

started on repairing the railroad loading pocket at shaft. When the mine first re-opened ore and rock was trammed by hand from the shaft, but the last of January the top tram electric haulage system went into commission. Additional trestle was erected in February. When the work of repairing the shaft-house and the railroad loading pocket was started it was found that the old timbers had rotted away and it was necessary to rebuild the railroad loading pocket. Ground was excavated beneath the supports for the pocket and concrete piers were installed beneath these timbers. Repairs on the railroad loading pocket was completed in April. Concrete piers were put in for the new railroad loading pocket for handling ore from C. & N. W. Lease Sec. 19, and the erection of this pocket was started. This pocket was completed later in the summer and trestles connecting it with the shaft were also built.

In order to permit of handling rock at less cost on surface it was decided to build a trestle beyond the C. & N. W. loading pocket and handle rock over this trestle. With the installation of a second top tram unit in the fall the new method of handling rock was started, which permitted two men to be laid off on each shift on the landing.

No ore was shipped from C. & N. W. Lease Sec. 19 during 1918 due to the fact that it was impossible to get the C. & N. W. Ry. Company to install tracks for handling the ore from this pocket. Complications in regard to this work arose from the Government operation of railroads, as the superintendent for this division was anxious to do the work but was unable to obtain authority. It is hoped that this new track will be installed in 1919, otherwise it will be necessary to stock all ore from this property and load it out by steam shovel.

In April a small engine house was erected near No. 3 shaft. Work on this engine house was completed in May and the hoist was installed later in the summer. The hoist was the one which had been previously used at the Princeton No. 1 shaft. It was hoped to have No. 3 shaft in operation early in the summer but due to delay in getting material it was not possible and it did not go into operation until the last of October. A special light

cage was ordered for this shaft as the hoist was not powerful enough to operate one of the standard cages. A counter balance pipe was installed in No. 3 shaft and a counter balance put on which was equal to the weight of the cage. This hoist operates in balance and during November and December all timber and supplies for the contracts operating on the fifth level and on the subs above the fifth were taken down through No. 3 shaft. Within 40 days it is expected that all supplies going into the mine will be taken down through No. 3 shaft, by which time the timber raise will have been completed from the sixth to the fifth levels.

During the summer an addition was built to the mine office to provide an office and change room for the mining captain. Previous to this time the captain had his office in the same room with the clerks and consequently there was not sufficient room for either. The addition to the office has provided comfortable quarters for the captain and has permitted several partitions to be torn out in the room used by the clerks, giving them sufficient room for their work.

The old hospital room in the Princeton dry was altered during the summer so that it now conforms with the standard Company hospital room for mine dries.

The old heating system at this property was installed many years ago at the time this property was operated by the Todd-Stambaugh Company. The pipes had rusted so badly that there were a number of leaks and it was decided to replace them with new lines. A complete new system of water and steam lines were installed to the various mine buildings in an underground launder, the steam pipes being covered. There were installed also return pipes for carrying the condensed water back from the radiators and special traps have been ordered which will elevate this hot water and deliver it to the boiler again. This work entailed a considerable expense, as it was necessary to use new pipe.

The heating plant boiler which was at the mine was entirely inadequate. It was located in the heating plant building, about 60 feet from the dry, and during the cold weather it was impossible for the dryman

to keep up steam so that it became necessary to put an additional fireman on each shift during the cold weather. There was also constant complaint that the dry was not warm enough and there was also not sufficient steam generated to carry the steam to the top landing. It was finally decided to build a frame heating plant building, about 12 feet back of the dry, in which a 150 H. P. fire box boiler from the Francis Mine was to be installed. This work was started late in the fall and completed as soon as possible. Owing to the mild weather it was not necessary to put on an extra man to fire the small boiler and the new boiler went into commission before any severe cold weather came. There has been a decrease in the amount of coal used, as compared with last winter, and at the same time there is plenty of heat for the dry and other mine buildings, as also the top landing. The regular dryman takes care of the boiler plant in addition to the dry, which permits of saving the wages of two men during the winter months, as compared with last year.

In order to handle the ore from the shaft to the C. & N. W. Ry. loading pocket it is necessary to have a second top tram unit. An order was placed for this unit with the Lake Shore Engine Works but, owing to war conditions, it was found that it would be considerable time before it was built and it was decided to take one from the Stephenson Mine for use at the Princeton and later on install the one at Stephenson which had been ordered for the Princeton. The top tram engine was installed on concrete foundations on the ground near the shaft and a small building erected over it. The sheaves for the rope line were then installed and the second top tram unit went into operation the last of October.

The installation of pumping plant on the 7th level, No. 2 shaft, rendered it necessary to provide a means of conveying the mine water from the shaft to the river and it was decided to carry the water in wooden water pipes from the shaft a distance of about 300 feet, beyond this point the water^{will} be carried in an open ditch about 400 feet, the ditch discharging into a deep ravine which connects with the river. Surface work in connection with the installation of new pumping plant has all been completed.

There were no shipments of Cambridge ore from the stockpile during the shipping season of 1918. The stocking trestle, which had been erected from the shaft for the entire length of the stockpile grounds, was entirely filled by the first of November. It was necessary to build a trestle branching from this trestle near the shaft and running parallel with it for the entire length of the stockpile ground in order to provide for stocking ore hoisted during the winter of 1918-1919. Thirty bents were put up here, the expense of erection of this trestle being higher than usual owing to the fact that part of it was located on the side of the Cambridge ore pile.

A storage house for keeping certain classes of mine material, such as salt, carbide, roller and spools for the top tram, etc. was made by cleaning out and putting up shelving in the old boiler house, which had not been in use since the steam plant was abandoned and electricity substituted as motive power.

The small building, which was formerly used for heating plant for the surface buildings, was made over into a small machine shop for repair of drill machines and into a shop for the electrician and a third room fixed up for an oil house.

The last of the year the north and west sides of the headframe above the landing were enclosed. The skip dumps on the east side of the shaft and here a building was erected which would completely house in the skip dumps. This is a decided improvement, as the Princeton shaft is located on the highest ground in the district and it is extremely difficult to operate on the landing in severe winter weather due to the exposed location of the shaft-house. There has been no delays in handling the product on the landing thus far this winter.

Considerable trouble was experienced in the early months of the year due to accidents to the hoisting engine. The drum does not fit the shaft and brass bushings are used to make a tight fit on the shaft. These bushings wear on account of the movement of the hoist due to the foundations not being stable. The movement of the hoist and the play caused by wearing of the bushings holding drum on the shaft caused several of the

teeth on the driving pinion to break and it was necessary to close down the mine to install new teeth temporarily on this pinion until a new pinion could be obtained. Four new teeth were set in the pinion and operations continued until the new pinion was received. It was again necessary to close down the mine for two days while the new pinion was installed, since which time there has been no further trouble with the hoist.

SUMMARY OF THE YEAR'S OPERATIONS

When the mine was re-opened in December 1917 it was impossible to foresee the extent of repair and development work necessary in order to get this property in condition for operating at a reasonable cost. In the first place, the old equipment was not of The Cleveland-Cliffs Iron Company standard design, nor was the shaft standard size. The landing floor at shaft-house is less than 30 feet above the ground and one two-ton skip is used to hoist the entire product, this skip running in balance with a small cage, which was installed in the second skip road after the Company took over the property. The above facts should be given consideration in their relation to the cost of operating this property. The extensive program of repairs and replacement, installation of new equipment and development work, was not entirely completed at the close of the year 1918. It was, however, practically completed, the only large items remaining being that of the installation of new pumping plant on 7th level and the development of the 7th level for the mining of the Sec. 19 ore body; also the raising of No. 3 shaft from the 6th to the 5th levels. These three items constitute the extraordinary work which must be done to complete the program of work necessary to put this property in first class condition.

During the past year there has been a total of 4324 feet of rock drifting on the 5th, 6th and 7th levels, and 615 feet of raising in rock, or a grand total of 4939 feet of rock drifting and raising. In addition to the above, there has been 825 feet of ore drifting on the 5th and 6th levels and 450 feet of ore raises, or a grand total of 1275 feet of ore drifting and raising on these two levels. The grand total of rock and ore drifting and raising on main levels was 6214 feet.

The hoist at No. 2 shaft can handle only about 400 tons per 8-hour shift or 800 tons per day. By the end of the year sufficient ore had been developed to permit of bringing the hoist up to 750 tons or more per day; since this work has now been completed all rock hoisted will be at the expense of the ore output.

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[Faint, mirrored text bleed-through from the reverse side of the page, including the word "Princeton" and other illegible characters.]

FATAL ACCIDENT - PRINCETON MINE.

I regret to report that an accident occurred at the Princeton Mine on Oct. 4th, which caused the death of Frank Bianchi, a miner, on the morning of the 5th. Bianchi was a married man with seven children.

Bianchi with two partners was driving a rock drift in the foot-wall on the 6th level near No. 3 shaft. It was a custom in this contract for the miners to fill the motor cars and push them out on the main line, from which point they were taken to the shaft by the motor. It happened on this day that they did not complete filling a car while the motor was working beyond their switch, so that when the motor came back the car was not quite filled. The motorman stopped the train and backed in and, when the car was filled, took it out to the shaft. After the car was taken out, Bianchi and his partner started to finish work on a set of timber which they had put up earlier in the day, while the third miner in the contract was drilling in breast. Bianchi's partner was standing on a plank staging putting in sprags near the top of the cap, while Bianchi was standing on the ground handing him material as it was needed. The motorman came back from the shaft with a train of empty cars and, through an oversight, the switch had not been thrown to the main line and the train was pushed into the drift where these men were working. Owing to the noise of the machine running in the breast, some 15 or 20 feet away, Bianchi and his partner did not hear the approaching cars. The motorman noticed that he was running into this drift and immediately stopped the motor but, as the head car of the train had not been coupled, it continued on and struck Bianchi in the back knocking him forward against the plank on which his partner was standing. It was thought at the time that Bianchi was not seriously injured but on the following morning death resulted from internal hemorrhage.

This accident was due to two causes; the switch should have been

thrown by the brakeman when the loaded car was pulled out of the drift, also the cars should have been coupled. Either one of these precautions would have prevented the accident. There was one rather sharp curve in the track in the old 6th level drift and it had been the habit of the motorman to push the empty cars back without coupling them, as he thought this prevented any possibility of the cars jumping the track at this curve. This accident was clearly preventable and was due to a violation of rules.

PRINCETON MINE.

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

GRADE	IRON	PHOS.	SILICA	MANG.
Cambridge,	59.24	.967	5.09	1.036
Princeport,	59.71	.257	7.26	.695
Sec.19 Cambridge,	61.12	.531	4.50	.836

Cargoes all mixed.

ORE STATEMENT - DECEMBER 31ST, 1918.

	PRINCEPORT	CAMBRIDGE SEC. 19.	CAMBRIDGE	TOTAL	TOTAL LAST YEAR
On hand January 1st, 1918,			3,457	3,457	154,938
Output for Year,	27,546	5,062	115,263	147,871	492
Stockpile overrun & Shortage,	394			394	1,598
Total,	27,940	5,062	118,720	151,722	153,832
Shipments,	23,266	0	42,978	66,244	150,375
Balance on Hand,	4,674	5,062	75,742	85,478	3,457
Increase in output,				149,371	
Increase in ore on hand,				82,021	

1918 - 2-8 Hr. Shifts during year

1917 - Mine idle during year.

SHIPMENTS FOR YEAR - 1918.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Princeport,	17,735	5,531	23,266	0
Cambridge Section 19,	0	0	0	0
Cambridge,	42,978	0	42,978	150,375
Total,	60,713	5,531	66,244	150,375
Total last Year,	0	150,375	150,375	
Decrease - 56%			84,131	

PRINCETON MINE.

PRINCETON MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 8.	
PRODUCT	148,265	
General Expense	.253	
Maintenance	.355	
Mining Expense	2.551	
Cost of Production	3.159	
Exploratory	.050	
<u>DEPRECIATION.</u>		
Original Purchase	.343	
Plant	.050	
Total Depreciation	.393	
Taxes	.067	
Central Office	.128	
Supply Inventory	.012	
Miscellaneous	.074	
Sundry Expense	.032	
Cost on Stockpile	3.915	
Loading & Shipping	.029	
Cost on Cars	3.944	
No. Days Operating	298	
No. Shifts and Hours	2-8hr	
Avg. Daily Product	497	
<u>COST OF PRODUCTION.</u>		
Labor	2.331	
Supplies	.828	
Total	3.159	

MINE NOT PRODUCING IN 1917.

PRINCETON MINE.

COMPARATIVE WAGES AND PRODUCT.

	1918.	1917.	INCREASE.	DECREASE.
PRODUCT	148,265	0	148,265	
No.Shifts and Hours	2-8hr	1-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	50	4	46	
Underground	173	4	169	
Total	223	8	215	
AVERAGE WAGES PER DAY				
Surface	4.33	3.31	1.02-30%	
Underground	5.06	4.04	1.02-25%	
Total	4.90	3.70	1.20-32%	
WAGES PER MONTH OF 25 DAYS				
Surface	108.25	82.75	25.50	
Underground	126.50	101.00	25.00	
Total	122.50	92.50	30.00	
PRODUCT PER MAN PER DAY				
Surface	9.66	-		
Underground	2.80	-		
Total	2.17	-		
LABOR COST PER TON				
Surface	.448	-		
Underground	1.808	-		
Total	2.256	-		
AVG. PRODUCT BRK'G & TRM'G	7.56			
" WAGES CONTRACT MINERS	5.52			
" " " TRAMMERS	5.21			
" " " LABOR	5.52			
TOTAL NUMBER OF DAYS				
Surface	15,351 $\frac{1}{4}$	1,146 $\frac{1}{4}$	14,205 $\frac{1}{4}$	
Underground	52,988 $\frac{3}{4}$	1,302 $\frac{3}{4}$	51,686	
Total	68,340 $\frac{1}{4}$	2,449	65,891 $\frac{1}{4}$	
AMOUNT FOR LABOR				
Surface	66,406.86	3,799.99	62,606.87	
Underground	268,105.95	5,261.13	262,844.82	
Total	334,512.81	9,061.12	325,451.69	

Proportion Surface to Underground Men:
 1918 - 1 to 3.48
 1917 - 1 to 1. not producing
 1916 - 1 to 1.29 " "
 1915 - 1 to 1.25 " "
 1914 - 1 to 1.31 " "
 1913 - 1 to 3.13
 1912 - 1 to 4.69
 1911 - 1 to 4.18

PRINCETON MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1918.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1 9 1 8.	AMOUNT 1 9 1 7.
6" to 8" Timber	146,890	.0265	3892.58	
8" to 10" "	62,460	.0568	3550.20	
10" to 12" "	50,634	.0747	3784.30	
12" to 14" "	8,918	.1094	975.58	
Total 1918	268,902	.0454	12202.66	
	LINEAL FEET.	PER 100'.		
5' Lagging	429,887	.6116	2629.20	
4" to 6" Cribbing	19,774	1.54	304.48	
8' Lagging	363,370	.65	2361.91	
Total Lagging	813,031	.65	5295.59	
Poles	41,269	1.00	412.69	
Total 1918	854,300	.6608	5708.28	
Product			147,849	
Feet Timber per ton of Ore			1.82	
Feet Lagging per ton of Ore			5.77	
Feet Lagging per foot of Timber			3.18	
Cost per ton for Timber			.0825	
" Lagging			.0358	
" Poles			.0028	
" Timber, Lagging & Poles			.1211	
Equivalent of stull timber to Bd. Measure			491,442	
Ft, Bd. Measure per ton of ore			3.324	

M ine not producing last year.

PRINCETON MINE.

PRINCETON MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 8.	AMOUNT 1 9 1 7.
40% Powder	17,800	.18205	3240.57	
50% "	13,500	.2099	2833.74	
60% "	8,000	.2799	2239.07	
80% " Gelatine	200	.3915	78.30	
Total Powder	39,500	.2124	8391.68	
Fuse	130,900	7.36	936.51	
Caps	32,500	13.27	431.36	
Cap Crimpers	37	.559	20.69	
Connecting Wire	1	.44	.44	
Tamping Bags	9,000	.252	22.68	
Total Fuse, Etc.			1438.68	
Total Explosives			9830.36	
Product			147,849	
Pounds Powder per ton of Ore			.267	
Cost per ton for Powder			.057	
" Fuse, Etc.			.0098	
" All Explosives			.0668	
Avg. Price per Lb. for Powder			.2124	

Mine not producing last year.

GWINN MINE.

The Gwinn Mine was operated on two 8-hour shifts from Jan. 1st to March 4th, and on one 8-hour shift from March 4th to Dec. 31st. The product for the year was as follows;

Gwinn Bessemer	25,873 tons
Gwinport No. 2	<u>129,661 "</u>
Total Ore	155,534 "
Rock	<u>25,100 "</u>
Total Ore and Rock	180,634 "

The decrease in product of 6,429 tons in 1918 was mainly due to operating on single shift for 10 months in 1918, as compared with six months in 1917. There has been considerable development work under way throughout the entire year, the principal work being the opening of the 10th level and raising to connect the shaft. The cost of the product has been higher than in the other soft ore mines operated by the Company. The reasons for this higher cost may be briefly stated as follows; first, the thin deposit; second, double as much development work for each ton of ore produced due to developing all of the levels and mining only on alternate levels; and third, the semi-hard character of the ore, placing it in a class between the soft and the hard ores.

The Bessemer output for the year was very small. It now seems to be an established fact that the Bessemer ores are found only near the hanging in the steeper pitching parts of the ore body. The major part of the ore produced in 1918 came from the flat lying deposit on the 8th level, where there was no ore of Bessemer grade. The development work in ore between the 9th and 10th levels was confined to the footwall, and no Bessemer ore was obtained here. The greater part of the Bessemer ore hoisted during 1918 came from the small pillars mined between the old square set rooms between the 7th and 6th levels. The Bessemer ore hoisted during 1918 graded about one half Bessemer and one half Gwinn ore. The conditions existing during 1918 are not likely to be duplicated unless it should again develop that the greater part of the ore produced in any given year should

be obtained from another flat lying part of the ore body. The Bessemer product for 1918 averaged considerably higher in iron than during any previous year, in fact all the ore at greater depth is running more uniformly high grade.

The shipments for 1918 and balance of ore in stock are as follows;

	Shipments for 1918	Balance Ore In Stock
Gwinn Bessemer	20,113 tons	1,074 tons
Gwinn	21,781 "	
Gwinnpport	<u>140,647 "</u>	<u>44,097 "</u>
Total	182,541 "	45,171 "

The ore in sight at the Gwinn Mine on Dec. 31st, 1918, was 802,200 tons. This is an increase of approximately 3,000 tons over the amount of ore shown in sight a year ago. The actual increase is, however, over 158,000 tons, for to the 3,000 tons increase, shown above, must be added the product obtained in 1918.

