	60.40	.036	----	6.57	56.432	
Crowell & Murray--	61.55	.035	----	6.88	57.315	
<u>MARY C. ELPHICKE</u> - - - - -						2,210
Mine-----	60.88	.044	8.69	----	-----	
Crowell & Murray--	61.47	.039	----	6.65	57.382	
Cremer & Case----	60.90	.038	----	6.36	57.027	
<u>J. J. TURNER</u> - - - - -						4,058
Mine-----	60.50	.042	8.73	----	-----	
Rattle-----	60.00	.040	----	7.08	55.752	
Crowell & Murray--	61.06	.041	----	7.32	56.590	
<u>ISHPEMING</u> - - - - -						3,953
Mine-----	60.62	.048	8.54	----	-----	
Cremer & Case----	60.70	.045	----	7.14	56.366	
Textor-----	59.40	.048	----	7.46	54.969	
<u>GRAND ISLAND</u> - - - - -						6,123
Mine-----	60.18	.041	8.85	----	-----	
Cremer & Case----	61.00	.039	----	7.32	56.535	
Crowell & Murray--	61.36	.037	----	7.35	56.850	
<u>YORKTON</u> - - - - -						2,638
Mine-----	60.12	.041	8.55	----	-----	
Textor-----	60.10	.040	----	7.21	55.767	
Emmerton-----	59.48	.038	----	7.17	55.215	

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>	<u>Tons</u>
<u>L. C. HANNA-</u> - - - - -						9,966
Mine-----	60.14	.044	8.44	----	-----	
Cremer & Case----	60.30	.039	----	7.13	56.001	
Rattle-----	60.40	.040	----	7.18	56.063	
<u>SCHOONMAKER-</u> - - - - -						11,805
Mine-----	60.64	.044	7.54	----	-----	
Cremer & Case----	61.30	.038	----	7.55	56.672	
Rattle-----	60.40	.044	----	7.30	55.991	
<u>REPLOGLE-</u> - - - - -						4,109
Mine-----	60.28	.043	7.92	----	-----	
Cremer & Case----	60.60	.039	----	6.74	56.516	
Crowell & Murray--	61.02	.042	----	7.32	56.553	
<u>BOOTH-</u> - - - - -						3,569
Mine-----	60.54	.045	7.68	----	-----	
Rattle-----	60.10	.042	----	6.70	55.073	
Crowell & Murray--	60.70	.047	----	6.85	56.542	
<u>PIONEER-</u> - - - - -						9,980
Mine-----	61.40	.042	8.02	----	-----	
Crowell & Murray--	61.68	.041	----	7.31	57.171	
Textor-----	60.65	.039	----	6.63	56.629	
<u>SHEADLE-</u> - - - - -						9,825
Mine-----	59.99	.040	8.67	----	-----	
Cremer & Case----	59.40	.038	----	6.83	55.343	
<u>BREITUNG-</u> - - - - -						5,364
Mine-----	60.29	.043	7.86	----	-----	
Textor-----	60.80	.044	----	6.93	56.587	
Crowell & Murray--	61.27	.043	----	6.83	57.085	
<u>TOWNSEND-</u> - - - - -						8,097
Mine-----	59.21	.041	8.47	----	-----	
Rattle-----	58.80	.043	----	8.00	54.096	
Cremer & Case----	59.60	.045	----	7.83	54.933	
<u>ROBERTS-</u> - - - - -						3,200
Mine-----	60.61	.045	7.61	----	-----	
Cremer & Case----	60.90	.045	----	6.57	56.899	
Rattle-----	60.20	.040	----	7.20	55.866	
<u>SHEADLE-</u> - - - - -						4,513
Mine-----	60.83	.044	7.01	----	-----	
Crowell & Murray--	61.78	.043	----	6.74	57.616	
Rattle-----	61.20	.045	----	6.50	57.222	

ACCIDENTS

Following is a list of the accidents which occurred at The Crosby Mine during the past year and were of a nature serious enough to be reported:

HENRY RYDINKI

Injured-----January 19th, 1918.
Occupation-----Machinist.
Nationality-----Finn.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Rydinki with others was laying pipe line to carry away mine water. When lifting a piece of pipe, he strained his back.