The estimate of ore in sight is as follows:

	<u>BESSEMER</u>	<u>GWINN</u>	<u>GWINNPORT</u>	<u>TOTAL</u>
Ore above 5th Level	7,380	7,380	14,760	29,520
" " 6th "	42,750	42,750	85,500	171,000
" " 7th "	4,000	4,000	26,740	34,740
" " 8th "	15,000	15,000	129,540	159,540
" " 9th "	10,000	10,000	143,650	163,650
" " 10th "	<u>15,000</u>	<u>15,000</u>	<u>165,350</u>	<u>195,350</u>
Total Developed Ore	94,130	94,130	565,540	753,800
Prospective Ore Below 10th Level	<u>5,000</u>	<u>5,000</u>	<u>40,400</u>	<u>50,400</u>
GRAND TOTAL	99,130	99,130	605,940	804,200

Additional ore has been developed during the past year, particularly in the territory between the 8th and 10th levels; also in the isolated ore body between the 8th and 7th levels. During the year the territory to the west of the developed ore body on the 9th level has been thoroughly explored with the result that it has been entirely eliminated as a high grade ore possibility. The work here showed that the formation was very flat and it is evident that the drill holes, which showed ore in this territory, merely followed a narrow seam of ore in the flat formation. Early in the year it was thought that the ore body below the 10th level was not large enough to warrant sinking the main shaft below the 10th level; however, later in the year sufficient ore was proven up on the 10th level to render it advisable

to sink the main shaft to the bottom of the deposit, which work will be done in 1919.

The work in detail for the year is as follows:

FOURTH LEVEL.

There was no mining on this level in 1918. It is being kept open in order that monthly examinations may be made of the stopes in order to determine the manner in which they are filling and to give accurate information of the height to which the cave has extended. It is a matter of great satisfaction to be able to report that there has been no movement of ground in this territory during 1918. No ground has fallen in the stopes, which are nearly filled to the back. This apparently proves that the system of mining alternate levels is an entirely safe proposition and that there is no danger of the ground caving through to surface. Any break of the capping through to surface above the Gwinn Mine would mean the immediate flooding and permanent abandonment of this property.

The fourth level drifts will be kept in repair in order that these monthly examination may be continued.

SUB-LEVELS BELOW SIXTH LEVEL.

Mining of the pillars between the old square set rooms Nos. 1 to 5 were completed on the first and second sub-levels in 1917.

3rd Sub Below 6th.

Two contracts were mining ore on this sub-level in January 1918. Work was completed on the pillar between the square set rooms Nos. 1 and 2 during this month, and mining was completed in April on the only remaining pillar which was between rooms 2 and 3. This finished the mining of all the pillars between the square set rooms at the elevation of the 3rd sub-level.

4th Sub Below 6th.

Mining of the pillar between rooms Nos. 1 and 2 was started the last of January and completed in June and work on the pillar between rooms Nos. 2 and 3 was started in May and finished in September. The two pillars between rooms Nos. 3 and 5 were mined in 1917. This completed the mining

GWINN MINE.

of all the ore on the 4th sub-level.

5th Sub Below the 6th.

In 1917 the ore was being mined on the 5th sub-level between square set rooms Nos. 3 and 4. Mining of this pillar was completed the last of April 1918. Mining of the pillar between square set rooms Nos. 1 and 2 was started in June and completed in December. Mining of the pillar between rooms Nos. 2 and 3 was started in October and had not yet been completed at the close of the year.

6th Sub Below the 6th.

Mining was started on the 6th sub-level in the pillar between square set rooms Nos. 3 and 4 in May and the mining of this pillar was completed in September. The pillar between square set rooms Nos. 4 and 5 was mined in 1917.

7th Sub Below the 6th.

Mining of the pillar between square set rooms Nos. 3 and 4 was started in October and had not yet been completed at the end of the year.

It will be noted from the above that there were a large number of sub-levels operated during the year between the 6th and 7th levels. These subs are located only 10 feet apart, as it is necessary to work under the floor covering of the sub-levels above and keep the places well timbered in order to prevent accidents on account of the open square set rooms on each side of the pillars. The territory available for mining ore is small as the pillars are only 21 feet in width between the square set rooms. Three gangs worked during the year in this territory and only at one point has a pillar been mined down to the floor of the 7th level. There will be work here for two gangs for at least another year.

SEVENTH LEVEL.

There are 34,740 tons of ore in sight between the 7th and 6th levels, part of which is represented by the shaft pillar, which cannot now be mined, the balance is in the pillars remaining to be mined between the old square set rooms.

During the year a drift was driven from the old 7th level haulage

drift over to a point above where mining had been completed on the 8th level. This drift holed to the cave above the 8th level workings in order that a watch might be kept of the manner in which the capping was breaking and the stopes being filled above the 8th level.

SUB-LEVELS ABOVE THE EIGHTH.

Considerable work has been done during the past year on and above the third sub, which had been opened in this territory several years ago when the ore body on the 8th level was originally developed. At that time a small deposit was found between the 8th and 7th levels which did not connect with these levels. Work was started in this isolated ore body in 1917 and has been continued on double shift throughout the year 1918.

5th Sub Above the 8th.

Work was started on this sub-level in March, by which time it had been found that the ore body extended far enough above the third sub to warrant opening other subs higher up in the ore. Accordingly the 5th Sub was opened by putting up raises from the third sub, the back of this 5th Sub being only a short distance below the old 7th level. The crosscuts on the 7th level were in jasper and, at the time they had been driven, it was not expected any ore would be found in the territory under them. This sub-level was opened up from two raises in March and mining was not completed until the last of October.. A much larger tonnage was developed at this elevation than had been expected at the time the sub-level was opened. The ore, however, did not average over 54.50 in iron and in several places was found too lean to be mined. All the merchantable ore was mined up to the hanging, the floors lagged and the contracts dropped down to open a new sub beneath the floor covering. The ore obtained from this 5th Sub was dumped by the miners into short raises, which had been put up from the third sub-level. From this point it was trammed and dumped into a raise which had been put up from the 9th level. This place was worked on double shift, the product from the night shift being held in the long raise from the 9th level and drawn out during the day when hoisting was in progress.

4th Sub Above the 8th.

This sub was opened in September and at the close of the year there were three gangs working here. It was opened just beneath the floor covering of the sub above. The grade of the product obtained from this sub has been considerably better than from the sub above, the ore averaging about 56% in iron. The deposit has been found to be larger than on the sub above and it is evident that a considerable tonnage will be obtained on this sub-level. Raises are now being put up from a new rock drift on the 9th level, which will permit of the product from this sub-level being dumped by the miners directly into raises extending through to the 9th level. This will render it possible to do away with the trammers now employed in transferring the ore from this sub-level to a raise from the 9th level, and will materially decrease the cost of the product here.

3rd Sub Above the 8th.

Work was started on this sub-level the latter part of 1917, and considerable work has been done here during 1918. From mining operations here early in the year it was found that the ore extended up some distance above this sub-level and that in order to mine it it would be necessary to open two subs above. In addition to a number of raises, which were put up from the third sub to the subs above, a drift was driven along the hanging, outlining the ore body. This showed that this isolated deposit was large enough to warrant drifting in rock on the 9th level and putting up raises which would hole to this ore body. On account of mining operations on the subs above it has not been possible to mine out the ore on this sub-level but it has been thoroughly developed in preparation for mining. Work done here has shown that there is a roll in the footwall between the foot and hanging wall drifts so that all of the pillar at the elevation of this sub-level is not ore. The formation beyond the roll is very flat, dipping about 15 degrees to the south, and the ore developed near the hanging indicates that the deposit will probably be thin below the elevation of this sub. The work done here in 1918 has resulted in the development of about five

times as much ore as it was anticipated would be obtained from this territory. One of the new raises from the 9th level has already holed here and three other raises are now being put up. When these hole, the rock development work, connected with the mining of this ore body, will have been completed. It is estimated that there are now 20,000 tons of ore developed on these sub-levels, all of which can be mined.

1st Sub Above 8th.

The first sub above the 8th was opened early in 1917 and mining continued throughout the year. It was opened in the flat lying ore body above the main 8th level. This sub-level was worked at two points, as the hanging rolled downward in the center of this ore body, separating the ore at this elevation into two parts. In January there were three gangs working on this sub-level and work was continued throughout the summer, all the ore being mined at this elevation in September. Part of the ore mined here was obtained under very unfavorable mining conditions. As the contracts approached the roll in the hanging the ore decreased in height and it was necessary to mine part of it using short legs from 4 to 6 feet in length. The ore body is nearly horizontal and it required a large number of holes to break the ore. This increased the amount of powder required and resulted in increasing the cost of the product from this sub-level. All the ore has now been mined on the first sub above the main deposit on the 8th level, except in the shaft pillar. It may develop later on that there will be a sub-level opened at this same elevation in the downward extension of the isolated ore body being mined on the third and fourth subs, described in previous paragraphs, but there is as yet no apparent connection between this ore body and the main 8th level ore body.

EIGHTH LEVEL.

During the early months of 1918 a large number of gangs were engaged in mining pillars on the main floor of the 8th level. Ore was mined here on double shift in January and February, at which time it became evident that on double shift these pillars would be mined out very much in advance of the opening of the 10th level, with the result that there would be a sudden de-

crease in the product from the mine with the completion of the mining on the 8th level. Results of the work here demonstrated that it would be advisable to put the mine back on single shift in order that the mining here might not advance more rapidly than the development work on lower levels. During the past year the greater part of the remaining pillars have been mined and at the close of the year there were only four gangs working here. At the end of the year there were 159,540 tons of ore remaining between the 8th and 7th levels, of which amount 120,000 tons are in the main pillar and will therefore not be available for mining until all the ore has been mined out below the 8th level.

SUB-LEVELS BELOW THE EIGHTH.

Some development work was done during 1917 in opening various sub-levels between the 8th and 9th levels. According to the system of mining being followed here, the ore between the 8th and 9th levels should be left intact until mining has been completed on the lower levels, after which part of the ore remaining on alternate levels will be mined. A portion of the flat ore body on the 8th level extends down far enough for one sub-level to be opened below the 8th, this being in territory entirely independent of the ore pillar between the 9th and 8th levels. In addition to mining operations on this ore it became necessary, in order to keep the product up to 400 tons per day, to do some mining at the elevation of the first sub below the 8th in the main pillar between the 8th and 9th levels. Fortunately the ore between these levels lies on a rather flat pitch so that it was considered safe to mine all the ore out at the elevation of the first sub below the 8th, as there would still be a large pillar left here.

1st Sub Below the 8th.

In January 1918 there were three gangs working on this sub-level. The number of gangs working here was gradually increased to six in the summer and during the last three months of the year there were eight gangs working here. About 75% of the ore on this sub-level has now been mined. As the contracts complete work here they will start mining the pillar between the 9th and 10th levels.

5th Sub Below 8th or 1st Sub Above 9th.

The work of outlining the ore under the hanging on this sub-level was started in April and continued through August. This work was done in anticipation of the mining of the pillar between the 9th and 10th levels, which rendered it necessary to take out the ore up to the hanging above the main 9th level.

NINTH LEVEL.

The major portion of the development work on the 9th level was completed in 1917, but some additional rock work has been done during the past year. In 1917 a drift had been started to the west of the developed 9th level ore body for the purpose of proving up some ore which had been shown up in drill holes to the south of the 8th level. This drift had been driven a distance of 300 feet in 1917. In January 1918 it was extended 133 feet further, at which point it was decided to stop drifting and do the balance of the exploratory work through raises and by drifting from one of these raises. This drift was driven in 1918 in the footwall beneath the ore formation. Three raises were then put up from the drift, in all of which some lean ore was found, but at no point was there ore of merchantable grade. The formation was found to lie almost horizontal and it seemed very doubtful whether an ore body of any size would be found in this territory. The work done on the sub-level opened from one of these raises will be described in another paragraph.

The size of the isolated ore body developed between the 8th and 7th levels rendered it advisable to drive a rock drift to the west on the 9th level and to put up raises from this drift to hole directly to this ore body. This drift, which was 365 feet in length, was completed in the fall. One raise has been extended through to this ore body a distance of 85 feet and three other raises are now being put up. As this ore body does not exceed 20 feet in thickness, the greater part of these raises will be in rock.

In order to provide working places for some of the gangs which had completed work on the 8th level, it was decided to start mining along the

hanging on the 9th level, as it was necessary to do this work before mining could be started on the ore pillar between the 9th and 10th levels. One gang started working here early in the summer, later on another gang started, and mining has been continued here during the balance of the year. An area 140' x 50' in size had been mined out here by the end of the year.

Some work was also done on the main level in preparing for the installation of the small electric hoist, which was purchased this summer to handle the ore from the 10th level until such a time as the main shaft had been extended down from the 9th to the 10th levels.

50 Ft. Sub Below the 9th.

A small amount of work was done on this sub-level during the summer, a drift about 100 feet in length under the hanging being driven to connect a raise to #2 winze. No further work will be done at this elevation until mining of the pillar between the 9th and 10th levels has been started.

Exploratory Drift on Sub 45 Ft. Above 9th Level.

A sub-level was opened at this elevation to develop the ore shown up in two horizontal drill holes drilled to the south from the main 8th level. These holes are located about 700 feet west of the main ore body on 9th level and the survey of the holes show that they had dipped downward so that the ore encountered here was about midway between the 9th and 8th levels. The exploratory drift driven on the 9th level in this territory had not shown favorable indications of ore but it was nevertheless considered advisable to drift to these drill holes. This drift was driven in a southwesterly direction from the raise following a four foot seam of good ore, there being jasper on both sides of the ore. The product from the drift averaged between 48 and 52% in iron. Work was started in March and continued until in September, by which time it had been fully demonstrated that there was no merchantable ore deposit here. A total of 225 feet of drifting was done to reach the location of the drill holes and in addition a crosscut was then driven nearly 100 feet to the south. There was no change in the formation, and accordingly further work here was abandoned. The formation was found to lie nearly horizontal and consisted of alternate bands of high grade ore

and jasper. There are apparently two main seams of ore here, each of which are about four feet in thickness, with other seams from a few inches up to a foot thick. It is evident that the drill holes on the 8th level followed one of these thicker horizontal seams of ore, this giving a false idea of the thickness of the ore here. As a result of the work done here in 1918, this territory has been definitely eliminated from further consideration.

TENTH LEVEL.

The 10th level was opened from No. 2 winze in 1917 at an elevation of 100 feet below the 9th level. Up to the close of the year 1917 there had been 350 feet of ore drifting on the level. The development of the 10th level was continued during the year 1918, the limits of the ore body being fully determined. It was found to extend a distance of 230 feet to the south beyond the limits determined in 1917. The ore here, however, is narrow and did not result in increasing the tonnage to any great extent. During 1918 there has been a total of 553 feet of drifting in ore and 690 feet in rock on the 10th level.

A rock drift, 600 feet in length, was driven in 1918 to the line of the shaft and the shaft sunk 65 feet below the 10th level, skip pit drift driven, and raising to connect with the present bottom of the shaft was started the last of December. It will require another month before the cage and skips can be operated to the 10th level.

A rock drift was also driven in the footwall on the 10th level, beneath the 9th level ore body, from which four raises have been extended up to the 9th level in preparation for mining the ore pillar between these levels.

Early in the year an incline two compartment raise was started from the 10th level following the footwall, which, when completed, was equipped and used for handling the material from the 10th level. Two one-ton skips were operated here in balance. The rock work on the 10th level has been done on double shift throughout the year. Even then the work has not progressed fast enough to permit of starting to mine the ore pillar between the 9th and 10th levels so that working places in ore could be provi-

ded for a sufficient number of gangs to maintain the product at 500 tons per day.

There was a total of 3411 feet of rock drifting and raising in 1918, as compared with a total of 3031 feet in 1917, an increase of 380 feet for 1918.

Development work has now been practically completed on the 10th level, and the work of sinking and opening the 11th level must be started within 90 days. There will continue to be a heavy charge for shaft sinking and rock drifting until the bottom of the ore body is reached, as two levels must be fully developed in order that one may be mined. There will only be one more level necessary for mining the ore body on the Gwinn Mine property, deeper levels may become necessary if the ore body extends over on the Wadsworth lands and it is decided to mine this ore from the Gwinn Mine shaft.

S U R F A C E.

The work of installing 40# rail in each skip compartment from the collar of the shaft down to the first level was completed in November. These rails were installed on the end pieces of the shaft to prevent the skips from catching in the timbers should they accidentally dump while being hoisted. Every winter for the past several years the skip ropes have broken due to the skip dumping over and catching in the end pieces of the shaft. This has always occurred in the winter time and was probably caused by ice. Some of these accident have been very serious, wrecking the shaft, making it necessary to close the mine down for several days while repairs were being made. Steam pipes have been installed in the skip-roads near these rails to prevent ice forming on them and it is confidently expected that there will be no future wrecks of the skips due to catching in the shaft.

In the fall an addition was made to the barn at the mine in order to provide room so that the team from the Francis Mine could be kept here. This addition cost less than it would have cost to have built a barn at the Francis Mine, and by concentrating the horses it decreased the expense of taking care of them on Sundays and holidays. At this time some needed repairs were also made to the barn, so that all the expense for this work is

GWINN MINE.

not chargeable to the addition.

During the year several of the top tram cars, both ore and rock, were rebuilt in the Gwinn Mine shops. Under ordinary operating conditions, the top tram cars will last through one year without much repairing, however, it is then necessary to take them into the shops and give them a thorough overhauling.

The surface expense at the mine was increased during 1918 due to the fact that all mine tracks, as well as the steam shovel tracks, have to be maintained by the mining company under General Order No. 15. In order to handle this work in the district a small section crew with a foreman was employed the latter part of the shipping season.

The only other maintenance charge of any importance at the Gwinn Mine for 1918 was incurred in inclosing the shaft-house. This work was not started until late in the year and was not completed at the close of the year. Both the skip and cage roads have been inclosed from the ground level up to the landing. This has had a very good effect in that it has given a control of the draft in the shaft. Heretofore in the winter time the skip roads have been downcast and the cage road upcast, which has resulted in the formation of ice in the skip compartment, often with serious results. Since inclosing the shaft-house from the ground to the landing, however, it has been possible to change the draft, making either the cage or skip roads downcast or upcast as desired. The draft is now controlled by opening and closing the doors to these compartments at the ground level, and thus far it has been possible to keep all ice out of both the cage and skip roads. Conditions may not be so favorable in very cold weather for thus far there has not been any extremely cold weather. It is planned to inclose the skip dumps up to the sheaves at the top of the shaft-house. When this work is completed it will be an easy matter to handle ore and rock on surface, even in the most severe weather.

JOPLING MINE.

Exploratory work was continued throughout the year 1918 on the Jopling property. This work was originally started in the summer of 1916 and has been continued from that time. In 1917, at the close of the year, drifting was in progress on a sub-level 83 feet above the 7th level drift from the Gwinn Mine. A drift had been driven 300 feet to the south-east of the shaft without finding any ore and it was decided to abandon drifting in this direction and conduct further explorations here by diamond drilling. In January 1918 a drift was started to the north-west of the raise in line of the shaft, following the same seam of lean ore as had been followed to the south-east in 1917. This drift was driven for two purposes, first, to more thoroughly develop this seam of lean ore with the idea that it might possibly lead into high grade ore and, second, with the idea of opening the ground so as to drain the water away from the raise in line of shaft so that it would be possible to continue this raise. The drift was driven 94 feet in a northwesterly direction along the strike of the lean ore, the ore gradually became more narrow and finally pinched out, after which drifting was abandoned. A raise was put up a distance of 43 feet, following the seam of lean ore, at which point it turned more to the north from the vertical, and raising was abandoned. The work of continuing the main raise in line of shaft was started again in March and continued through August. It was continued until it had reached an elevation of approximately 380 feet above the 7th level of the Gwinn Mine. At a point 363 feet above the 7th level, or 543 feet below surface, a drift was started to the north-east of the shaft. After advancing a short distance to the north-east it was turned due east and continued for the balance of the year, by which time it had reached a point approximately 195 feet from the raise. It has followed the same seam of lean ore that was followed in the raise, advancing in the general direction of diamond drill hole No. 37, from which it is now about 200 feet distant. Practically no work was done here in

December owing to an accident in the raise. The cribbing, which divides the dirt road from the ladder road, broke and permitted the dirt in the raise to run out through the ladder road down on the 7th level. It was necessary to clean this dirt up and repair the raise before drifting could be resumed on the sub-level. The sub-level has been opened at the elevation of the bottom of the ore as shown up by diamond drill hole No. 37, so that the results of the drift should be a positive check on the drilling. Barring unforeseen accidents, definite information should be available within six months and a decision can then be made as to whether it is advisable to continue work on this property.

During the year several holes were drilled on the sub-level which had been opened 83 feet above the 7th level from the Gwinn Mine and also one hole was drilled from the 7th level drift. Three holes were drilled on the level 83 feet above the 7th level, none of which encountered ore. There was a total of 223 feet of drilling here. The formation encountered in these holes did not indicate that ore would be found in this territory. A horizontal hole, 400 feet in depth, was drilled south of the Jopling shaft in the drift from the Gwinn Mine on the 7th level. This hole passed through a great thickness of lean ore formation and was stopped in hanging material. It was considered that these four drill holes, together with the drifting on the sub-level 83 feet above the 7th level, definitely proved that the ore shown up by the surface drill holes did not extend down to this elevation.

GWINN MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

GRADE	IRON	PHOS.	SILICA	MANG.
Gwinn Bessemer,	59.63	.060	7.84	.321
Gwinn,	58.41	.079	9.68	.344
Gwinport,	57.42	.265	9.10	.327

Above grades went into mixed cargoes.

ORE STATEMENT - DECEMBER 31ST, 1918.

	GWINN BESSEMER	GWINN	GWINNPORT	TOTAL	TOTAL LAST YEAR
On hand Jan. 1st, 1918,	17,095	0	55,083	72,178	98,285
Output for Year,	22,261		129,661	151,922	161,963
Transferred,	21,781	21,781			
Stockpile Overrun,	3,612			3,612	
Total,	21,187	21,781	184,744	227,712	260,248
Shipments,	20,113	21,781	140,647	182,541	188,070
Balance on hand,	1,074	0	44,097	45,171	72,178
Decrease in ourput - 4%				6,429	
Decrease in ore on hand,				27,007	

1918 - 2-8 Hr. Shifts Jan. 1st to March 4th
1-8 Hr. Shift March 4th to Dec. 31st

1917 - 2-8 Hr. Shifts Jan. 1st to July 16th
1-8 Hr. Shift July 16th to December 10th
2-8 Hr. Shifts Dec. 10th to Dec. 31st

GWINN MINE

SHIPMENTS FOR YEAR -- 1918.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Gwinn Bessemer,	5,453	14,660	20,113	52,615
Gwinn,	4,022	17,759	21,781	31,565
Gwinport,	65,804	74,843	140,647	103,890
Total,	75,279	107,262	182,541	188,070
Total last Year,	76,004	112,066	188,070	
Decrease - 3%			5,529	

GWINN MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	155,534	161,963		6,429
General Expense	.199	.161	.038	
Maintenance	.119	.133		.014
Mining Expense	2.041	1.547	.494	
Cost of Production	2.359	1.841	.518	
<u>DEPRECIATION.</u>				
Plant Account	.570	.300	.270	
Equipment		.001		.001
Original Purchase	.003	.003		
Uncompleted Construction	0	0		
Total Depreciation	.573	.304	.269	
Taxes	.056	.044	.012	
Central Office	.093	.069	.024	
Supply Inventory	.028	0	.028	
Miscellaneous	.003	0	.003	
Sundry Expense	.022	.018	.004	
Cost on Stockpile	3.134	2.276	.858	
Loading & Shipping	.177	.145	.032	
Total Cost on Cars	3.311	2.421	.890	
No. Days Operating	298	300		2
No. Shifts & Hours	1-8hr 247	123	124	126
	2-8hr 51	177		
Avg. Daily Product	522	540		18
<u>Cost of Production.</u>				
Labor	1.588	1.160	.428	
Supplies	.771	.681	.090	
Total	2.359	1.841	.518	

GWINN MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 8.	1 9 1 7.	INCREASE.	DECREASE.
PRODUCT	155,534	161,963		6,429
No.Shifts and Hours	1-8hr-247 2-8hr 51	1-8hr-123 2-8hr-177		
AVERAGE NUMBER MEN WORKING				
Surface	35	33	2	
Underground	125	120	5	
Total	160	153	7	
AVERAGE WAGES PER DAY				
Surface	4.33	3.38	.95-28%	
Underground	5.16	4.03	1.13-28%	
Total	4.98	3.89	1.09-28%	
WAGES PER MONTH OF 25 DAYS				
Surface	108.25	84.50	13.75	
Underground	129.00	100.75	28.25	
Total	124.50	97.25	27.25	
PRODUCT PER MAN PER DAY				
Surface	14.61	16.33		1.71
Underground	4.16	4.44		.28
Total	3.24	3.49		.25
LABOR COST PER TON				
Surface	.296	.207	.089	
Underground	1.242	.909	.333	
Total	1.538	1.116	.422	
AVG. PRODUCT BRK'G & TRM'G	7.03	8.49		1.46
" WAGES CONTRACT MINERS	5.40	4.23	1.17	
" " " TRAMMERS	0	0		
" " " LABOR	5.40	4.23	1.17-27%	
TOTAL NUMBER OF DAYS				
Surface	10,642 $\frac{1}{2}$	9,917 $\frac{3}{4}$	734 $\frac{3}{4}$	
Underground	37,419	36,510 $\frac{1}{2}$	908 $\frac{1}{2}$	
Total	48,061 $\frac{1}{2}$	46,428 $\frac{1}{4}$	1,643 $\frac{1}{4}$	
AMOUNT FOR LABOR				
Surface	46,087.60	33,489.67	12,597.93	
Underground	193,153.05	147,238.99	45,914.06	
Total	239,240.65	180,728.66	58,511.99	

Proportion Surface to Underground Men:

1918 - 1 to 3.57
 1917 - 1 to 3.63
 1916 - 1 to 3.50
 1915 - 1 to 3.22
 1914 - 1 to 2.16

GWINN MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1918.

KIND.	LINEAL FEET.	AVG. PRICE	AMOUNT	AMOUNT
		PER FOOT.	1 9 1 8.	1 9 1 7.
6" Timber Cribbing	16,071	.02468	396.71	2046.90
6" to 8" Stull	96,538	.03216	3104.98	130.68
8" to 10"	58,050	.05415	3143.83	2459.32
10" to 12"	24,231	.07227	1751.28	1177.12
12" to 14"	5,072	.10250	519.92	901.00
Total Timber 1918	199,962	.04459	8916.72	
" 1917	198,085	.0338		6715.02
	LINEAL FEET.	PER 100'.		
5' Lagging	50,532	2.903	1467.25	1921.75
8' "	572,292	.63	3616.47	2509.71
Total Lagging (1)	622,824	.8162	5083.72	4431.46
Poles	31,396	.9786	307.27	629.15
Total 1918	654,120	.8241	5390.99	
Total 1917	929,064	.545		5060.61
Product			155,534	161,963
Feet timber per ton of ore			1.285	1.223
Feet lagging " (1)			4.005	5.328
Feet lagging per foot of Timber			3.13	4.34
Cost per ton for Timber			.057	.042
" Lagging			.033	.027
" Poles			.002	.004
" Timber, Lagging & Poles			.092	.073
Equivalent of stull timber to Bd. measure			421,408	324,272
Ft. Bd. Measure per ton of ore			2.71	2.00
Total cost for Timber, Lagging & Poles 1918				14307.71
" 1917				11775.63
" 1916				6297.88
" 1915				6946.16
" 1914				4629.28

GWINN MINE.

GWINN MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1918.	AMOUNT 1917.
40% Powder, Red Cross				35.30
" Gelatine	20,415	.2488	5080.02	
50% " Red Cross	16,900	.2015	3405.35	6473.97
" " "				616.24
60% " Gelatine	32,025	.2816	9019.11	16345.28
80% " "				15.08
Total Powder	69,340	.25244	17504.48	23485.87
Tamping Bags	5,600	2.5678	14.38	
Fuse	205,500	7.855	1614.34	1723.64
Caps	42,675	13.238	564.96	676.41
Cap Crimpers	14	.5407	7.57	9.22
Total Fuse, Etc.			2201.25	2409.27
Total Explosives			19705.73	25895.14
Product			155,534	161,963
Pounds Powder per ton Ore			.446	.647
Cost per ton for Powder			.112	.145
" " Fuse, Etc.			.013	.015
" " All Explosives			.125	.160
Avg. Price per lb. for Powder			.252	.224

FRANCIS MINE.

The Francis Mine was operated on two 8-hour shifts from Jan. 1st to Sept. 30th and on one 8-hour shift from Sept. 30th to Dec. 31st, the mine being put on single shift on account of the labor shortage. The product for the year was as follows;

Franport	41,007 tons
Franwood	528 "
Total	41,535 "
Rock	24,204 "
Total Ore & Rock	65,739 "

A small product was obtained from the development work at this mine in 1918. It had been planned to start mining at the bottom of the deposit and work upwards toward the surface. It developed, however, that it would be entirely practicable to start mining 40 feet above the 4th level and continue mining down to the 5th level without interference with the later mining of the downward extension of the ore body or of the ore above the 4th level. This conclusion was due to the fact that the ore body forms a trough at the elevation of the 5th level with a gentle pitch to the west, so that by stopping mining operations at the point where the ore passed below the 5th level, there could be no interference with the mining of the deeper ore. Above the 4th level the ore body extends upwards on its regular dip of about 50 degrees and there would be no difficulty in mining here later on. The main ore body, as determined by the development work of 1918, comes down from the north side of the basin or trough. The ore thus far developed on the south side of the trough, which ore is dipping to the north, has been largely second class, running from 50 to 55% in iron and from .500 to 1.00 in phosphorus.

The most disappointing feature that has developed from the past year's work is that of the imperfect enrichment of the ore body. The ore body is an enrichment of the ferruginous slate. Unfortunately, this enrichment has not always been complete, with the result that the thickness of the ore body is very irregular, which made it extremely difficult to

control the grade of the output.

Regular mining operations were started 40 feet above the 4th level in July. Only a small product was obtained during the remaining months of the year. This was due to two causes; first, the shortage of labor, and second, the variation in grade and size of the ore body.

Shipments for 1918 and the balance of ore in stock were as follows;

	<u>Shipments for 1918</u>	<u>Balance Ore in Stock</u>
Franport	30,247 tons	12,538 tons
Franwood	528 "	
Total	<u>30,775 "</u>	<u>12,538 "</u>

The ore in sight on Dec. 31st 1918, was 229,400 tons. A year ago there were 102,000 tons of ore developed. The estimate of 1918 is disappointing in that as a result of the year's work there was only 127,400 tons of ore developed. The estimate of ore in sight is as follows;

	<u>Franport</u>
Ore Above 4th Level	21,880 tons
" " 5th "	<u>187,960 "</u>
Total Developed Ore	209,840 "
Prospective Ore Below	
5th Level	<u>19,560 "</u>
GRAND TOTAL	<u>229,400 "</u>

It is estimated that the ore to be mined will all be Franport grade. It has been found that practically all the ore on the north footwall runs low in phosphorus, while the ore on the south footwall runs high in phosphorus, and would grade as Franwood. However, the amount of low phosphorus ore is so much greater than the high phosphorus, that it is figured that these ores can be mixed to give a product which will be Franport grade running about .300 in phosphorus.

It is estimated that there are 19,560 tons of prospective ore below the 5th level. The area of the ore on the 5th level has been fairly well determined, although its western limits has not yet been exactly located. The dip and pitch of the ore has been accurately determined as a result of the past year's work, so that it appears reasonable to assume that the ore will be found to extend a short distance below the 5th level.

The eastern limit of the ore body above the 4th level has not yet

been determined. The development work in this territory, however, has been rather discouraging, as it does not indicate an extension much beyond the limits already determined. At the east end of the 4th level the footwall has risen above the elevation of the 4th level. Some lean ore high in phosphorus has been found on the south side of the trough; the ore on the north side rises above the foot and from apparent indications pinches out to the east at a point about 40 feet above the 4th level. It will be necessary to continue development work at this point, both by drifting and diamond drilling, for there is a large area to the east under Johnson Lake which has never been explored by drilling from surface. The indications are not favorable here as a result of the underground work, but at the same time they are not conclusive enough to warrant dropping all further explorations. All of the ore heretofore developed in the Gwinn district has had an eastward pitch. The Francis ore body, with its westward pitch, has been the only exception. At the eastern end of the 4th level the formation is lying almost horizontal in the center of the trough, there being apparently no defined pitch either to the east or west. It is possible that beyond this point an easter^{ly} pitching trough will be found extending beneath Johnson Lake. This development might result in the discovery of a continuation of the present ore body and largely increase the tonnage.

The work in detail for the year was as follows:

SUBS ABOVE THE FOURTH LEVEL.

40 Ft. Sub.

Mining on this sub-level was started the latter part of July and continued for the balance of the year. A number of raises were put up from the footwall drift on the 4th level and mining started. The ore body was found to be very irregular; at the west end it was over 30 feet wide for a length of about 60 feet, then, for a distance of several hundred feet, it was only drift wide. The total length of the ore body at the elevation of this sub-level was 750 feet. At the close of the year, mining had been completed at this elevation, except at the extreme east end, where two contracts were working. One of these contracts is slicing, falling back along

the foot, the other gang, working more to the south and near the center of the trough, is still engaged in drifting to the east in ore averaging about 57% iron. The results of the mining operations on this sub-level were very disappointing. There were some sections of the ore body which did not grade above 52% in iron, so that in order to hold the grade of the product up it was necessary to put this lean ore on the rockpile. There were only a few points at which the ore body was more than 8 feet wide, so, as a general proposition, it might be stated that the mining on this sub-level consisted of driving a drift along the footwall for the entire length of the deposit.

28 Ft. Sub.

The 28 Ft. Sub was opened in September directly beneath the floor covering of the 40 Ft. Sub. Mining was continued here for the balance of the year, by which time about 70% on this sub-level had been mined out. The same irregular enrichment was found here as on the sub above.

18 Ft. Sub.

This sub-level was opened the last of November and, at the close of the year, there were three gangs working at this elevation beneath that portion of the 28Ft. Sub. where mining had been completed.

FOURTH LEVEL.

By the end of December 1917, the 4th level drift from the shaft had been extended to the south-east a distance of 467 feet. No. 1 cross-cut had been turned off 420 feet from the shaft and 27 feet of ore had been shown up here at the close of the year. In 1918, the main haulage drift was continued to the south-east a distance of 450 feet. After No. 2 crosscut was turned off, 100 feet east of No. 1, it was decided to turn the main haulage drift more to the south until it encountered ore and then follow the ore along the foot to the east. This would permit of gaining more information of the ore body than would have been possible if the haulage drift had been continued back in the footwall and crosscuts driven to the ore. After the drift reached the ore body it was continued in ore until it encountered the footwall which cut across the breast to the south. This is the footwall beneath the trough at the eastern limit of the ore body

at the elevation of the 4th level. The drift was then curved to the south and then, after advancing a distance of 50 feet, it again encountered the ore formation on the south side of the deposit. The ore here, however, was low in iron and high in phosphorus and, after advancing about 30 feet in this material, it was decided to put up a raise here and explore at this point by drifting from the raise above the elevation of the 4th level. Late in the year, after mining had been started 40 feet above the 4th level, it was decided to drive a parallel drift back of the ore in the footwall, which drift would be necessary both for the later mining of the remaining ore between the 4th and 3rd levels and also for taking timber in to the contracts after mining had been completed to the sill floor of the 4th level. By the end of the year this drift had been driven a distance of 160 feet.

No. 1 crosscut had not been quite completed at the close of 1917. Up to this time it had shown the ore body to be 27 feet in width. It was continued in January 1918, and showed the ore body to be 35 feet wide at this point. Later in the year, No. 1 crosscut was continued to the south in hanging material across the trough to the south leg of the deposit. Here a large amount of lean ore was developed, but at only one point was the ore found to be of merchantable grade, its width here being about 10 feet. After the south footwall was reached a drift was driven nearly a hundred feet further to the east along the footwall, where, however, no merchantable ore was found. It was then decided to abandon further explorations at this point, as it seemed certain that there was no high grade ore to be expected in this territory on the south leg of the deposit. Late in the year the 10' seam of 56% ore was found to extend 25 feet to the east and 20 feet to the west of No. 1 crosscut. Several raises were put up here to see if this ore extended any distance above the 4th level but they proved that the enrichment here was simply local, as the ore did not extend at any point over five feet above the back. All the merchantable ore was then mined out and timber blasted down.

No. 2 crosscut was turned off in February and was completed early

in March. It showed the ore body to be 25 feet in width at this point.

No other crosscuts were turned off from the haulage drift but later in the year several raises, that had been put up from the 5th level to the elevation of the 4th level, were connected by crosscuts to the 4th level haulage drift. In one of these crosscuts the ore was found to be only 8 feet wide and in another 10 feet, indicating that the narrow deposit developed above the 4th level continued narrow in certain areas down to the elevation of the 4th level. At the elevation of the 4th level this narrow area seems to be principally confined to the eastern end of the ore body.

Exclusive of mining operations, there has been a grand total of 1994 feet of drifting and raising on the 4th level during 1918, of which 1274 feet was rock drifting, 320 feet ore drifting and 400 feet ore and rock raising.

FIFTH LEVEL.

In 1917 the 5th level haulage drift had been driven in a distance of 805 feet to the south-east of the shaft. No. 1 crosscut had been turned off at a point 440 feet of the shaft and driven 300 feet to the south, entirely across the ore formation into the arkose footwall on the south side of the trough. The main haulage drift was turned due south at a point 680 feet from the shaft and up to the close of 1917 had advanced 125 feet across the formation without encountering ore at this elevation. In 1918 it was continued 60 feet further to the south in arkose. The work done here definitely proved that the ore body at the elevation of the 5th level formed a trough with a decided pitch to the west and that in the vicinity of No. 2 crosscut ore would only be found by raising above the level.

Early in the year a drift was started to the west in ore from No. 1 crosscut near the center of the trough. This drift was continued in ore a distance of 80 feet, then passed out of good ore into lean ore and rock, in which it was continued a distance of 150 feet. Ore was again encountered in which it was continued a distance of 245 feet to the west, where work was stopped and a crosscut driven to the north to prove up the

width of the ore, which it developed was 50 feet wide at this point. This drift gave the first definite information that the ore body extended below the 5th level. Work was stopped in the drift because it had developed sufficient ore to warrant the driving of a main haulage drift south from the shaft into this territory, which would shorten the tram at least 1000 feet, as this work had proven that the ore body extended to a point within 225 feet of the shaft.