MITCHELL LECLAIR

Injured-----January 21st, 1918.
Occupation-----Machinist.
Nationality-----American.
Time lost-----Two and one-half days.
Received Compensation-----None.

Remarks: Leclair was rolling a piece of 10" pipe onto a plank. The plank broke, and the pipe dropped onto his foot.

ELI YOVETICH

Injured-----February 4th, 1918.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----41½ Days.
Received compensation-----\$71.00.

Remarks: Yovetich was loading ore into tram car when a piece of taconite rolled from the side of the drift onto his foot.

MORRIS KOSKI

Injured-----February 5th, 1918.
Occupation-----Miner.
Nationality-----Finn.
Time Lost-----Fifty-nine days.
Received compensation-----\$82.00.

Remarks: Koski was barring down loose material from back of drift preparatory to putting up a set of timber, when some dirt fell, hitting him on the head and shoulders. Now confined in State Asylum.

MIKE STANICH

Injured-----February 23rd, 1918.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----Six days.
Received Compensation-----None.

Remarks: In drawing a moil out of a drilled hole Stanich struck his hand against an iron bar standing nearby.

MIKE ZACHOVICH

Injured-----March 11th, 1918.
Occupation-----Motor Brakeman.
Nationality-----Montenegrin.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Zachovich uncoupled a car from train. Car began to move down incline and noticing this the motorman stopped his train. The cars came together, catching Zachovich between them.

WILFRED WIVELL

Injured-----March 24th, 1918.
Occupation-----Motorman.
Nationality-----American.
Time Lost-----Six days.
Received Compensation-----None.

Remarks: Wivell's motor left the track and in coupling a second motor to pull the derailed locomotive onto the track, his hand was squeezed between the drawheads.

MIKE WUCKOVICH

Injured-----April 17th, 1918.
Occupation-----Open Pit Laborer.
Nationality-----Montenegrin.
Time Lost-----Four days.
Received Compensation-----None.

Remarks: Wuckovich was standing near a man breaking taconite with a sledge. A piece of rock flew and hit Wuckovich on the right eye.

ANTTI HOPPONEN

Injured-----May 14th, 1918.
Occupation-----Wash plant laborer.
Nationality-----Finn.
Time Lost-----Twenty-two days.
Received Compensation-----None.

Remarks: A rock hit the side of the chute and glanced outside of same, striking Hopponen on the head. Returned to work June 7th. On July 29th Hopponen was taken to Hibbing where an X-Ray examination showed fracture of skull. Hopponen died September 10th. This accident will be explained further.

NICK APOSTOLOPOLOUS

Injured-----June 26th, 1918.
Occupation-----Trackman.
Nationality-----Greek.
Time Lost-----Eighteen days.
Received Compensation-----\$24.00.

Remarks: In lifting heavy rock strained back.

CHARLES HINKLEY

Injured-----June 29th, 1918.
Occupation-----Steam Shovel Engr.
Nationality-----American.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Hinkley was lifting a rock and sprained his back.

ROKO PAVICHOVICH

Injured-----July 11th, 1918.
Occupation-----Gopherhole Man.
Nationality-----Montenegrin.
Time Lost-----10½ Days.
Received Compensation-----\$9.00.

Remarks: In picking down loose dirt from bank, a slide started and in making a quick get-a-way Pavichovich twisted his knee.

MIKE ANONIA

Injured-----July 15th, 1918.
Occupation-----Top Lander.
Nationality-----Italian.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Anonia was working in a rock chute on the top landing and a rock glanced and struck him on the right leg.

JIM TORENTO

Injured-----July 17th, 1918.
Occupation-----Gopherhole Man.
Nationality-----Italian.
Time Lost-----Five Days.
Received Compensation-----None.

Remarks: Toronto was employed as a gopherhole man and in starting to make a hole, a small rock rolled from the bank, striking him on the right shoulder.

ALEX HITEY

Injured-----July 28th, 1918.
Occupation-----Swamper.
Nationality-----Greek.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Hitey was using an axe and the handle caught in his overalls, causing axe to deflect and to strike him on left wrist.

CHARLES DOSEN

Injured-----August 13th, 1918
Occupation-----Dumpman.
Nationality-----Austrian.
Time Lost-----4½ Days.
Received Compensation-----None.