As a result of the information gained by the above drift it was decided to drift from the shaft into this territory, and early in the fall this drift was started. This will be the main haulage drift for handling the greater part of the ore between the 5th and 4th levels, and from this drift raises will be put up for mining this ore. It will be driven in the footwall on the north side of the deposit and will be located about 300 feet south of the main drift, which was originally driven for developing the ore at this elevation. It will handle ore west of No. 1 crosscut. In order to complete this drift as rapidly as possible a drift was also started to the west in the footwall from No. 1 crosscut, which will meet the drift being driven south of the shaft. At the close of the year the drift to the south of the shaft had reached the point where it turned to the east. Timber was put in at this point so that the drift could also later be extended to the south across the ore, the point at which the turn was made being about 100 feet west of the ore as proven up by the drift which had been driven to the west from No. 1 crosscut early in the year.

During the past year there has been a total of 557 feet of rock drifting and 350 feet of ore drifting on the 5th level. There has been a total of 1121 feet of ore and rock raising above the 5th level, or a grand total of 2033 feet development work in drifts and raises on and above the 5th level. In addition to the above, there has been a large amount of development drifting done on sub-levels between the 5th and 4th levels in an effort to outline and fully develop the ore body here. The ore body on the north side of the trough has been entirely outlined by a drift along the footwall on a sub-level opened 40 feet above the 5th level. At this

point it was shown to have a length of 650 feet. The grade of the ore in the footwall drifts and crosscuts driven on these sub-levels averaged higher than on the subs above the 4th level, where mining is now in progress, from which it is assumed that the enrichment became more uniform below the 4th level.

Considerable exploration work has been done on the south side of the deposit, where results have been unfavorable. The enrichment here is very irregular and the ore has not been found to extend to a uniform height above the 5th level. One sub-level was opened 80 feet above No. 2 crosscut, near the south side of the deposit, from which a drift was driven 125 feet to the east in a lean high phosphorus ore. It is possible that some merchantable ore will be found in this territory at this elevation but it does not seem likely as a result of the development work which was done on this sub-level. At other points on the south side of the deposit other sub-levels have been opened at different elevations in an effort to find the top of the deposit and start mining operations. As a result of this work mining was started the last of the year from several raises at an elevation of 51 feet above the 5th level in the territory west of No. 1 crosscut. An arbitrary limit for mining operations here has been established and to the south of this line it is now planned to mine the ore out down to the 5th level. North of this line the ore will be mined down from the 4th level in regular sub-level operations which have already been started.

In 1918 there were a total of 1121 feet of raises put up from No. 1 and No. 2 crosscuts and from the footwall drifts between these crosscuts to the elevation of the 4th level in preparation for mining the ore body below the 4th level. The territory east of No. 1 crosscut has been thoroughly developed for mining operations, while the territory west of No. 1 crosscut still has to be developed for mining the downward extension of the west 300 feet of the ore body now being mined above the 4th level. That part of the deposit which lies south of the arbitrary limit, which is roughly located in the center of the trough at the elevation of the 5th level, has already been developed for mining west of No. 1 crosscut. To complete

the development of the 5th level for mining the ore above it, it is necessary to drive 500 feet of rock haulage drifts and put up 1000 feet of raises.

As stated before, it has now been definitely determined that the ore body extends below the 5th level. During the coming year drilling must be done in order to determine the size and extent of the ore below the 5th level in order to determine whether the shaft should be sunk and another level opened at greater depth. There is probably a sufficient tonnage already developed to warrant sinking the main shaft but it will be necessary to drill in order to determine at what elevation to open the new level.

The last of the year electric haulage went into operation on the 4th and 5th levels. All the equipment necessary for this work has been on hand at the mine since in the summer, except the cable for carrying current underground. Due to war conditions the delivery of this cable was delayed many months, which was very unfortunate, as the underground work was seriously handicapped due to the shortage of trammers. It is expected that very much better results will be obtained from now on due to the installation of electric haulage.

Late in the summer the counter balance pipe was installed in the shaft, after which the counter balance was put on and the cage hoist put in commission. Prior to this time the cage and one skip had operated in balance, the skip hoist only being in operation.

An electric plunger pump of 1000 gallon 1000' head capacity was installed in the pump-house on the 5th level the latter part of the year. Prior to this time a centrifugal pump had handled the water from the 3rd level to surface. This centrifugal pump has been moved to the 5th level to the permanent pump-house, where it is installed as a relief pump in case of accident to the plunger pump. The Francis Mine makes only about 94 gallons of water per minute and this water is pumped on the day shift, the pump being operated only $2\frac{1}{2}$ hours out of every 24. There has been practically no water encountered in the opening of the 4th and 5th levels, as the water enters the shaft in the first 200 feet below ledge.

A raise was put up from the skip pit drift, which is located 55

feet below the 5th level, to the bottom of the settling basin of the sump. Near the bottom of this raise a 10 inch pipe was installed, which pipe projected out into the skip pit drift. This pipe was securely concreted in place and valves placed at the bottom. It has operated successfully for drawing off the dirt which has settled in the sump and it is expected that it will be possible to keep the sump from filling with mud. In addition to the work outlined above, several concrete dams were installed in the sump with control valves, so that the water could be shut off from the suction if necessary. Early in the year the permanent discharge line was installed in the shaft.

During the past year there has been two serious accidents in the shaft. The first one occurred on Aug. 24th, and work was not resumed until the morning of Sept. 3rd. This accident was due to the carelessness of the hoisting engineer, who overwound the skip, causing the rope to break and the skip to fall to the bottom of the shaft. A number of the steel dividers between the skip and cage compartments, as also a number of the end pieces, were bent and twisted so that it was necessary to cut them out to install new ones. There was also considerable damage done below the 5th level, where the skip left the runners, breaking through into the cage compartment.

The second accident occurred in November, at which time the mine was idle from the 2nd of November to the 9th, due to a very unusual accident. The counter balance weight was in the act of being hoisted preparatory to putting it in the counter balance pipe when the bolt, which extends through the three heavy castings making up the weight, broke off near the bottom end and two of the castings went down the shaft, one in the ladder road and the other in the cage road. The one which started down the ladder road, wrecked all the ladders and tore out the sollar for a distance of over 100 feet, it was then deflected into the cage road, in which it traveled to the bottom of the shaft. In falling, it struck a number of the steel dividers bending them out into the cage road and knocking out a number of the casing plank between the skip and cage roads. The other weight, which fell down the cage road, struck the ascending cage wrecking the upper part of it, but

fortunately the cage was strong enough to stop the weight and it was found resting on the floor of the cage. Repairs to the shaft were completed so that operations could be started on the 9th of the month, but it was necessary to continue repairs for more than 30 days after this time, which work was done on the night shift when the mine was not operated.

There was a decrease in the output during the latter part of November and the early part of December due to the influenza epidemic.

DIAMOND DRILLING.

A diamond drill hole was drilled on the 4th level near the shaft in May. The hole was located 25 feet south-west of the shaft and was drilled on a course of S 32° W. Following is the record of the hole;

HOLE NO. 3

0 - 70- 70' Black Slate
70 - 82- 12' Ferruginous Slate
82 - 111- 29' Chert
111 - 220-109' Black Slate
220 - 245- 25' Mixed Black Slate and Chert
245 - 422-177' Gray Slate
422 - 449- 27' Black Slate
449 - 460- 11' Gray Slate

On completion of this hole the drill was moved to the 5th level, where a hole was drilled due south from a point 25 feet south-west of the shaft. Following is a record of this hole;

HOLE NO. 4

0 - 98- 98' Arkose
98 - 135- 37' Black Slate
135 - 140- 5' Gray Slate
140 - 175- 35' Chert
175 - 205- 30' Mixed Arkose and Slate
205 - 235- 30' Ferruginous Slate
235 - 245- 10' Second Class Ore - Anal. 55.20 - .069
245 - 280- 35' Ore - Anal. 57.07 - .064
280 - 290- 10' Second Class Ore - Anal. 55.90 - .063
290 - 295- 5' " " " " 57.00 - .061
295 - 320- 25' Ore - Anal. 58.84 - .062
320 - 325- 5' " " 57.60 - .064
325 - 330- 5' Lean Ore - Anal. 49.00 - .096
330 - 335- 5' Ferruginous Slate
335 - 380- 45' Second Class Ore - Anal. 54.10 - .092
380 - 395- 15' Lean Ore - Anal. 48.07 - .435
395 - 410- 15' Ferruginous Slate.

As it was not possible to continue this hole to the arkose footwall on the south side of the trough, on account of caving ground, it was decided

to drill another hole, which was located 400 feet south-east of the shaft in the drift which was following the ore to the west. The record of this hole is as follows;

HOLE No. 5.

0 - 85- 85' Ferruginous Slate
85 - 110- 25' Second Class Ore - Anal. 51.78 - .835
110 - 130 20' Ferruginous Slate
130 - 180 50' Arkose.

S U M M A R Y.

The Francis Mine went on an operating basis on May 1st, 1918. Some accounts were kept open as all the equipment had not yet been installed, but the opening statement was definitely closed on Dec. 31st, 1918. Owing to labor conditions the opening work here did not progress as fast as it should have done. Actual mining operations were delayed in starting due to the shortage of men, and up to the close of the year the output continued so small that it was impossible to produce ore at a reasonable cost. By the end of the year, however, the property was in splendid condition for operating at a reasonable cost. Two skips were in operation, and also a cage. The installation of electric haulage had been completed on the 4th and 5th levels and the cost of production from now on is dependent on the number of gangs of miners which can work in ore. The production and the future cost of product depends therefore on the ore body. Almost exactly a quarter of a million tons of ore has been developed, of which 209,000 tons lies above the 5th level. The most serious drawback is the irregularity in the size and grade of the ore. This has seriously interfered with mining operations since they were started in July, and doubtless will continue to be a serious problem at this property. Preparations are being made on surface for stocking second class or low grade ore, it being the intention to save ore of this grade which is encountered in development work. It would be possible to obtain a very low operating cost at this property if this material could be mined, as it would permit of adding a large number of contracts to the working force in the mine, all of whom could operate to good advantage. The ore is soft and plastic in character and could be mined

very cheaply if the mining operations could be conducted uniformly on the various levels. Where, however, one sub-level is 25 feet wide at a given point and it develops that the next sub below is only 7 feet wide, it can readily be seen that mining operations are being conducted under unfavorable conditions. The development work below the 4th level in the area west of No. 1 crosscut, which comprises about 60% of the ore body, seems to indicate that the enrichment in this territory will prove more uniform and therefore mining operations can be conducted at a more reasonable cost than in the territory where mining is now in progress. It is doubtful, however, whether the conditions here will prove favorable enough to offset the increased cost of production at other points so as to permit of a low mining cost. Ore can be produced at this property as cheaply as at any property operated by the Company on the Marquette range, if it were not for the unfavorable conditions spoken of above. Every effort will be made to produce ore at a low cost, but these facts are presented in order that a clear understanding may be had of the conditions under which this property must be operated.

The ore body has been thoroughly developed in the territory between the 5th and 4th levels and apparently the limits of the deposit above the 4th level have also been determined. The area of the downward extension of the ore body below the 5th level have also been partly determined. It would seem from the above that it would be possible to figure the total tonnage available on this property within fairly accurate limits. This, however, cannot be done at this time, as there are several possibilities of extension of the ore body beyond the present limits. The proof of these extensions can only be determined by drifting and diamond drilling. There is the area to the east of the present known limits of the ore body on the 4th level, which territory was never explored by diamond drilling from surface; there is also the upward extension of the ore body above the 4th level up to the safety limit of mining; there is also a remote possibility of ore at some point south of the present Francis ore body beyond the upward roll of the footwall on the south side of the trough; and there is the downward continuation of the ore body below the 5th level.

SURFACE.

During the past year the Francis Mine has been fully equipped on surface for operating. The work in detail was as follows;

Lining plates were installed in the railroad loading pockets at the shaft, this work being completed so that ore was shipped during the past season.

The cage hoist was installed in the engine house and the cage put in operation in November. The engine house floors have been painted and all necessary safety devices installed so that the engine house is now in first class condition.

During the year a storage house was erected for pipe and iron, for coke and blacksmith coal and for necessary supplies for machine shop and carpenter shop. This building is located between the shop building and the railroad tracks so that coke and blacksmith coal can be unloaded directly from the cars into the building. It has permitted all material at the mine to be put under cover, greatly improving the appearance of this property, and has also the advantage that all material can be easily located in the winter when the ground is covered with snow.

The railroad tracks to the pockets and to the stockpile were installed by the C. & N. W. Ry. Company in the spring.

The work of grading the stockpile grounds to provide sufficient stockpile room for the winter season was continued throughout the past summer. The stocking trestle was extended beyond the limits needed for stocking this fall and sollar made by dumping lean ore here. This ore was used in leveling off the ground and at all points it is about six inches thick. After it was leveled it was rolled and is now as hard and level as a plank floor. It was not possible to complete this work before freezing weather, but it will be completed in the spring as soon as the weather will permit. Late in the fall it was decided to erect a trestle for stocking lean ore. This trestle was put up late in the year, but stocking did not start owing to delay in obtaining an engine for operating the top tram. A portion of the sheaves for the rope line have been installed and it is

planned to complete the installation as soon as the top tram engine is obtained.

Material for enclosing the Francis Mine shaft-house was received in November, and this work was started about the middle of December. If weather permits, it is planned to complete this work as soon as possible.

Some further work was done in 1918 in the boiler room. Metal lath covered with concrete plaster has been used for enclosing the room where the heating plant boiler is located. In addition, considerable shelving was put up in the room devoted to storage here, which completed the work on this building.

Considerable trouble was experienced in the fall in obtaining a water supply for the mine due to the blocking of the old well points. Two other points were put down near the boiler house from which the present supply is being obtained, but they have not operated satisfactorily due to quicksand blocking the points. If a good tonnage of ore is developed at this property, which will warrant the expenditure, it would be advisable to extend the main water system from the Jopling Mine over to the Francis. The distance between these mines is approximately 4500 feet and a three inch line would provide sufficient water for all purposes. At the present time there is not an adequate supply of water for fire protection. A connection with the Gwinn water system would render a pumping plant at the mine unnecessary and with the added fire protection which it would provide it would seem that this expense would be justified. This work, however, can be postponed until material and labor is cheaper.

FRANCIS MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1918.

GRADE	IRON	PHOS.	SILICA	MANG.
Franport,	56.89	.295	6.75	.631
Franwood,	51.85	.728	8.85	.829

Above grades went into mixed cargoes.

ORE STATEMENT - DECEMBER 31ST, 1918.

	FRANPORT	FRANWOOD	TOTAL	TOTAL LAST YEAR
Balance on hand Jan. 1st, 1918,	1,778		1,778	0
Putout for Year,	41,007	528	41,535	1,778
Total,	42,785	528	43,313	1,778
Shipments,	30,247	528	30,775	0
Balance on hand,	12,538	0	12,538	1,778
Increase in output,			39,757	
Increase in ore on hand,			10,760	

1918 - 2-8 Hr. Shifts Jan. 1st to Dec. 1st
1-8 Hr. Shift Dec. 1st to Dec. 31st

SHIPMENTS FOR YEAR - 1918.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Franport,	20,235	10,012	30,247	0
Franwood,	528	0	528	0
Total,	20,763	10,012	30,775	0
Total last Year,	0	0	0	
Increase,			30,775	

FRANCIS MINE.

COMPARATIVE MINING COST FOR YEAR.

		1 9 1 8.
PRODUCT		41,535
General Expense		.300
Maintenance		.335
Mining Expense		2,580
Cost of Production		3,215
Exploratory)		
Ore in development)		.713
Depreciation.		
Uncompleted Construction		.600
Total Depreciation		.600
Taxes		.017
Central Office		.124
Supply Inventory		.072
Miscellaneous		.007
Sundry Expense		.028
Cost on Stockpile		4,776
Loading & Shipping		.121
Cost on Cars		4,897
No. Days Operating		190
No. Shifts and Hours	2-8hr	120
	1-8hr	70
Avg. Daily Product		219
<u>COST OF PRODUCTION.</u>		
Labor		2,165
Supplies		1,050
Total		3,215

Mine started on producing basis May 1, 1918.

FRANCIS MINE.

COMPARATIVE WAGES AND PRODUCT.

	1918.		
PRODUCT	41,535		
No. Shifts and Hours	2-8hr-120		
	1-8hr- 70		
AVERAGE NUMBER MEN WORKING			
Surface	25		
Underground	55		
Total	80		
AVERAGE WAGES PER DAY			
Surface	4.57		
Underground	5.61		
Total	5.28		
WAGES PER MO. OF 25 DAYS			
Surface	114.25		
Underground	140.25		
Total	132.00		
PRODUCT PER MAN PER DAY			
Surface	7.80		
Underground	3.61		
Total	2.47		
LABOR COST PER TON			
Surface	.586		
Underground	1.556		
Total	2.142		
AVG. PRODUCT BRK'G & TRM'G	6.80		
" WAGES CONTRACT MINERS	5.43		
" " " LABOR	5.43		
TOTAL NUMBER OF DAYS			
Surface	5,325½		
Underground	11,523		
Total	16,848½		
AMOUNT FOR LABOR			
Surface	24,343.61		
Underground	64,645.59		
Total	88,989.20		

Proportion Surface to Underground Men:
1918 - 1 to 2.20

Mine started on producing basis May, 1, 1918.

FRANCIS MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1918.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT.	LAST YEAR.
4 " to 6" Timber	62,145	.0175	1085.68	Not Optg.
6" " 8" "	41,468	.0300	1245.04	last year
8" " 10" "	12,316	.0549	676.15	"
10" " 12" "	5,712	.0750	428.40	"
12" " 14" "	2,576	.1100	283.36	"
Total Timber 1918	124,217	.0299	3718.63	"
	LINEAL FEET.	PER 100'.		
5' Lagging	95,625	.6727	643.23	"
8' "	124,450	.6151	765.53	"
Total Lagging	220,075	.6401	1408.76	"
Poles	8,488	.9813	83.29	"
Total Lagging & Poles 1918	228,563	.6528	1492.05	"
Product for Year			27,665	"
Feet Timber per ton of ore			4.49	"
" Lagging " "			7.95	"
" " " foot of timber			1.77	"
Cost per ton for timber			.1344	"
" Lagging			.0509	"
" Poles			.0030	"
" Timber, Lagging & Poles			.1883	"
Equivalent of stull timber to Bd.Measure			181,353	"
Ft.Board Measure per ton of ore			6.555	"
Total for Timber, Lagging & Poles			5210.68	

This statement covers period Mine started operating, May 1, 1918, to Dec.31,1918.

FRANCIS MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND	QUANTITY.	AVERAGE PRICE.	AMOUNT 1 9 1 8.
40% Powder Red Cross	9,350	.1802	1,685.29
40% " Gelatine	1,800	.2145	386.08
50% " "	100	.2565	25.65
Total Powder	11,250	.1864	2,097.02
Fuse	42,600	.807	343.98
Caps	8,100	1.311	106.19
Cap Crimpers	6	.502	3.01
Tamping Bags	4,700		11.56
Total Fuse, Etc.	55,406		464.74
Total All Explosives	66,656		2,561.76
Product			27,665
Pounds Powder per Ton Ore			.407
Cost per ton for Powder			.076
" " Fuse, Caps, Etc.			.017
" " All Explosives			.093
Avg. Price per Lb. for Powder			.1864

This statement covers period mine started operated, May 1, 1918, to Dec. 31, 1918.

GARDNER-MACKINAW MINES.

The work of re-opening the Gardner-Mackinaw Mines was started in the fall of 1916. By the end of 1917 the Mackinaw shaft had been sunk to a depth of 947 feet and the Gardner to a depth of 625 feet. Drifting was under way on the 4th level of the Mackinaw to the Gardner shaft, from which it was planned to raise and connect with the shaft which was being sunk. On Dec. 31st, 1917, this connecting drift on the 4th level had reached a point 143 feet from the line of the Gardner shaft, while the bottom of the shaft was 235 feet above the level. A drift was also being driven on the 4th level on Gardner property towards the ore body near the boundary line between the Gardner-Mackinaw properties. Sinking was in progress at the Gardner shaft; sinking at the Mackinaw had been temporarily stopped while the drift to the Gardner was being driven on the 4th level. At this time the work of excavating the sump for the permanent pumping plant was also in progress.

In 1918 the Gardner shaft was sunk 301 feet to the point which previously had been decided on as the required depth for mining the ore on this property. The drift from the Mackinaw was continued to the line of the Gardner shaft and a raise put up which holed to the shaft a short distance below the third level, there being about 80 feet of raising. From this point down the shaft was stripped to the 4th level and sinking continued 65 feet below the 4th level to provide for skip pit pocket and sump.

On completion of this work preparations were made for sinking the Mackinaw shaft to its ultimate depth of 1340 feet. Sinking was started on August 5th but abandoned after it had been sunk 13 feet, due to the discovery that the ore was very high in sulphur. The elevation of the bottom of the shaft when sinking was abandoned was 959 feet below the collar. It had practically reached the elevation of the 5th level at the time work was stopped.

The discovery that the ore body on both the Mackinaw and Gardner properties contained a large amount of sulphur was entirely unexpected and

completely altered the plans which had been decided on in regard to these properties. An analysis of drill cores from surface diamond drill holes showed an increasing content of sulphur at greater depth, and, until more definite information was available concerning the sulphur content of the ore, it was decided advisable to stop sinking operations at the Mackinaw shaft. When the shaft was being sunk in 1913, the lean ore encountered about 400 feet below surface in the Mackinaw shaft, was found to carry considerable more than the usual amount of sulphur found in the other ores in the Gwinn district. This matter was reported in a letter by Mr. Jackson, the superintendent, but these results did not indicate that the sulphur would later be found so high in the main ore body. Since the discovery of sulphur, the general plan of operation at the properties may be briefly stated as follows;

To develop the ore body as rapidly as possible on the 4th level, also to raise and develop the ore on its upward extension to the 3rd level; to repeat this operation again on the 3rd level and also on the 2nd, in order that the entire ore body above the 4th level could be opened and definite information obtained as to the sulphur content. At the close of the year this program had been carried out to the point that drifting was in progress in the ore on the 3rd level and drifts were also being driven from both shafts towards the ore body on this level. It is now planned to open the second level as soon as additional miners are available for this work.

The work in detail for the year was as follows:

MACKINAW MINE.

The product for 1918 was as follows;

Mackinaw Ore	2,363 tons
Rock	<u>19,731</u> "
Total Ore and Rock	22,094 "

The following is an estimate of the ore above the 4th level, made in September, from cross sections based on diamond drill holes:

	<u>Tons</u>	<u>2/3 Available</u>
Ore Above 1st Level	25,200	16,800
" " 2nd "	61,440	40,960
" " 3rd "	106,000	70,670
" " 4th "	<u>148,750</u>	<u>99,160</u>
Total	341,390	227,590

FOURTH LEVEL.

Owing to the fact that the two shafts were to be connected on the 4th level it was decided to drive one drift near the Mackinaw property line to the ore body, which drift would be used for the haulage of ore to either the Gardner or Mackinaw shafts, depending on which property it came from. This drift started on the Mackinaw property but was driven the greater part of the distance on the Gardner, being located close to the Mackinaw line. The drifts was started early in the year and reached the line of the Mackinaw property near the ore body the last of June, ore being encountered in July. A crosscut was driven which proved the ore to be about 15 feet wide at this point, after which a drift was started to the north-west along the footwall, following the ore. By the end of the year the ore had been developed on the Mackinaw property for a distance of 250 feet. Drifting will be continued until the end of the ore body is reached. It developed that south-east of the crosscut there was practically no ore, in other words, the crosscut happened to be located at the south-east end of the ore body.

It has been decided to try mining the ore by the shrinkage stope method to see if it is suitable for adoption for the mining of the ore on these two properties. It is planned to carry stopes up on the footwall, these stopes being approximately 25 feet in width, with 15' pillars between. Owing to the extreme hardness of the jasper capping it is expected that it will be possible to make stopes of this width without timber and by leaving a 15' pillar there will be no danger of the hanging breaking. This will permit of mining from 2/3 to 3/4 of the ore. The preparatory work of opening a stope between the 4th and 3rd levels on the Mackinaw property has been started. This work has been started at a point where the

ore ran below .500 in sulphur. Raises have been put up near the Mackinaw line on the Gardner property from the 4th to the elevation of the 3rd level and drifting is now in progress from the top of these raises towards the Mackinaw property, from which the drifts are now distant less than 100 feet. This will permit of the ore body on the 3rd level being developed very rapidly.

Electric haulage was installed on the 4th level in the summer and has been in operation since. Owing to the shortage of trammers it permitted better progress to be made with the work of opening this level.

SUMP.

A sump level was opened in 1917, 12 feet below the 4th level, from the shaft and up to the close of the year there had been 428 feet of drifting on the sump level. In 1918 drifting was continued and the work on the sump completed. There was a total of 432 feet of drifting in 1918, the total for the two years being 860 feet. This drift was small in size, as it was thought that it would stand without timbering if made small. It stood very well for the first three or four months, then the rock started to slab off due to action of the air and it was considered advisable to timber it. Connections were made from the sump drift to the permanent pump-house for the suction of the two permanent pumps. A raise was also put up back of the skip road to the sump, holing near the point that the water entered the sump so that the mud which settled here could be drawn off through this raise. When all work was completed a concrete dam was put in at the shaft and also concrete dams near the two suction, so that it would be possible to shut off either suction in case of accident.

PUMP HOUSE.

Early in the year a temporary pump-house was cut near the shaft on the 4th level and a 250 gallon 1000' head electric centrifugal pump installed here. A portion of the main sump was sealed off with a temporary dam and all the mine water was handled by this pump during the balance of the year. The pump-houses for the two permanent pumps were located about 100 feet directly back of the shaft. These pump-houses were cut in arkose,

which made it necessary to support the ground. In order to make them fire-proof it was decided to install steel sets to support the ground and lag up these sets with plank and put concrete plaster over the plank. Owing to the nature of the ground the two pump-houses were separated by a rock pillar 15 feet in thickness. The pump-house for the 1000 gallon 1000' head centrifugal pump is 12' x 30' in size and it has been entirely completed. The pump had been taken underground, set up on the foundations, and was ready for connection to the discharge column, when it was taken out of the mine and sent to the Holmes Mine on account of water trouble, which made it necessary for them to obtain a pump as soon as possible. The pump-house for the plunger pump is 20' x 40' in size. This pump-house has been excavated, the steel sets installed, and it is now ready for concrete plaster on the plank, which is used for lagging between the sets. The type of plunger pump purchased rendered it necessary to make a much larger pump-house than has ordinarily been required for pumps of the same capacity. The pump which will be installed here is a belt driven Aldrich pump of 1000 gallon 1000' head capacity. The last of the year the concrete foundations for this pump were installed and it is now planned to take this pump underground and get it into commission as soon as possible. The drift to the pump-house and the cutting of the pump-houses was equivalent to a length of 338 feet of an ordinary drift. A summary of the work done on the 4th level shows that there has been 432 feet of rock drifting on the sump level; work equivalent to 338 feet of drifting in the permanent pump-house and 60 feet in the temporary pump-house; also 65 feet of rock drifting on the main level and 360 feet of ore drifting, a grand total of 1245 feet of drifting during 1918.

THIRD LEVEL.

The work of opening the 3rd level was started in September. At the time the shaft was sunk a drift had been driven in 10 feet from the cage compartment. At the end of the year there had been an equivalent of 222 feet of drifting done on the 3rd level, the pocket installed at the shaft and the plat cut. This drift is now in 80 feet from the shaft or

within a distance of 450 feet of the ore body on this level.

SUB-LEVEL 50 FEET ABOVE THE 4TH LEVEL.

One raise was put up on the Mackinaw property from the 4th level to the 3rd level. Ore was encountered about 40 feet above the level in this raise and at an elevation of 50 feet a sub-level was opened and about 35 feet of drifting done in the ore. The raise was then continued up to the elevation of the 3rd level, where drifting was started. The drift soon passed from the Mackinaw property on the Gardner, on which drifting was being continued at the close of the year.

There has been a serious shortage of labor at this property all through the year and development work has progressed very slowly. The development work has not advanced far enough to give any basis for an estimate of the ore on this property so that no new estimate has been made.

GARDNER MINE.

The hoist for the year was as follows;

Gardner Ore	42 tons
Rock	<u>15,672 "</u>
Total Hoist	15,714 "

An estimate of the ore, made in September, based on cross sections made from diamond drill holes was as follows;

	<u>Tons</u>	<u>2/3 Available</u>
Ore Above 1st Level	28,000	18,000
" " 2nd "	98,000	73,000
" " 3rd "	263,000	175,000
" " 4th "	<u>480,000</u>	<u>320,000</u>
TOTAL	869,000	586,000

This estimate must not be accepted as accurately giving the available tonnage. It is merely a conservative estimate based on drill records only.

The shaft was sunk 301 feet in 1918, the total depth being 926 feet. The 3rd and 4th levels have been opened, but at the close of the year work was confined to the 3rd level.

FOURTH LEVEL.

During 1918, the connecting drift from the Mackinaw shaft was completed. After sinking was finished the loading pocket was installed at the shaft and the tail drift driven beyond the shaft. The drift to the ore body was started near the Mackinaw shaft and driven across the north-west corner of the Gardner property. There was 430 feet of drifting on the Gardner, beyond which point the drift advanced to the south-west on the Mackinaw, until it had crossed the ore body. A drift was driven to the south on the Gardner, near the boundary line, a distance of 115 feet in the footwall, and two raises were put up to the elevation of the 3rd level. No ore was encountered in either one of these raises. The development work done just over the boundary line on the Mackinaw showed conclusively that there would not be any ore found on the Gardner property at the elevation of the 4th level. The ore passed over the boundary line at a point half-way between the 3rd and 4th levels.

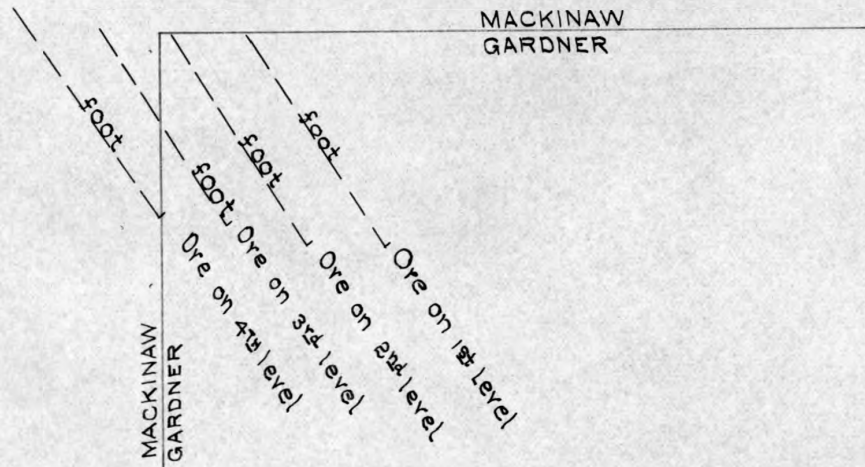
GARDNER MINE.

THIRD LEVEL.

It was decided to drift back towards the footwall from the first raise and determine if there was any ore at the elevation of the 3rd level. After drifting 50 feet through hanging wall jasper, five feet of ore was found on the footwall. This ore will be followed to the north-west, where it is expected that it will soon widen out.

A raise was put up to the elevation of the 3rd level on the Mackinaw property, near the Gardner line, and a drift driven to the east over on the Gardner. By the end of December this drift had advanced 55 feet on the Gardner in high grade ore. The drift has not gone directly across the formation, but the work here indicates a much larger ore body than on the 4th level, 100 feet below. The actual indicated length of the ore body on the 3rd level on Gardner property is only 150 feet, so that there will be only a small tonnage of ore between the 4th and 3rd levels. The ore thus far developed on the 3rd level has been higher in sulphur than the ore on the 4th level, a condition which it is hoped is merely local.

From the diamond drill holes it is known that the ore body on the Gardner increases very rapidly in size above the 3rd level. The following sketch shows the ore body on the 3rd level and also its probable location on the upper levels with respect to the Mackinaw property line.



The ore thus far developed on the Gardner has averaged about .800

in sulphur. This is considerably higher than on the 4th level at the same location in the ore body and is also higher than is indicated by the analyses of cores of the nearest diamond drill holes, therefore it is assumed that it is local to this particular part of the 3rd level. Accurate information will be available only when the ore body has been fully developed by drifts and crosscuts.

The loading pocket at the shaft on the 3rd level was installed as soon as sinking of the shaft was completed, after which the plat was cut. The drift to the ore body was then started and, up to the close of the year, it had advanced 545 feet. It is now 375 feet distant from the ore body, as shown up by a drift from a raise at the elevation of the 3rd level.

There was a total of 600 feet of rock drifting on the 3rd level in 1918.

SUMMARY.

During 1918 the shaft was sunk 301 feet, two plats cut and two loading pockets installed. There was 797 feet of rock drifting on the 4th level and 600 feet on the 3rd level. There was also 225 feet of rock raising, the grand total of rock drifting and raising being 1622 feet in 1918.

GARDNER-MACKINAW SURFACE.

As these two properties are now operated as one, the surface work is not reported separately.

During the past year stockpile grounds have been made at each property and plank sollars laid, only sufficient ground, however, was prepared to take care of the estimated output for the winter of 1918-1919.

Permanent trestles have been erected at each shaft and a few temporary bents put up for stocking the ore hoisted this winter. The last of the year timber was being framed for several additional bents for each mine, which will be put up so that two grades of ore can be made, based on sulphur in the ore.

Top tram engine houses have been put up at each shaft. They are frame buildings, with concrete floors and cement plastered walls on metal lath. Electric top tram engines have been installed, which are used for pulling the cars back from the stockpile. Owing to the height of the trestles it was considered advisable to have the cars run out by gravity. The Gardner system has been in operation more than a month and the Mackinaw will go in operation within three weeks.

Both the Mackinaw and the Gardner shafts have been closed in from the ground level up to the top of shaft-house. It is now possible to keep ice out of the shaft, which had previously interfered with the operation of the cage and skip.

Early in the fall it was decided to proceed with the building of the permanent heating plant for the dry and surface buildings, which are located at the Mackinaw. (The Gardner engine house is heated by a stove) The contractor, however, was not able to obtain brick masons and it was finally decided to defer the work until spring. The concrete foundations for the building, as also the boiler, are now in and the material for the building is all on the ground.

On account of the uncertainty connected with future work at these mines it was decided to build an addition to the present temporary dry, which would about double its capacity. The concrete foundations for this addition have been installed, and the building will be put up just as soon as the work on shaft-houses and trestles is completed.

The frame work for a water tank, which will be located 35 feet above the ground level, was erected in the fall, but it has not yet been possible to obtain a tank.

The C. & N. W. Ry. Company have not yet installed the pocket tracks at the Gardner shaft. It has been impossible to secure authorization for this work, which must be done before ore can be shipped from pockets. The M. M. & S. E. Ry. installed tracks to the mine in the summer of 1918. This work is not yet quite completed but very little additional work is necessary to enable shipments to be made from the pockets.

The top tram plant at Gardner went into operation the first week in December, and the Mackinaw plant will go into operation about Jan. 21st, 1919. Prior to Dec. 1st, rock had been handled on the top landing at the Gardner by using a puffer to pull back the empty car. Before this method was used, rock was hoisted on cars on the cage and trammed from the shaft by hand. Ore was not encountered on the Gardner property until the last of December, so that it has all been handled by the permanent top tram equipment. Both rock and ore have been handled during the entire year in cars on the cage at the Mackinaw shaft. The Gardner equipment was installed first, as it was expected from the drill records that ore would first be encountered on this property. Actual development of the mine resulted in the first ore being found on the Mackinaw property, after which work was pushed as rapidly as possible in order to complete the installation of equipment at the Mackinaw, so that all the material hoisted could be handled on the landing.

When the large amount of sulphur was found in the ore in August, all construction work was temporarily stopped. It was resumed again in September, when it was decided to proceed with the opening of these two properties.

A contract was let in the spring for the erection of 10 double houses and three cottages. Owing to shortage of labor and other delays, only one double house had been entirely completed by the end of the year,

however, three others are practically finished and three others nearly ready for plastering. The three cottages have been completed. There are a number of applications for houses already and more will be made as soon as additional men are obtained.

GENERAL SURFACE.

Gwinn District Crushing Plant.

The Gwinn District Crusher started operating on Tuesday, April 23rd, and the plant was closed down on Oct. 30th. It was operated on single shift until May 9th when a double shift was started, which was continued until July 27th, after which it was again operated on single shift for the balance of the season. The following table gives the comparison of the operations for 1918-1917;

				Decrease	Increase
Year 1918	Tons Crushed	284,996			
" 1917	" "	312,680		27,684	
			Per Ton		
Year 1918	General Exp.	987.16	.003	.001	
" 1917	" "	1427.78	.004		
Year 1918	Maintenance	2484.99	.009	.002	
" 1917	" "	3410.05	.011		
Year 1918	Operating	8291.75	.029		.003
" 1917	" "	8207.68	.026		
Year 1918	Total Opt.	23514.28	.082		
" 1917	" "	25692.41	.082		

The above table shows that the decrease in General Expense and Maintenance was exactly equal to the increase in operating cost. The expense was materially increased after July on account of the gradual decrease in tonnage which was sent to the crusher. Very much better results would have been obtained if the crusher could have been operated to full capacity throughout the season. The plant was operated without any unusual expense for maintenance and if sufficient ore had been available would have shown a lower operating cost than in the previous year. After the plant closed down some repairs were made during the month of November but the greater part of the repairs were postponed until spring when it was thought that labor would be more plentiful. There will not be any extensive repairs required in order to put the plant in condition for operating next season.

Central Power Plant.

The coal crushing plant was completed and went into operation in

March 1918. It was necessary to increase the working force on account of crushing the coal, and for the balance of the season the operating cost of Boiler Plant was higher. There have been an unusual amount of repairs to the boiler plant during the past year. The turbine has operated quite steadily throughout the year and it has been necessary to constantly rebuild the arches in some of the boilers. This was due in a large measure to poor brick which were used, as it was impossible to obtain brick of good quality. It is expected that this will be the last year that the Central Power Plant boiler room is operated. As soon as the water power plant is in operation on the Dead River sufficient current will be available so that it will not be necessary to operate the turbine except in case of an accident to the transmission line. The compressor will then be operated electrically. It is planned to keep these boilers in condition for operation in case of accident to the transmission line. It will require not to exceed four men to operate the plant when sufficient current becomes available as compared with 15 men at the present time.