Remarks: In dumping a car, a rock rolled down striking Dosen on the foot.

LOUIS CREMER

Injured-----September 12th, 1918.
Occupation-----Skiptender.
Nationality-----Italian.
Time Lost-----Ten days.
Received Compensation-----\$8.00.

Remarks: Cremer stepped out on skip to open shaft pocket preparatory to loading. A small rock fell down shaft, striking him on the head. Presumably this was a piece of taconite that had settled on one of the shaft timbers and worked off from the jar of the skip.

THEODORE KARDORAS

Injured-----September 21st, 1918.
Occupation-----Top lander.
Nationality-----Greek.
Time Lost-----27 Days.
Received Compensation-----\$42.00.

Remarks: Kardoras was sorting ore on top landing. When moving a chunk of rock another piece rolled against his finger.

MILO MELOF

Injured-----September 24th, 1918.
Occupation-----Open Pit Laborer.
Nationality-----Montenegrin.
Time Lost-----Three days.
Received Compensation-----None.

Remarks: Melof was breaking rock on top of a motor car and the steam shovel runner swung dipper over car. In getting away from dipper, fell from the motor car.

EMIL JOHNSON

Injured-----October 22nd, 1918.
Occupation-----Surface laborer.
Nationality-----Finn.
Time Lost-----Four Days.
Received Compensation-----None.

Remarks: Johnson was carrying piece of pipe down the pit and slipped, spraining his left foot.

JOHN RILEY

Injured-----December 4th, 1918.
Occupation-----Machinist.
Nationality-----American.
Time Lost-----Four Days.
Received Compensation-----None.

Remarks: Riley was assisting electrician in stringing wires and foreign particle fell into his eye.

JOHN SANDEL

Injured-----December 14th, 1918.
Occupation-----Surface laborer.
Nationality-----Austrian.
Time Lost-----11 days in 1918.
Received Compensation-----None.

Remarks: Sandel was unloading coal from cars and jumped from car to dock. Complains of soreness in arch of right foot.

ANTTI HOPPONEN INJURED AT CROSBY MINE MAY 14TH.

Antti Hopponen, No. 250, was injured at the Crosby washing plant on May 14th. A rock from the picking belt, which had been sorted and thrown into the rock chute, glanced from the side of the receiving bin and struck Hopponen on the head. He was unconscious for a few minutes following the accident, but was able, with assistance, to walk to an automobile and from an automobile into the hospital, within a short time. His wound was dressed and he was sent to his boarding house. There was no evidence at the time of Hopponen's visit to the hospital of any fracture, or was there any discovered during the period that Hopponen went to the hospital for treatment, between May 14th and June 7th, when he reported for work. Hopponen lost 22 days. He worked at the washing plant from June 7th to July 26th, but reported at the hospital from time to time during this period for the purpose of having his head dressed. The wound had healed over nicely and the physician believed that he would have no more trouble. However, on July 18th the wound reopened on account of the formation of pus. In dressing the wound on July 18th a small piece of bone was removed and several days later a second, and larger piece,

was taken out of his head, convincing the physician that there must be a fracture to the skull. After removing the particles of bone the wound continued to discharge and on July 29th Hopponen was taken to the Hibbing hospital and an X-Ray plate secured. This plate showed that there was no fracture of the inner Dura, merely the outer bone of the skull. On July 31st an operation was performed and the depressed bone was removed. Following this operation it was necessary to make a second incision to drain pus from the wound. Meningitis developed and Hopponen died on September 10th.

ANALYSIS OF COST SHEET

Mining operations were conducted continuously during 1917, whereas in 1918 mining activities were discontinued from October 19th to the end of the year. Underground work was carried on during January, February, March, April, November and December, 1917, while in 1918 underground operations were conducted during January, February, March and a half of April. The fact that considerable more underground work was done in 1917 than in 1918 would have the effect of higher costs for 1917 ore and while the charges under the various captions are higher during 1918, the increase in wages and supplies would have caused a still further increase, as compared to 1917, if we had carried on underground mining operations as extensively as during the previous year.

The total production of crude ore for the year 1918 amounted to 262,234 tons and compares with an output of 290,795 tons for 1917.