Central Shops.

During the past year a storage house was erected near the Central Shops to house blacksmith coal, coke and iron and steel. A small storage house was also erected near the Central Power Plant to house the fire brick and stoker parts. These buildings were very necessary in order to take care of the material.

Gwinn Townsite.

There were two houses erected on lots which had been sold in the Gwinn Townsite during the past year. During the year three lots were sold as follows;

Lot 5	-	Block 12
" 7	-	" 12
" 5	-	" 16.

During the summer of 1918 the double roadway on Pine Street was given a top dressing of tarvia by the County Road Commission, who have now taken over this street as part of the trunk line road system in Marquette County. In the future these roadways will be maintained by the county. At

this time the wide business block at the lower end of Pine Street was dressed with tarvia, as also the street on the business block between Pine and Elm Streets. The road from Gwinn to Austin was rebuilt and has also now been taken over by the County Road Commission as part of the trunk line road system.

Water Supply and Water System.

The winter of 1918 was a very difficult one for operating the water supply system. The frost again penetrated the ground very deeply, as in the previous year, and several sections of the 8 inch main were frozen. The conditions were not as severe as in the previous year, however, but the expense of keeping the system in operation was higher than it had been in previous years, with the exception of the year 1917.

There has been no trouble of any kind with the water supply during the past year. The settling basin used at the American Mine has continued to operate very successfully and the river water has been entirely free from iron ore discoloration.

Gardens.

There were a large number of gardens planted by company employes in 1918. Except for the hard freeze in June the season was favorable for raising of vegetables and a good crop of potatoes was obtained. A considerable number, however, were discouraged on account of the poor results they obtained in the previous year, but those who did plant, obtained good results and materially increased the supply of food in this community.

Gwinn Association.

The Gwinn Club House has been the center of the various activities of the district during the past year. It was headquarters for the Red Cross work in Forsyth Township, and this work was carried on with good attendance until the influenza outbreak in the early winter.

The night school work, which was started in 1915, was continued through 1918. The attendance, however, was not as good as in the previous years.

The attendance throughout the year at the moving picture shows

has been much greater than in any previous year. There were many performances at which many people had to be turned away due to the small capacity of the room devoted to the moving pictures. Every effort has been made to show only high class pictures and a number of the special war pictures were shown during the year.

Interest in the library has shown an increase and a number of books were added during the year. There are now nearly 700 books in the library, and during the year over 3000 were loaned.

As in the previous year, a Garden and Canned Vegetable Exhibit was given at the Club House in the fall and prizes awarded. There was an increase in the exhibit of canned vegetables, showing that the course in canning vegetables, given by the School Board during the summer vacation, has had excellent results.

One number of a Lyceum course, which was given in December 1917, was followed by three other entertainments during the winter of 1918. These were good musical entertainments and were greatly enjoyed by the company employee's.

I would again call your attention to the necessity of an addition on the west side of the Club House in order to increase the seating capacity of the room given over to the motion pictures, and also to increase the size of the gymnasium room. There is no question of the value of the moving picture shows, both from the standpoint of entertainment and also for its educational possibilities. It is hoped that some serious consideration will be given to this matter in the coming year.

MACKINAW-GARDNER MINE.

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR - 1918.

GRADE	IRON	PHOS.	SILICA	MANG.
Gardner,	61.35	.090	3.40	.250
Mackinaw,	60.75	.081	3.29	.271

No shipments from these properties during 1918.

ORE STATEMENT - DECEMBER 31ST, 1918.

	MACKINAW	GARDNER	TOTAL	TOTAL LAST YEAR
On hand January 1st, 1918,	51		51	51
Output for Year,	2,312	42	2,354	
Total,	2,363	42	2,405	

1918 - 3-8 Hr. Shifts Jan. 1st to Dec. 1st
2-8 Hr. Shifts Dec, 1st to Dec, 31st

*Damascus
Bond*

GWINN MINE.

COST DATA FOR YEARS 1918-1917.

	YEAR 1918	YEAR 1917	INCREASE	DECREASE
<u>Shifts and Hours</u>	2-8 Hr. Jan.-Mar. 4 1-8 Hr. Mar.4-Dec. 31	2-8 Hr. Jan.-July 1-8 Hr. Jul.-Dec. 15 2-8 Hr. Dec.15-Dec. 31		
Product	155,534	161,963		6,429
Average Daily Product	522	540		18
Number of Days Operated	298	300		2
Number of Days Idle	15	13	2	
Number of Men - Surface	35	33	2	
Average Rate Per Day - Surface	\$4.33	\$3.38	.95	
Tons Per Man - Surface	14.70	16.33		1.63
Number of Men - Underground	134	120	14	
Average Rate Per Day - Underground	\$5.16	\$4.03	\$1.13	
Tons Per Man - Underground	4.16	4.44		.18
Total Average Men	170	153	17	
Total Average Rate	\$4.98	\$3.89	\$1.09	
Tons Per Man Per Day	3.24	3.49		.15
General Expense - Per Ton	.199	.161	.038	
Maintenance " "	.119	.133		.014
Mining Expense " "	2.041	1.547	.494	
Cost of Production " "	2.359	1.841	.518	
Average Daily Cost - Labor	\$829.00	\$626.00	\$203.00	
" " " - Supplies	\$402.00	\$368.00	\$34.00	
" " " - Total	\$1231.00	\$994.00	\$237.00	

	<u>COST OF PRODUCTION</u>	<u>LABOR</u>	<u>PER TON</u>	<u>PER TON</u>	<u>TOTAL</u>	<u>PER TON</u>	
Year 1918		247,022.48	1.587	119,845.48	.772	366,867.96	2.359
Year 1917		187,906.14	1.160	110,354.89	.681	298,261.03	1.841
INCREASE		59,116.34	.427	9,590.59	.091	68,606.93	.518

WAGE RATES, Increased: April 16th, August 1st and October 1st, 1918.
May 1st and October 1st, 1917.

GWINN MINE.

ANALYSIS OF MINING COSTS FOR 1918-1917.

	<u>YEAR 1918</u>	<u>YEAR 1917</u>
Product for Year	155,534	161,963
Average Daily Product	522	540
Number of Shifts and Hours	2-8 Hr. 51 1-8 Hr. 247	2-8 Hr. 177 1-8 Hr. 123

	1918 AMOUNT	PER TON	1917 AMOUNT	PER TON	PER TON 1918 INCREASE	PER TON 1917 DECREASE
<u>MAINTENANCE</u>						
150-Air Pipes	3,769.78	.024	3,177.30	.020	.004	
166-Ventilation	590.82	.004			.004	
<u>Total</u>	4,360.60	.028	3,177.30	.020	.008	
<u>SUPERINTENDENCE</u>						
160-Captain and Bosses	10,012.92	.064	7,329.61	.045	.019	
161-Dry House	5,229.07	.034	5,403.21	.033	.001	
<u>Total</u>	15,241.99	.098	12,732.82	.078	.020	
<u>POWER</u>						
151-Compressors	27,266.41	.175	17,585.87	.108	.067	
152-Hoisting	16,735.33	.108	9,319.34	.057	.051	
153-Pumping	9,321.61	.060	7,753.55	.048	.012	
<u>Total</u>	53,323.35	.343	34,658.76	.213	.130	
<u>MINING</u>						
156-Breaking Ore	114,355.75	.735	109,518.16	.676	.059	
157-Tramming	22,258.89	.143	16,948.77	.105	.038	
158-Filling	33.71	.000	135.42	.001		.001
159-Timbering	40,198.25	.258	29,532.84	.182	.076	
164-Sorting Ore	1,361.38	.009	438.96	.003	.006	
<u>Total</u>	178,208.68	1.145	156,574.15	.967	.179	.001
<u>DEVELOPMENT</u>						
154-Sink. & Shaft Rprs.	21,844.65	.140	7,031.94	.043	.097	
155-Drifting	37,255.55	.240	30,118.21	.186	.054	
<u>Total</u>	59,100.20	.380	37,150.15	.229	.151	
<u>HANDLING OUTPUT</u>						
162-Top Landing	5,654.36	.037	5,118.96	.032	.005	
163-Stocking Ore	1,473.86	.010	1,236.87	.008	.002	
<u>Total</u>	7,128.22	.047	6,355.83	.040	.007	
TOTAL MINING EXPENSE	317,362.34	2.041	250,649.01	1.547	.494	

GWINN MINE.
ANALYSIS OF COST SHEETS EXPLAINING INCREASE OR
DECREASE IN VARIOUS ACCOUNTS BETWEEN YEARS
1918 AND 1917.

	GENERAL EXPENSE:			
Engineering. (Acct. #27)	Year 1918	2465.71	Cost per ton	.016
	Year 1917	<u>2493.26</u>	" " "	<u>.016</u>
	DECREASE	27.55	DECREASE	.000

Analysis. (Acct. #28)	Year 1918	9557.75	Cost per ton	.062
	Year 1917	<u>8729.06</u>	" " "	<u>.054</u>
	INCREASE	828.69	INCREASE	.008

The increase is due to the increase in wages and increased cost of chemicals and laboratory supplies. Determinations for 1918 numbered 30,540 as compared to 32,635 for 1917 and cost .215 each in 1918 and .192 each in 1917. The labor of running the laboratory in 1918 increased \$1,077.71 over 1917 and chemicals and supplies cost \$938.61 more in 1918 than in 1917.

Personal Injury Exp. (Acct. #30)	Year 1918	1441.60	Cost per ton	.009
	Year 1917,	<u>1648.55</u>	" " "	<u>.010</u>
	DECREASE	206.95	DECREASE	.001

The small decrease is due to less money having been paid out as compensation for personal injuries.

Mine Office (Acct. #30a)	Year 1918	6410.36	Cost per ton	.041
	Year 1917	<u>4442.25</u>	" " "	<u>.027</u>
	INCREASE	1968.11	INCREASE	.014

The increase is due to a policeman being employed all of the year 1918 and to increases in clerk's salaries.

District Office (Acct. 30b)	Year 1918	10796.24	Cost per ton	.069
	Year 1917	<u>8594.89</u>	" " "	<u>.053</u>
	INCREASE	2201.35		.016

The increase resulted from increases in salaries and from charging out through Dist. Office approximately \$800.00 on account of Gwinn Association and expenses of Influenza epidemic.

TOTAL GENERAL EXPENSE:	Year 1918	31040.94	Cost per ton	.199
	Year 1917	<u>26027.42</u>	" " "	<u>.161</u>
	INCREASE	5013.52	INCREASE	.038

	MAINTENANCE			
Tracks and Yards (Acct. #125)	Year 1918	1268.09	Cost per ton	.008
	Year 1917	<u>787.76</u>	" " "	<u>.005</u>
	INCREASE	480.33	INCREASE	.003

The increase is the result of increases in surface wages; heavy snows in January, February and March, and expense of maintaining side tracks, which the mine did not have to bear in past years.

MAINTENANCE(cont.)

Docks, Trestles & Pockets (Acct. #126)	Year 1918	480.58	Cost per ton	.033
	Year 1917	<u>582.33</u>	" " "	<u>.033</u>
	DECREASE	101.75		.000

There was a slight decrease in the amount charged to this account due to less ^{repairs} to loading pockets at the shaft and to less repairs to permanent trestles. The production for 1918 being a little less than for 1917, left the cost per ton the same as for 1917.

Buildings (Acct. #127)	Year 1918	1517.15	Cost per ton	.010
	Year 1917	<u>619.29</u>	" " "	<u>.004</u>
	INCREASE	897.86	INCREASE	.006

The increase is on account of increased wages; a charge of \$414.69 for an addition to the barn and \$392.66 in December for enclosing headframe at top landing.

Boiler Plant (Acct. #129)	Year 1918	272.42	Cost per ton	.002
	Year 1917	<u>152.63</u>	" " "	<u>.001</u>
	INCREASE	119.79	INCREASE	.001

A comparatively heavy charge in April of \$148.27 for repairs to boilers is responsible for this increase.

Hoisting Machinery (Acct. #130)	Year 1918	1818.54	Cost per ton	.012
	Year 1917	<u>2668.83</u>	" " "	<u>.016</u>
	DECREASE	850.29	DECREASE	.004

The decrease is due to only one new skip rope being put on in 1918 as compared to two new skip ropes and one new cage rope in 1917 and to charging the cost of heating the shaft in cold weather to Hoisting instead of Hoisting Machinery.

Compressor & Power Drills (Acct. #131)	Year 1918	957.09	Cost per ton	.006
	Year 1917	<u>2948.85</u>	" " "	<u>.018</u>
	DECREASE	1991.76	DECREASE	.012

There were no new drills purchased in 1918. The decrease in this account equals very closely the amount, \$1965.00, spent for new drill machines in 1917.

Pumping Machinery (Acct. #132)	Year 1918	823.21	Cost per ton	.005
	Year 1917	<u>1462.28</u>	" " "	<u>.009</u>
	DECREASE	639.07	DECREASE	.004

There were no new permanent pumps purchased in 1918 or unusual additions to sumps, ditches, etc. entering into this account, as in 1917, when new equipment was installed on the 9th level.

Top Tram Engine & Cars (Acct. #133)	Year 1918	1901.16	Cost per ton	.012
	Year 1917	<u>1273.55</u>	" " "	<u>.008</u>
	INCREASE	627.61	INCREASE	.004

The increase is due to increased wages and to rebuilding two top tram cars which were wrecked last spring.

MAINTENANCE(cont.)

Skips and Skip Roads (Acct. #134)	Year 1918	2634.03	Cost per ton	.017
	Year 1917	<u>1329.35</u>	" " "	<u>.008</u>
	INCREASE	1294.68	INCREASE	.005

Installing rails in each skip way to prevent the skip from catching under the timbers if it should be over balanced, cost approximately \$600.00. The balance of the increase is due to repairs to skips in main shaft, repairs to cage, and overhauling auxilliary skips used in underground shaft.

Underground Tracks and Cars (Acct. #135)	Year 1918	1703.94	Cost per ton	.011
	Year 1917	<u>1772.03</u>	" " "	<u>.011</u>
	DECREASE	69.89		.000

No new cars were added in 1918. Increase in wages kept ordinary charges to this account up to a figure slightly less than that for 1917.

Electric Tram Plant Acct. #136)	Year 1918	4,619.47	Cost per ton	.030
	Year 1917	<u>7,394.23</u>	" " "	<u>.046</u>
	DECREASE	2,774.76	DECREASE	.016

No new equipment was purchased in 1918 or extensive additions made to main line tracks. But for the increase in wages and material required in the ordinary maintenance this charge would have been no more than in 1916, when it amounted to \$4093.95.

Telephones & Safety Devices (Acct. #137)	Year 1918	469.00	Cost per ton	.003
	Year 1917	<u>583.00</u>	" " "	<u>.004</u>
	DECREASE	114.00	DECREASE	.001

The decrease is due to less work of this character being necessary during the year.

TOTAL MAINTENANCE	Year 1918	18464.68	Cost per ton	.119
	Year 1917	<u>21584.60</u>	" " "	<u>.133</u>
	DECREASE	3119.60	DECREASE	.014

MINING EXPENSE

Air Pipes (Acct. #150)	Year 1918	3769.78	Cost per ton	.024
	Year 1917	<u>3177.30</u>	" " "	<u>.020</u>
	INCREASE	592.48	INCREASE	.004

The increase is due to new 3" line on the 10th level and increased wages, Chiefly to increased wages, as new installation on 10th level just about equalled new installation on 9th and 6th levels in 1917.

Compressors (Acct. #151)	Year 1918	27266.41	Cost per ton	.175
	Year 1917	<u>17585.87</u>	" " "	<u>.108</u>
	INCREASE	9680.54	INCREASE	.067

The cost of labor for operating the Central Power Plant Compressor was \$1498.83 higher in 1918 than in 1917, as a result of the several wage increases. The compressor was steam operated the entire year, which, with the increased cost of coal and increased cost of maintenance of boiler plant, caused the power charge for 1918 to increase 18528.24 over 1917. There was a small decrease in other items entering into this account, so that the total increase in the cost of operating

MINING EXPENSE (cont.)

Compressors(cont.) and maintaining the Central Power Plant Compressor amounted to \$19606.04. The Gwinn Mine proportion of this increase (Acct. #151) accounts for the increase above of \$9,680.54.

Hoisting	Year 1918	16735.33	Cost per ton	.108
(Acct. #152)	Year 1917	<u>9319.34</u>	" " "	<u>.057</u>
	INCREASE	7415.99	INCREASE	.051

The increase is due to the increases in wage rates; increase of charge for electric current from .01 to .015 per K. W.; charging the cost of heating the shaft in the winter months to Hoisting instead of Hoisting Machinery and the expense both for labor and supplies for operating an auxilliary hoist on the 9th level while developing the 10th level.

Pumping	Year 1918	9321.61	Cost per ton	.060
(Acct. #153)	Year 1917	<u>7753.55</u>	" " "	<u>.048</u>
	INCREASE	1568.06	INCREASE	.012

The increase is due increased wages; increase in cost of electric current from .01 to .015 per K. W. and operating pump on 9th level.

Sinking and Shaft Repairs	Year 1918	21844.65	Cost per ton	.140
(Acct. #154)	Year 1917	<u>7031.94</u>	" " "	<u>.043</u>
	INCREASE	14812.71	INCREASE	.097

The increase in this account is due directly to sinking the shaft from the 9th to the 10th levels, and cutting the plat and pocket at the 10th level.

Rock Drifting	Year 1918	37255.55	Cost per ton	.240
(Acct. #155)	Year 1917	<u>30118.21</u>	" " "	<u>.186</u>
	INCREASE	7137.34	INCREASE	.054

more

There were 380 feet/ of rock drifting in 1918 than in 1917 and the cost per foot due to increase in wages and costs of supplies was 99¢ per foot higher than in 1917.

Breaking Ore	Year 1918	114,355.75	Cost per ton	.735
(Acct. #156)	Year 1917	<u>109,518.11</u>	" " "	<u>.676</u>
	INCREASE	4,837.64	INCREASE	.059

Mining conditions in 1918 were very similar to those of 1917, although certain areas were somewhat restricted as compared to 1917. On the whole, the increase in this account can be attributed to higher wages paid and periods of labor shortage, as during the draft period and the influenza epidemic.

Tramming	Year 1918	22,258.89	Cost per ton	.143
(Acct. #157)	Year 1917	<u>16,948.77</u>	" " "	<u>.105</u>
	INCREASE	5,310.12	INCREASE	.038

The increase is due to increase in wages; increase in charge for electric current from .01 to .015 per K. W. and to operating two motors on the 9th level, one serving the auxilliary shaft, instead of only one motor.

Filling	Year 1918	33.71	Cost per ton	.000
(Acct. #158)	Year 1917	<u>135.42</u>	" " "	<u>.001</u>
	DECREASE	101.71	DECREASE	.001

There was very little filling done in 1918.

MINING EXPENSE(cont.)

Timbering (Acct. #159)	Year 1918	40,198.25	Cost per ton	.258
	Year 1917	<u>29,532.84</u>	" " "	<u>.182</u>
	INCREASE	10,665.41	INCREASE	.076

The increase is due to increases in wages and increased cost of timber, which was approximately \$4000.00 more in 1918 than in 1917; retimbering on the 8th level and more timber trammers required to distribute timber to the more isolated contracts.

Captain and Bosses (Acct. #160)	Year 1918	10,012.92	Cost per ton	.064
	Year 1917	<u>7,329.61</u>	" " "	<u>.045</u>
	INCREASE	2,783.31	INCREASE	.019

This increase is due to increases in salaries and wages.

Dry House. (Acct. #161)	Year 1918	5,229.07	Cost per ton	.034
	Year 1917	<u>5,403.21</u>	" " "	<u>.033</u>
	DECREASE	214.14	INCREASE	.001

The coal burned in the heating plant in 1917 cost \$2694.03 and in 1918, \$2142.39, a difference of \$551.64 but due to increase in wages, \$337.50 of this decrease was balanced, leaving a total decrease in this account of \$214.14.

Top Landing and Trammig (Acct. #162)	Year 1918	5,654.36	Cost per ton	.037
	Year 1917	<u>5,118.96</u>	" " "	<u>.032</u>
	INCREASE	535.40	INCREASE	.005

This increase is due almost entirely to increases in wages. A small portion of it is due to increase in cost of electric current from .01 to .015 per K. W.

Stocking Ore. (Acct. #163)	Year 1918	1,473.86	Cost per ton	.010
	Year 1917	<u>1,236.87</u>	" " "	<u>.008</u>
	INCREASE	236.99	INCREASE	.002

The increase is directly the result of increases in wages.

Sorting Ore (Acct. #164)	Year 1918	1,361.38	Cost per ton	.009
	Year 1917	<u>438.96</u>	" " "	<u>.003</u>
	INCREASE	922.42	INCREASE	.006

This account shows an increase, which is due chiefly to more careful time-keeping on this particular operation in regard to miners sorting rock from ore underground.

Ventilation (Acct. #171)	Year 1918	590.82	Cost per ton	.004
	Year 1917	<u>000.00</u>	" " "	<u>.000</u>
	INCREASE	590.82	INCREASE	.004

In 1918 a blower was used to clear the drifts of smoke after blasting on the 10th level and in the shaft when sinking, before the main shaft was connected between the 9th and 10th levels.

MINING EXPENSE(cont.)

TOTAL MINING EXPENSE:	Year 1918	317,362.34	Cost per ton	2.041
	Year 1917	<u>250,649.01</u>	" " "	<u>1.547</u>
	INCREASE	66,713.33	INCREASE	.494
COST OF PRODUCTION:	Year 1918	366,867.96	Cost per ton	2.359
	Year 1917	<u>298,261.03</u>	" " "	<u>1.841</u>
	INCREASE	68,606.93	INCREASE	.518

The increase in cost of production is due to

1. Increases in wages.
2. Increases in cost of supplies.
3. Labor shortage.
4. Decrease of 6,429 tons in production.

E & A #366, HOISTING PLANT, UNDERGROUND, GWINN MINE.

MADE APRIL 29, 1918 - COMPLETED DEC. 31, 1918.

	ESTIMATE	EXPENDED TO DATE	UNEXPENDED BALANCE	OVERRUN
1 Hoist and Motor	2050.00	2050.25		.25
2 Freight	30.00	19.50	10.50	
3 Foundation	75.00	248.11		173.11
4 Labor, Installing Hoist	40.00	209.25		169.25
5 3 Sheaves, Bearings, etc.	50.00	176.17		126.17
6 600' 3/4" Rope	96.00		96.00	
7 Overhauling 2-1 Ton Skips	100.00	5.44	94.56	
8 Wiring for Hoist	40.00	11.70	28.30	
9 Signal System	50.00	23.62	16.38	
Total	2531.00	2754.04		223.04
10% for Contingencies	50.00			50.00
GRAND TOTAL	2581.00			173.04

There was a slight overrun on this E & A due to estimate being too low for three items - Foundation, Labor Installing Hoist and Sheaves for Rope Line. Sufficient allowance was not made for these items.

3. Foundations - Overrun \$173.11. The actual cost was made up as follows; Labor \$162.77, Supplies \$85.34. The supplies included cement, gravel and foundation bolts; the labor, drilling holes for foundation bolts, installing the concrete foundations and grouting in hoist.

4. Labor, Installing Hoist - Overrun \$169.25. The estimate for this account was entirely too low. The expense of taking hoist apart, moving it underground, and setting it up was not given sufficient consideration when making the estimate.

5. Sheaves, Bearings, Etc. - Overrun \$126.17. The actual cost was made up as follows; Labor \$104.07, Supplies \$72.10. Roller bearing sheaves were used which cost more than the type estimated. Some difficulty was experienced in placing sheaves at the pocket, which increased the labor cost. Two small skips operated in balance, which required six sheaves instead of three as originally estimated; this increased both the labor and supply cost.

E & A #331, ELECTRIC HAULAGE, FRANCIS MINE.

MADE NOV. 27, 1916 - COMPLETED DEC. 31, 1918.

	ESTIMATE	EXPENDED TO DATE	UNEXPENDED BALANCE	OVERRUN
1 Motor Generator Set	3000.00	3006.55		6.55
2 Cable from Engine House to Levels	1200.00	1307.00		107.00
3 Trolley Wire and Bonding	1000.00	741.99	258.01	
4 Two Locomotives	6000.00	5672.00	328.00	
5 Installation	800.00	1855.37		1055.37
Total	<u>12000.00</u>	<u>12582.91</u>		<u>582.91</u>
10% for Contingencies	1200.00			1200.00
GRAND TOTAL	<u>13200.00</u>	<u>12582.91</u>	617.09	

There was only an overrun in three items on this E & A, the total cost coming within the amount estimated.

1. Motor Generator Set - Overrun \$6.55. The motor generator set cost \$2977.50 and the freight charge was \$49.05, the total cost being \$3006.55. The overrun was probably due to not allowing a sufficient amount for freight.

2. Cable from Engine House to Levels - Overrun \$107.00. Originally 1360 feet of cable, costing \$1307.00, was purchased for the Francis Mine. This cable was taken to the Gardner-Mackinaw and the 1200 ft. cable, which had been ordered for the Gardner-Mackinaw, was later sent to the Francis. The Francis still has on hand and not used 160 feet of cable which will be available for use when the shaft is sunk. This account is entitled to a credit of \$123.60 for this piece of cable.

5. Installation - Overrun \$1055.37. The estimate was made in 1916 and the work was not done until in the fall of 1918. A large part of the overrun is therefore due to increases in wages and cost of supplies. No provision was made in the estimate however for the last two items, i. e. excavating motor pit underground and for work in drifts on account of installation of motor haulage.

The detail of cost of installation is as follows:

Wiring and Bonding, 4th and 5th Levels-----	\$736.51
Installing cable in shaft-----	37.95
Freight on motor cars and motors, taking two motors and 12 motor cars underground-----	244.58
Installing motor generator set and switchboard-----	274.94
Cable used at switchboard-----	170.18
Excavating motor pit underground (For repairing motors)-----	169.69
Work in drifts account installation of electric haulage-----	221.52
Total	<u>\$1855.37</u>

E & A #330, ELECTRIC SKIP HOIST, FRANCIS MINE

MADE JULY 1916 - COMPLETED JAN. 1918.

	ESTIMATE	EXPENDED TO DATE	UNEXPENDED BALANCE	OVERRUN
1 Hoist	5300.00	5100.00	200.00	
2 Herringbone Gear	2000.00	1987.00	13.00	
3 Motor and Switchboard	5300.00	5625.82		325.82
4 Foundation and Installation	1000.00	2600.00		1600.23
5 One Skip	400.00	407.00		7.00
Total	<u>14000.00</u>	<u>15720.05</u>		<u>1720.05</u>
10% for Contingencies	1400.00			1400.00
	<u>15400.00</u>	<u>15720.05</u>		<u>320.05</u>

This E & A shows an overrun in two items, Motor and Switchboard, and Foundation and Installation.

3. Motor and Switchboard - Overrun \$325.82. The motor and switchboard cost \$5122.00, freight was \$83.32, making cost delivered to mine \$5205.32. The cost of cable used in installation was \$245.70. There was also charged to this account one geared limit switch, costing \$175.00. This was a safety device to prevent overwinding. The mine clerk did not have any authority for charging it out to this account.

4. Foundation and Installation.- Overrun \$1600.23. It was originally planned to have only one hoist at this property, the foundations for which were installed about four years ago. When it was decided to install two hoists at this property it became necessary to remove this old foundation. The cost of this work was \$187.17, a charge which was not taken into consideration at the time the estimate was made. The labor cost of each item was materially increased due to the several wage increases which took place before this work was done. It would appear, however, that the original estimate was too low to cover the cost of foundations, and the cost of installing hoist, motor and switchboards. The detail of charges to this account was as follows:

Blasting out old foundations	\$187.17
Excavating for foundations	65.56
Foundation Forms	267.61
Foundations(Labor and Supplies)	450.64
Installation of Hoist, Motor & Switchboard	<u>1636.60</u>
	2607.58

E & A #342, DWELLINGS - GWINN TOWNSITE.

MADE MAY 1917 - COMPLETED DEC. 1918.

	ESTIMATE	EXPENDED TO DATE	UNEXPENDED BALANCE	OVERRUN
1 Five Double Houses with basements	11805.00	12507.36		702.36
2 Two Single Houses with basements	4062.00	4679.69		617.69
3 Sewer and Water Connections	500.00	352.52	147.48	
4 Fencing	500.00	1159.76		659.76
5 Wiring Double Houses		254.65		254.65
6 " Single "		92.93		92.93
7 Engineering		4.69		4.69
8 Grading		165.43		165.43
Total	16867.00	19217.03		2350.03
10% for Contingencies	1687.00			1687.00
GRAND TOTAL	18554.00	19217.03		663.03

The main reason for the overrun was due to overlooking several items when making the estimate.

1. Five Double Houses with Basements - Overrun \$702.36. The contract price on these houses was \$11603.44, which was less than the amount estimated. The overrun was due to two changes made in plan of houses after the contract was let. An archway was made between the two front rooms downstairs on all houses and a toilet and bathroom installed in two double houses. The additional cost was \$677.80 for these two items. There was also an item of \$147.00 for installation of hot water tanks in the four houses in which bathrooms were installed.

2. Two Single Houses with Basements - Overrun \$617.69. The contract price on these houses was \$4062.24. The overrun is due to installing a steam heating plant in each house. The rent was increased to cover interest on this additional expense.

4. Fencing - Overrun \$659.76. The original estimate was too low for the type of fence which was built. Owing to delay in delivery of the fencing material, this work was not done until after several wage increases had taken effect which materially increased the cost.

5. Wiring Double Houses - Overrun \$254.65. No provision was made in the original estimate for wiring so that this item is an extra.

6. Wiring Single Houses - Overrun \$92.93. No provision was made in original estimate for wiring these houses.

8. Grading - Overrun \$165.43. No estimate was made for grading in the original estimate. Some ground had to be hauled in to provide for proper grades at the two single houses.

E & A #359, HOIST NO. 3 SHAFT, PRINCETON MINE.

MADE JAN. 25, 1918 - COMPLETED DEC. 31, 1918.

	ESTIMATE	EXPENDED TO DATE	UNEXPENDED BALANCE	OVERRUN
1 Engine Room	800.00	1057.78		257.78
2 Foundation for Hoist	250.00	537.83		287.83
3 Dismantling and Moving Hoist from #1 and Erecting	275.00	624.02		349.02
4 Pulley Stands	90.00	173.55		83.55
5 Hoisting Ropes	450.00	354.33	95.67	
6 400 ft. Counter Balance Pipe	1316.00	1840.19		524.19
7 Counter Balance	300.00	460.73		160.73
8 Signal System, Lights, etc.	175.00	544.82		369.82
9 Standard Cage	675.00	1374.61		699.61
10 Head Sheaves	325.00	692.70		367.70
Total	<u>4656.00</u>	<u>7660.56</u>		<u>3004.56</u>
10% for Contingencies	465.00			465.00
GRAND TOTAL	<u>5121.00</u>	<u>7660.56</u>		<u>2539.56</u>

1. Engine Room - Overrun \$257.78. The contract for erection of building amounted to \$769.98. The balance of cost was due to installation of concrete floor, grading around building, erecting brick chimney and purchase of stove for heating. These items were not given consideration at the time of making the E & A, the estimate being based on the contractor's bid for building without floor.

2. Foundations for Hoist - Overrun \$287.83. The estimate of cost of foundations for the hoist did not allow for cost of excavating for foundations nor for the advance in costs of labor and supplies, which took place before this work was done.

3. Dismantling and Moving Hoist from #1 Shaft and Erecting - Overrun \$349.02.

The high cost for this work was due to extensive repairs which it was found necessary to make to the hoist after it was dismantled, preparatory to moving to No. 3 engine house. Two wage increases were effective before the hoist was finally installed which increased the cost of erecting.

4. Pulley Stands - Overrun \$83.55. The pulley stands were not erected until in the fall by which time two wage increases were effective. Sufficient allowance was not made, however, in the original estimate for this work. The pulley stands are substantially built to carry two sheaves, one for the cage and one for the counter balance rope at different elevations.

6. Counter Balance Pipe - Overrun \$524.19. The overrun in this account is due to an error in the clerical department at the mine. The requisition for counter balance pipe called for 300 feet for Princeton and 125 feet for Gwinn Mine. The 125 feet belonging to Gwinn Mine was charged out to the Princeton and the error was not discovered until E & A #359 was closed. The Gwinn Mine actually received 113'2" of the pipe, costing \$470.77. The small balance of overrun is due to freight charge on pipe and labor unloading.

7. Counter Balance - Overrun \$160.73. The counter balance weight cost \$319.40 and the cost of installing counter balance pipe in the shaft, \$140.61, was charged to this account, which accounts for the overrun.

8. Signal System, Light, Etc. - Overrun \$369.82. The original estimate was entirely too low. The signal system, lights and telephones required an 8 conductor cable, which alone cost more than the amount estimated. There was also the expense of conduit pipe for surface lights at shaft and underground; the cost of telephones etc. Through an error by the mine clerk \$69.29 was charged for cable which was not used and which was later sold to the Gwinn Mine.

9. Standard Cage - Overrun \$699.61. The estimate for E & A was based on the probable cost of building cage in the Hard Ore Shops. A contract was later given the Lake Shore Engine Works for \$800.00 or \$125.00 more than the estimated cost. When the cage was received it was found too large for No. 3 shaft, which is a few inches smaller than the standard sized shaft. This was overlooked by the Mechanical Department when they gave the order to the Lake Shore Engine Works, and I also overlooked it as I did not know that this shaft was not standard size.

10. Head Sheaves - Overrun \$367.70. The actual cost, \$692.70 was made up as follows; Labor \$454.58 and Supplies \$238.12. The estimate of \$325.00 was too low on account of overlooking the fact that the head frame at No. 3 shaft had not been completed. Considerable work had to be done on the top of headframe before the head sheaves could be installed. The sheaves which were used had to be taken down from the top of No. 1 headframe and moved over to No. 3, also the old bearings were rebabbited. The greater part of the charge for supplies was made up of fir timber used in completing No. 3 headframe.

The estimate of the cost of this E & A was made without a thorough investigation of each item. Due allowance for increases in wages account of delays in the work was not made and also some items were overlooked entirely. It was impossible to foresee that the hoist taken out from No. 1 engine house had to be repaired, for this did not develop until the hoist was dismantled. The analyses of this E & A indicates that a liberal allowance above the expected cost should be made when using old equipment, also that each item of E & A should be thoroughly investigated before submitting the estimate.

REPUBLIC MINE.

PRODUCTION.

The product for the year, 1918, was as follows:-

No. 9 Shaft,	Bessemer Ore,	Shipped from Pockets,	27,997 tons
"	Pascoe	" " " "	11,681 "
Pascoe Shaft,	Bessemer	" " " "	25,530 "
"	Basic	" " " "	15,362 "
No. 9 Shaft,	Bessemer Ore,	Stocked,	20,901 "
"	Pascoe	" " " "	8,724 "
Pascoe Shaft,	Bessemer	" " " "	15,697 "
"	Basic	" " " "	<u>16,584 "</u>
TOTAL,			<u>142,476 "</u>

A summary of the above by grades follows:-

Bessemer Ore Hoisted,	90,125 tons,	63.3%
Basic " "	31,946 "	22.4%
Pascoe " "	<u>20,405 "</u>	<u>14.3%</u>
TOTAL,	<u>142,476 "</u>	<u>100.0%</u>

For sake of comparison, the product for the two previous years is shown:-

	<u>1917</u>	<u>1916</u>
Bessemer Ore,	101,263 tons, 66.1%	99014 tons 57.3%
Basic " "	30,682 " 20.0%	38904 " 22.4%
Pascoe " "	21,480 " 13.9%	35178 " 20.3%
TOTAL,	<u>153,425 " 100.0%</u>	<u>173096 " 100.0%</u>

It will be seen that the product has decreased steadily for the last three years, dropping from 173,096 tons in 1916 to 153,425 in 1917 and to the still lower figure of 142,476 tons in 1918. This, however, is to be expected if we examine the ore estimate carefully showing the available broken ore on stulls and the ore left in place each year available for mining.

The following table shows the available ore reserves at the beginning of the last three years:-

ORE RESERVES ON HAND ON JANUARY 1ST.

<u>YEAR</u>	<u>AVAILABLE BROKEN ORE ON STULLS.</u>	<u>AVAILABLE ORE IN PLACE IN SIGHT.</u>	<u>TOTAL</u>
1916	177,934 tons,	184,550 tons,	362,484 tons
1917	132,630 "	63,390 "	196,020 "
1918	73,538 "	100,926 "	174,464 "

Take the year 1918 for example. We hoisted 142,476 tons whereas the ore reserves were only estimated at 174,464 tons. We started the year with only about half the broken ore on hand that we had the year before. That means that we had to break the bulk of our tonnage before it could be hoisted and in fact we broke 95% of the ore that was produced. We were dependent on the working stopes for the bulk of our tonnage, not having the broken ore in reserve that existed in 1915. At the beginning of that year, there were 213,000 tons of broken ore on hand.

It is obvious that the reduction in ore reserves from 213,000 tons on January 1st, 1915, to 73,538 tons on January 1st, 1918, would make it difficult to keep up the hoist.

From the looks of the mine underground, it seems as though the tide has turned. I anticipate that the product for 1917 will exceed that of last year. We are now slowly increasing our ore reserves and the opening up of new ore bodies on the two new levels will keep our product up.

Although we could have maintained a larger product if we had a few more trammers employed during the summer months, it really was not advisable because it simply meant that sooner or later our product would suffer. If we can keep our miners busy breaking ore in all of the known ore areas, it is not advisable to try to hoist more ore than is being broken. Some months we could produce a tonnage of say 16,000 tons but the following month we would have to drop back to 8,000 or 9,000 tons. At the present rate, we are breaking ore, the mine is good for an average of 550 tons per day.

The rock hoist for the year was 30,479 tons, practically all of which came from the shaft sinking and rock drifting. Very little rock came from the stopes, as the ore is cleaner than it was a year ago.

MONTHLY PRODUCTION AND TONS PER DAY, ETC.