The following statement shows the charges under the several main captions for the years 1917 and 1918:

	<u>1918</u>	<u>1917</u>
General Expense-----	.056	.045
Maintenance-----	.073	.069
Mining Expense-----	<u>.628</u>	<u>.594</u>
Cost of Production-----	.757	.708

The advance in wages and supplies during 1918, as compared with the previous year, and the fact that the efficiency of labor was somewhat lower, were responsible for the increase in the costs noted above.

GENERAL EXPENSE

The items "Insurance", "Engineering", and "Personal Injury" were all nominal and were the same for the years 1917 and 1918.

"Analysis" was \$.002 higher in 1918, due to the fact that the price paid Lerch Brothers per determination was advanced

10¢ over the previous year.

"Mine Office" showed an increased cost per ton of \$.009 in 1918, which was caused by the fact that an extra man was employed in the office and to the advance in wages and supplies.

MAINTENANCE

The charges to "Shop Machinery", "Hoisting Machinery", "Skips & Skip Roads", "Underground Tracks & Cars" and "Telephone & Safety Devices", were low in both 1918 and 1917 and the charge per ton against the output was the same for the two years.

An increase of \$.005 in "Tracks & Yards" was due to quite extensive work in connection with cleaning the mine premises and repairs made to the roads. It was necessary to spread ashes over the roads leading from the coal dock to the pits, for the handling of coal to the shovels and the several bridges and drainage ditch culverts were repaired.

The charges to "Docks, Trestles and Pockets" were exceptionally high in 1917 on account of the construction cost of the rock pockets and headframe grizzly. The 1918 expense was nominal and as a result there was a decrease of \$.007 per ton for this item.

There was a decrease of \$.005 per ton for "Buildings" in 1918, no new work having been undertaken during the year, further than the "New Shop Building", which was charged to a special Estimate & Authorization" account. In 1917 a new concrete oil house was erected and extensive repairs made on the Boiler House and shop buildings.

The charging off of the cost of our surface drainage ditch to 1918 accounts explains the increase of \$.003 against "Pumping Machinery".

The item "Top Tram Engine & Cars" was \$.004 per ton higher in 1918, due to the extensive repairs put on the top tram cars. It was necessary to practically rebuild our two end-dump-

ing cars as they were pushed over the end of the pile and badly damaged.

The excessive charges to cover the repairs on the underground locomotives and haulage tracks in 1918 was responsible for an increase of \$.007 per ton in the item "Electric Tram Plant".

MINING EXPENSE

The charges to "Hoisting", "Pumping", and "Sinking and Shaft Repairs", were very nominal and practically the same per ton of ore produced covering the two years considered. The increase in the cost of current from The Great Northern Power Company was offset by the larger output secured per shift worked in the cases "Hoisting" and "Pumping".

A rock drift was extended from the bottom of the pit to drain the water from the west boundary haulage workings and winzes were sunk in rock to the north and south of our operating shaft from the first to the second level in 1917, whereas during 1918 there were no charges to "Rock Drifting" and this resulted in a decrease of \$.026 per ton against the item "Rock Drifting".

While the cost of supplies and wages were considerably higher in 1918, there was an increase of only \$.016 per ton for "Breaking Ore", due to the fact that underground operations were much less extensive in 1918. Other things being equal, the advance of wages and supplies during 1918 would have resulted in an increase of at least 12¢ per ton against this item.

The higher rate paid for current and the advance in wages were responsible for an increase of \$.004 per ton for "Tramming".

The item "Timbering" shows a decrease of \$.010 per ton for 1918, as compared with the figure for the previous year. This is explained by the fact that there was considerably more underground work done during 1917. The advance in the price of timber

did not materially affect the 1918 costs for most of the supply used had been purchased in 1916 and 1917.

The account "Captain & Bosses" shows an increase of \$.006 per ton for 1918, as compared to the previous year, due to the advance in wages.

The increase of \$.005 per ton for "Dry House" in 1918 is explained by the advance in wages and the fact that especial attention was devoted to the keeping clean of this building and surrounding premises during 1918.

The increase of \$.003 per ton for "Top Landing and Tramming" and \$.002 for "Stocking Ore" was due to the advance in wages during 1918.