MONTH	YEAR 1917				YEAR 1918			
	PRODUCT	TONS PER DAY.	NO. MEN	TONS PER MAN PER DAY	PRODUCT	TONS PER DAY.	NO. MEN	TONS PER MAN PER DAY
Jan.	13,863	533	237	2.24	12,744	490	221	2.21
Feb.	13,869	578	238	2.41	11,602	483	219	2.20
Mar.	14,850	550	240	2.28	10,990	440	219	2.01
Apr.	11,583	504	251	1.99	11,670	449	209	2.15
May,	15,225	586	260	2.32	15,795	585	228	2.57
Jun.	12,969	519	255	2.02	10,572	441	222	1.99
Jul.	12,150	486	255	1.90	12,895	496	216	2.27
Aug.	13,067	484	246	1.97	11,923	459	222	2.06
Sep.	13,602	567	241	2.36	10,517	457	230	1.98
Oct.	12,332	457	235	1.94	12,278	455	233	1.95
Nov.	9,846	394	222	1.77	10,268	446	228	2.04
Dec.	10,069	420	219	1.99	11,222	493	215	2.17

You will note that the month of May, 1918, was the banner month for the year. In fact, the tons per man was exceeded only twice previous since the Cleveland-Cliffs Iron Company acquired this property, namely, August and September, 1915, at which time, labor was plentiful and there were a quarter of a million tons of available broken ore on the stulls.

I anticipate that the year 1918 will be the turning point and that the product for 1919 will show a considerable increase.

TRAMMING.

Although the number of trammers employed during the year was the least in the history of the Mine, the cars per man per day trammed increased. Under the stimulus of high wages, our trammers surely worked to the limit. If they had not responded, our product would have been very small.

The following table shows these facts:

YEAR	AVERAGE NO. OF TRAMMERS	TOTAL CARS TRAMMED	DAYS	CARS PER TRAMMER PER DAY
1914	33	67,519	5353	12.6
1915	39	150,969	12172	12.4
1916	38	140,725	11429	12.3
1917	30	119,883	9122	13.1
1918:				
Jan.	28	9,171	730	12.6
Feb.	27	8,664	634	13.7
Mar.	25	8,828	617	14.3
Apr.	22	8,404	582	14.4
May,	26	10,548	696	15.1
Jun.	20	7,246	484	15.0
Jul.	20	8,586	520	16.5
Aug.	18	7,688	456	16.8
Sep.	19	6,829	431	15.9
Oct.	18	8,166	499	16.3
Nov.	19	6,850	414	16.5
Dec.	18	7,379	432	17.1
TOTAL,	21.7	98,359	6495	15.1

The above table shows how the efficiency of the trammers increased. You will note the few trammers employed since May, but the cars trammed have risen steadily until December shows our trammers averaging about five cars more per day than ever before.

I believe our trammers deserve a great deal of credit in trying to keep the product up to the maximum of their ability.

COST OF PRODUCTION.

MONTH	1917 COST SHEET COST OF PRODUCTION			1918 COST SHEET COST OF PRODUCTION		
	LABOR	SUPPLIES	TOTAL	LABOR	SUPPLIES	TOTAL
Jan.	1.532	.604	2.136	1.832	1.023	2.855
Feb.	1.428	.626	2.054	1.864	1.108	2.972
Mar.	1.495	.645	2.140	2.044	1.190	3.234
Apr.	1.658	.833	2.494	1.981	.984	2.965
May,	1.581	.686	2.267	1.725	.770	2.495
Jun.	1.728	1.232	2.958	2.339	.951	3.290
Jul.	1.837	.932	2.328	2.024	.957	2.981
Aug.	1.761	1.128	2.889	2.398	.844	3.242
Sep.	1.587	1.048	2.635	2.495	.940	3.435
Oct.	2.032	1.110	3.142	2.778	.939	3.717
Nov.	2.218	1.164	3.382	2.790	1.215	4.005
Dec.	2.018	1.166	3.184	2.677	.994	3.671
AVERAGE,	1.628	.966	2.594	2.165	1.038	3.203

A comparison of the costs shows that the cost of production has increased 23.5% compared with 1917. The cost per ton for supplies has been kept down, notwithstanding price increases, so that the increased cost is due to the labor charges.

The wage increases for the years 1917 and 1918 were as follows:-

10% on May 1st, 1917,
 10% " Oct. 1st, 1917,
 15% " Apr. 15th-1918,
 10% " Aug. 1st, 1918,
 10% " Oct. 1st, 1918.

This makes an average increase of 21.6% for the year 1918. You will note that the increase in the cost per ton approximates the wage increase almost exactly.

SHIPMENTS.

The shipments for the year amounted to 151,171 tons.

The ore was consigned to the following points:-

SHIPPED TO:	BESSEMER		BASIC		PASCOE		TOTAL
	LUMP	CRUSHED	LUMP	CRUSHED	LUMP	CRUSHED	
L.S. & I. Docks,	33499	45922	19186	17445	13395	18997	148444
Thomas Furnace Co.		2152					2152
Ashland Furnace,				575			575
TOTAL,							151171

The Lump shipments totalled 66,080 tons. There was a heavy demand for this kind of ore and we screened all the ore that went through our Crushing Plant. The Lump ore equalled 43.6% of the entire shipments. This is the largest proportion of Lump ore ever forwarded from the mine, being nearly half the entire product.

LOW PHOSPHORUS ORE:-

We shipped 2152 tons of very high grade ore to the Thomas Furnace Co. of Milwaukee. The average of the entire shipment was: 67.42 Iron, .019 Phosphorus.

We took the greatest care to secure this ore and keep it clean of rock. The bulk of the tonnage came from #2 Stope, 2272' Level, Pascoe Shaft. The ore on the day shift was sampled from each skip and dumped into a storage pocket on surface. The night shift ore was similarly sampled and stored separately. The following day this ore would be dumped into separate railway cars and held until the analysis could be run. If the Phosphorus analyzed less than .020, the railway car containing this ore was tagged: "Special Ore" and put on a side track. When four cars of this "Special Ore" were accumulated, they would be switched to the Crusher. All the pockets, screens, crusher and slides were then carefully cleaned out with brooms, after which the "Special Ore" would be dumped and crushed and loaded into gondolas. The car sample was taken by holding a scoop in the stream of ore running into the car. Each car sample weighed about 150 lbs. If the average analysis of the latter sample of the four gondolas ran .020 or less, all the cars would be sent forward. If the average ran higher than .020, the car or cars that ran too high would be dumped and reloaded with other ore.

GRADING SHIPMENTS.

The experience of the two previous seasons proved that the method of mixing the ores adopted in 1916 gave satisfactory results and so all cargoes were made up the same way. The scheme in brief was to use either one or two dock pockets as a unit and to mix the ore in the pockets by having the low grade ore dumped on top of the high grade ore, finishing off again with high grade ore. When the proportions in the mixture were multiples of the number of cars dumped into one pocket, each pocket would contain the same amount of ore of each grade. If the proportions were multiples of the total cars dumped into two pockets, then every other pocket contained the same ore.

The scheme was explained fully in the 1916 Annual Report.

We had trouble at various times during the year checking the lower Lake chemists. We would check fine on say a half dozen cargoes and the following lot would show varying results. Then would come a period when the mine and lower Lake analysis would agree closely.

During 1917, we checked fine all through the season. Having employed the same sampler and using exactly the same equipment and methods in 1918, we could find no reason for the discrepancies. Some of the lower Lake results were preposterous and I am positive the trouble was at the lower end. Another reason why the mine analysis was more liable to be right was due to the smaller quantity of Pascoe grade ore used in all the mixtures. We did not produce enough of that grade of ore and consequently had less to put into the mixtures. For the sake of comparison, I submit the comparative analysis for 1917 and 1918 and the cargo mixtures for the last two years:-

COMPARATIVE ANALYSIS.

	<u>MINE ANALYSIS</u>		<u>LOWER LAKE</u>	
	<u>IRON</u>	<u>PHOS.</u>	<u>IRON</u>	<u>PHOS.</u>
1917.				
Republic Lump,	63.75		63.96	
Bessemer Crushed,	62.60	.038	62.80	.038
Basic "	61.59		61.89	
1918.				
Republic Lump,	64.70	.048	64.07	
Bessemer Crushed,	62.70	.0366	62.51	.0365
Basic "	62.57	.055	62.73	

You will note that all three grades of ore show a higher Iron content than 1917, increasing the value per ton of ore shipped. The mine and lower Lake analysis on the crushed ores show a fine check, especially on the Phosphorus which checks within .0001%

BASIC LUMP CARGOES.

	<u>1917</u>		<u>1918</u>	
Bessemer Lump,	30659 tons	48.8%	33499 tons	50.6%
Basic "	18358 "	29.2%	19186 "	29.0%
Pascoe "	13882 "	22.0%	13395 "	20.4%
	<u>62899 "</u>	<u>100.0%</u>	<u>66080 "</u>	<u>100.0%</u>

BESSEMER CRUSHED CARGOES.

	<u>1917</u>		<u>1918</u>	
Bessemer Ore,	51438 tons	67.5%	45437 tons	68.6%
Pascoe "	13909 "	18.3%	14102 "	21.4%
Abbotsford Ore,	1149 "	1.5%		
Holmes "	9619 "	12.7%	6616 "	10.0%
	<u>76115 "</u>	<u>100.0%</u>	<u>66155 "</u>	<u>100.0%</u>

BASIC CRUSHED CARGOES.

	<u>1917</u>		<u>1918</u>	
Bessemer Ore,	8080 tons	21.4%	573 tons	2.6%
Basic "	17622 "	46.8%	17350 "	76.0%
Pascoe "	11825 "	31.4%	4893 "	21.4%
Abbotsford Ore,	176 "	.4%		
	<u>37703 "</u>	<u>100.0%</u>	<u>22815 "</u>	<u>100.0%</u>

The only cargoes that we had any trouble checking with the lower Lake chemists were the Basic Lump mixtures which carried less Pascoe ore than the year previous. During 1917, there was no trouble with this mixture and there should have been less trouble during 1918.

SORTING ORE.

This problem was not as serious during 1918 as in previous years, due to cleaner ore secured from the stopes. In 1917, we discarded 30.6% of the No. 9 hoist which represented rock picked from the Belt. The percentage of the No. 9 product picked from the Belt in No. 9 Shaft was reduced to about 10% during 1918.

FARM.

The crops from the farm were poor; the weather conditions were far from favorable for the hay crop. Some oats were grown. A portion of the farm was turned over to the employees who grew potatoes and garden truck.

The hay crop amounted to 15 tons and 309 bushels of oats were produced.

TOWNSHIP LIGHTING.

Current continues to be furnished the Township of Republic. During the latter part of 1917, current was sold at a loss, but the installation of the Generator at the Water Power Plant brought the cost per K.W.H. down from over 3¢ to .004¢. The following table shows the electricity sold the Township:-

YEAR	K.W.H.	RATE	AMOUNT
1915	33637	3¢	\$1009.11
1916	36789	"	1103.67
1917	43246	"	1297.38
Jan., 1918,	4620	"	138.60
Feb., "	4210	"	126.30
Mar., "	3420	"	102.60
Apr., "	2862	"	85.86
May, "	2720	"	81.60
Jun., "	2305	"	69.15
Jul., "	2450	"	73.50
Aug., "	2660	"	79.80
Sep., "	3205	"	96.15
Oct., "	4015	"	120.45
Nov., "	4684	"	140.52
Dec., "	5929	"	177.87
TOTAL 1918	43080	"	1292.40

ESTIMATED PRODUCTION.

The product for the ensuing year is estimated at 500 tons per day. We will have no trouble reaching or exceeding this figure if our underground development work continues favorable. At the end of 1918, we were breaking ore at the rate of 550 tons per day and if we have stopes to work in so that we can keep on breaking 15,000 tons monthly, our product can be kept up to that figure.

I believe that there will be no shortage of trammers and therefore if we find the ore, we ought to be able to get it to the shaft as fast as we can break tonnage.

DELAYS.

We had the least number of delays in recent years. The Pascoe Shaft skip-road which is one of our constant source of troubles, has been kept in such repair that most of the delays from this source have been eliminated. The delays follow:-

DATE	HOURS LOST	SHAFT	CAUSE OF DELAY	PRODUCT LOST
Jan. 5,	2½	Pascoe,	Fan broke on 1710' Level,	50 tons,
" 22,	3¼	"	Broken rail,	50 "
Feb. 7,	8	No. 9,	Broken piston on hoist,	125 "
" 14,	2	Pascoe,	Feed Water Heater leaking,	50 "
" 25,	1½	"	Broken Fan,	50 "
Apr. 11,	6½	"	Hanging Roller torn down,	100 "
" 12,	8	"	" " " "	150 "
" 18,	2	"	Rope caught in hanging rollers,	50 "
Jul. 3,	4½	"	Skip derailed,	100 "
Sep. 20,	3½	"	Repairing skip-road,	75 "
Oct. 1,	4	No. 9,	Balance rope broken,	75 "
" 21,	2½	Pascoe,	Repairing Skip-road,	75 "
" 29,	16	"	Skip derailed,	300 "
" 30,	6½	"	Repairing Skip-road,	100 "
Dec. 13,	1	"	Top Tram car off track,	40 "

Compared with the previous four years, the delays have been reduced greatly; in fact, we had only one-fourth as many as the previous two years.

LABOR & WAGES.

Wages have been increased until they are nearly 110% greater than the wage scale effective August 1st, 1915. The trammers wages in this mine have increased from 24¢ per car to 51¢ per car, or 112%. Notwithstanding the large pay, it was impossible to keep our tramming gangs filled during the summer months.

ENGINEERING.

All of the surveying is done by engineers from the Central Office at Ishpeming. Considering the increase in wages, the cost of doing this work is but little more than last year.

ANALYSIS.

The Stope, Stockpile and car samples are analyzed by resident chemist. He spends half of his time during the shipping season calculating cargoes and taking general charge of the shipping. The cost per unit has increased slightly during the year.

YEAR	DETERMINATIONS	COST PER DETERM.
1916	6,683	.31851
1917	5,997	.43170
1918	6,717	.30750

You will note that the cost per determination has dropped. This is due partially to larger number of determinations and partially to the fact that less labor was employed preparing the samples. The reason for the increase in the number of determinations was the all-rail shipments of low Phosphorus ore to the Thomas Furnace Company. We took extra stope samples and additional top landers samples in order to make the maximum tonnage of this high grade ore.

PERSONAL INJURIES.

The number of accident for the last few years is as follows:-

1915,	111 Accidents,
1916,	99 "
1917,	79 "
1918,	61 "

The reduction in the number of accidents is very gratifying and I hope we have as good fortune in 1919. It is impossible to prevent all accidents and their prevention is sometimes a matter of good luck. Some of our men have had narrow escapes from severe injuries.

This property has a number of stopes in which the men have to be most careful to guard against falls from the back. The Pascoe grade ore is particularly hazardous.

As a result of the small number of accidents, the personal injury expense for 1918 was small.

MINE OFFICE.

The mine office force is unchanged in number and personnel. Although we have a larger force than may seem necessary for the number of men employed, the extra work brought on by the War kept the force pretty busy. The Liberty Loan collections and receipts, the Marquette County War Relief collections, daily explosive reports, Red Cross subscriptions, War Savings Stamps, etc., made extra work. In addition, all the Spies Mine reports and correspondence had to be written in this office. In fact, the stenographic work was doubled.

CRUSHER & POCKETS.

The storage pockets at the Crushing Plant used to store the ore from No. 9 Shaft were entirely rebuilt. Although these pockets are constructed entirely of wood, they will probably last a few years. There is a question, though, as to whether the capacity of these pockets will be large enough to handle all the ore when our entire out-put will be handled through the No. 9 Shaft.

The Crusher did not give us nearly as much trouble as in previous years. The principal source of worry was the clutch that drove the main shaft belt wheel. This was constantly giving out and closing the plant down. We removed this and put in a rigid coupling and an auto starter. The current would be thrown on gradually with the starter and after the Crusher was up to speed, no further trouble could come up. The main shaft broke in two during the year shutting the plant down for four days. Repairs were made as quickly as possible and no ore was tacked.

New screens and concaves were ordered. These will be placed in position so that at the beginning of the 1919 shipping season, the plant ought to be in first class shape.

The "Fine" ore loading pocket was raised 6" which permitted us to load more ore into the railway cars. In fact, we can now load the cars 40% over the rated capacity. This change permitted us to put 2,200 tons of ore through the Crushing Plant daily until we were halted by the Cleveland Office for exceeding our schedule.

BUILDINGS.

The roofs on the Warehouse and barn were patched. On house #2, we placed a new roof.

At the #5 Engine House, a temporary heating system was installed. Since the steam driven generator was shut down, the Engine House has been very cold during the winter, the only heat radiation coming from the hoist cylinder. Although we do not expect to operate this plant much longer, still some method of heating had to be devised so the exhaust steam line was piped up so that the exhaust was made to travel through a 10" pipe installed inside the building. The radiation from this pipe is sufficient to keep the building warm.

A new Picking Belt was installed at the No. 9 Shaft House. It took two days to complete the installation, during which time, the rock pickers sorted out the rock as the ore was dumped direct onto the stockpile.

SHOP MACHINERY.

Notwithstanding the increased cost of supplies, the Shop Machinery expense for 1918 was much less than for 1917. The Drill Sharpener gave us less trouble. We purchased a set of gauging blocks for the Drill Sharpener that gave us fine results.

I have been experimenting for two years to find a type of bit most suited to our ground. We experimented with the Carr bit, Bull bit, Rose bit, 5° double taper bit and 8° double taper bit. The latter bit finally did the business, reducing the number of steels sharpened by 50%. The number of bits per ton of ore before and after installing the 8° gauging blocks, was as follows:-

Before	1.05 tons of broken ore per bit.
After	2.40 " " " " " "

Before making the change, the bits had a 15° taper. Now we sharpen them in a 15° dolly and swage them on an 8° gauging block which forges a better bit and makes the gauge absolute so that the steels follow correctly.

BOILER PLANT.

There were some minor repairs made at the Central Plant on the boilers themselves. We purchased a turbine flue cleaner that made it possible to keep the boilers entirely free from scale. A new roof was also put on the Boiler House. The old roof was in bad shape ever since the severe windstorm of May, 1916.

The most marked saving in connection with the Boiler Plant was the large saving in fuel. We burned the least coal in the history of the mine and probably had the poorest grade of fuel to get the results from. We hoisted the most tons of ore per ton of coal, -the month of May, 1918, being a record breaker.

YEAR	TONS ORE HOISTED	POUNDS COAL PER TON ORE	TONS COAL BURNED.	AVERAGE MONTHLY CONSUMPTION
1914	124,920	148.4	8,949	746
1915	185,212	71.0	7,158	596
1916	173,096	102.2	8,436	702
1917	153,425	115.3	8,567	713
Jan., 1918	12,744	134.2	834	834
Feb., "	11,602	123.8	694	694
Mar., "	10,990	124.7	673	673
Apr., "	11,670	86.8	490	490
May, "	15,795	70.0	514	514
Jun., "	10,572	87.9	442	442
Jul., "	12,895	70.5	435	435
Aug., "	11,923	96.9	522	522
Sep., "	10,517	106.5	526	526
Oct., "	12,278	93.3	530	530
Nov., "	10,268	88.4	439	439
Dec., "	11,222	96.1	520	520
TOTAL, "	142,476	* 97.5 Avge.	6,618	552 Avge.