There was an increase of \$.033 to the caption "Sorting Ore" for the past year as compared with 1917. We encountered considerably more decomposed taconite in our open pit operations last summer than at any previous time and as a result it was necessary to work one additional man on the headframe grizzly. Further than this, objection was made to the quantity of sandy rock in our ore and we endeavored to do more careful sorting at our headframe. The wage advance, of course, also had an important bearing on this increase.

There was a charge of \$.010 per ton for "Removing Rock from Open Pits" during 1918, whereas there was no expense against this item in 1917.

The stripping of a small pocket of ore over No. 16 cross-out in 1917 resulted in a charge of \$.003 per ton for that year's output. No stripping operations were undertaken during 1918.

CONCENTRATING COSTS

We turned out 185,558 tons of concentrates in 1918 as against 187,938 tons in 1917.

GENERAL EXPENSE

The following statement shows the charges under the several captions, covering the expenses of concentrating Crosby

ore for the years 1917 and 1918.

	<u>1918</u>	<u>1917</u>
General Expense-----	.036	.034
Transportation Maintenance-	.023	.016
Transportation Cost-----	.076	.063
Maintenance Washing Plant--	.042	.037
Operating Washing Plant----	<u>.138</u>	<u>.121</u>
TOTAL-----	.315	.271

The average tonnage of concentrates turned out per 24-hour day during 1918 was 1,167 as compared to 1,174 during the previous year.

Under General Expense the items "Analysis" and "Mine Office" were slightly higher, due to the increase in wages and the advanced cost per determination. Partly offsetting this, there was a decrease of \$.005 per ton for "Personal Injury" expense, there having been but one bad accident in 1918.

Under "Transportation Maintenance" there was an increase of \$.005 per ton against "Locomotive & Cars" and \$.002 for "Tracks". This was the result of the advance in wages and the cost of coal.

There was a uniform increase of the various items making up the charges to "Transportation Operation", due entirely to the advance in wages and cost of supplies, such as coal, oil, grease and waste.

The increased cost per ton of \$.005 for "Maintenance of Washing Plant" was the result of more than the usual repairs and replacements to "Bins, Screens, Log and Turbo". The 1918 rate per ton against the other items making up this caption compared very closely with those for the previous year.

The advance in wages and cost for current were responsible for an increase of \$.017 to "Operating Washing Plant". The larger increases were in the items "Foreman", "Rock Pickers", "Pocketmen" and "Electric Power". The only item under this caption to show a decrease was "Operating Labor" and this was due

to the fact that less men were employed at the mill on over-
time and on Sundays.

CROSBY MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

GRADE	IRON	PHOS.	SILICA
Crude on stockpile,	50.84	.034	21.50
Washed Ore,	60.44	.042	8.60

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1918.

GRADE	IRON	Mine PHOS.	Lake Erie IRON	MOIST.
Crosby,	60.38	.043	60.38	7.09

ORE STATEMENT AND SHIPMENTS FOR YEAR 1918.

	CRUDE ORE	CONCEN- TRATES.	SHIPMENTS	PERCENTAGE OF RECOVERY	TOTAL LAST YEAR
On hand Jan. 1st, 1918,	36,031	0	185,558	62	41,404
Output for Year,	257,661	185,558	185,558	62	288,889
Stockpile Overrun,	4,574				1,906
Total,	298,266	185,558	185,558		332,199
Crude Ore Treated,	298,266				296,168
Balance on Hand,	0	0	0		36,031
Total last Year,		187,938	187,938		
Decrease in Output,	28,560	2,380			
Decrease in ore on Hand,	36,031				

1918 - 2-8 Hr. Shifts Jan. 1st to April 22nd
 2-10 " " April 22nd to Oct. 19th
 3-8 " " Oct. 19th to Dec. 31st

1917 - 2-10 Hr. Shifts Jan. 1st to Dec. 11th
 2-8 " " Dec. 11th to Dec. 31st
 Washing Plant operated May 1st to Oct. 30th

CROSBY MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	262,235	290,795		28,560
General Expense	.056	.045	.011	
Maintenance	.073	.069	.004	
Mining Expense	.628	.594	.034	
Cost of Production	.757	.708	.049	
<u>DEPRECIATION.</u>				
Original Purchase	.026	.026	0	
Plant Account	.042	.042	0	
Equipment	.011	.007	.004	
Construction		.003		.003
Total Depreciation	.079	.078	.001	
Taxes	.090	.037	.053	
Central Office	.033	.033		
Supply Inventory	.013		.013	
Miscellaneous	.003		.003	
Winter Expense	.094		.094	
Sundry Expense	.005	.011		.006
Cost on Stockpile	1.074	.867	.207	
Loading & Shipping	.052	.025	.027	
Total Cost on Cars	1.126	.892	.234	
No. Days Operating	243	311		18
No. Shifts and Hours	2-8hr	2-8hr		
Avg. Daily Product	1079	935	144	
<u>COST OF PRODUCTION.</u>				
Labor	.557	.542	.015	
Supplies	.200	.166	.034	
Total	.757	.708	.049	

CROSBY MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	262,235	290,795		28,560
No.Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING:				
Surface	39	37	2	
Underground	65	87		22
Total	104	124		20
AVERAGE WAGES PER DAY				
Surface	5.06	3.98	1.08-27%	
Underground	5.22	4.06	1.16-28%	
Total	5.16	4.04	1.12-27.8	
WAGES PER MONTH OF 25 DAYS				
Surface	126.50	99.50	27.00	
Underground	130.50	101.50	29.00	
Total	129.00	101.00	28.00	
PRODUCT PER MAN PER DAY				
Surface	20.63	24.03		3.40
Underground	12.77	10.50	2.27	
Total	7.89	7.31	.58	
LABOR COST PER TON				
Surface	.245	.166	.079	
Underground	.409	.387	.022	
Total	.654	.553	.101	
AVG.PRODUCT BRK'G ORE BASED ON CRUDE ORE	23.71	17.65	6.06	
TOTAL NUMBER OF DAYS				
Surface	12,713 $\frac{3}{4}$	12,108 $\frac{3}{4}$	605	
Underground	20,531 $\frac{1}{2}$	27,690 $\frac{1}{4}$		7,158 $\frac{3}{4}$
Total	33,245 $\frac{1}{4}$	39,799		6,553 $\frac{1}{2}$
AMOUNT FOR LABOR				
Surface	64,376.19	48,152.21	16,223.98	
Underground	107,143.68	112,507.99	94,635.69	
Total	171,519.87	160,660.20	110,859.67	

Proportion Surface to Underground Men:

1918 - 1 to 1.66
1917 - 1 to 2.35
1916 - 1 to 2.14

CROSBY MINE.

CROSBY MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1918.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1918.	AMOUNT 1917.
6" to 8" Timber	4,290	.059	252.45	654.24
8" to 10"	7,150	.059	420.75	572.46
10" to 12"	1,430	.059	84.15	245.34
12" to 14"	858	.059	50.49	130.85
14" to 16"	572	.059	33.66	32.71
Total Timber 1918	14,300	.059	841.50	
" " 1917	32,102	.05995		1635.60
	LINEAL FEET.	PER 100'		
6' Lagging	56,950	.80	456.86	484.75
10' "				37.50
Total Lagging	56,950	.80	456.86	522.25
Poles	300	1.666	50.00	
Total 1918	57,250	.885	506.86	
Total 1917	87,550	.5965		522.25
Product			298,265	290,795
Feet Timber per ton of Ore			.04794	.11039
Feet Lagging " "			.19093	.30107
Feet Lagging per ft. of Timber			4.0034	2.7272
Cost per ton for Timber			.0028	.0050
" " Lagging			.0015	.0018
" " Poles			.0002	
" " Timber, Lagging & Poles			.0045	.0074
Equivalent of stall timber to Bd. measure			27,571	64,074
Ft. Bd. Measure per ton of ore			.09243	.22034
Total cost for Timber, Lagging & Poles 1918				1348.36
" " 1917				2157.85
" " 1916				1492.65
" " 1913				4068.66
" " 1912				1318.84
" " 1911				3550.21
" " 1910				5090.20
" " 1909				5034.18

Less underground work and coarse quality - less timber used during 1918; price of timber slightly higher.