

SPIES MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICE.	AMOUNT 1 9 1 9.	AMOUNT 1 9 1 8.
25% Powder				649.47
40% "	53,100	.1720	9130.65	14603.33
Total Powder	53,100	.1720	9130.65	15252.80
Fuse,	117,500	3.17	959.65	1657.51
Caps,	16,800	14.36	241.29	366.56
Cap Crimpers,	5	.57	2.84	1.12
Tamping Bags	5,000	1.50	7.50	8.40
Total Fuse, Etc.,	139,305		1211.28	2033.59
Total Explosives,			10341.93	17286.39
Product			70,914	123,675
Pounds Powder per ton of Ore			.75	.68
Cost per ton for Powder			.128	.124
" Fuse, Caps, Etc.			.018	.016
" All Explosives,			.146	.139
Avg. Price per Lb. for Powder			.172	.181

CROSBY MINE
ANNUAL REPORT FOR 1919.

The production of wash ore from the Crosby Mine during the year 1919 amounted to 209,860 tons, of which 20,993 tons came from underground operations and 188,867 tons from the open pit. The washing plant was operated from May 2nd to August 7th. and from August 27th to October 29th, inclusive, handling 188,867 tons of crude ore and turning out 116,753 tons of concentrates. On account of the strike on the Great Northern Ore Docks, the mill was idle for a period of 17 days, from August 8th to the 26th, inclusive. During this period we continued the operation of the mine and stocked 22,283 tons of ore, using our railway locomotive and 7-yard cars in connection with the work. This stockpile was loaded out with the model "60" shovel and treated at our washing plant during the last two weeks of September and the first week of October.

We had no ore in stock May 1st. 1919, last Winter's operations being confined to extending the second level tramways in rock, cutting the second level plat and pocket, providing a sump of suitable capacity and in the cleaning up and stripping of the second level drifts. The underground equipment was given a thorough overhauling in preparation for mining activities.

We hoisted 31,766 tons of rock during the past year, besides casting onto the waste piles an appreciable tonnage in our West Pit operations. Now that the West Pit work is completed so far as shovel operations are concerned, and a part of the East Pit will be mined down to the bottom rock, it will not be necessary to handle such a large amount of rock at the shaft. We should have a place for waste rock in the East Pit by the middle of the Summer and thereafter the bulk of the rock encountered in

mining operations will be dumped here, instead of being sorted on the headframe grizzlies.

Upon the completion of the shipping season, October 29th, underground mining operations were resumed and we had in stock on December 31st., 1919, 20,993 tons of crude ore. We estimate that the stockpile as of May 1st., 1920, should approximate 75,000 tons, which will yield 45,000 tons of concentrates, based on a concentration ratio of 60%. In order to realize our estimate of production for 1920, (130,000 tons), we will then be required to secure approximately 140,000 tons of crude ore during the six months from May 1st. to November 1st. This will necessitate a monthly production of better than 23,000 tons. While this tonnage is decidedly lower than has been realized during the past several years, it must be borne in mind that shovel operations in the West Pit have been completed and the bulk of our product must now come from the East Pit.

Based on the phosphorus content of our stockpile on January 1st. 1920, and the material that we will be mining during the first four months of 1920, we feel that we should secure from 25,000 to 30,000 tons of Bessemer concentrates the coming season. We will operate our East Pit steam shovels in the lower phosphorus ores during the early part of the shipping season, so as to realize the maximum tonnage of Bessemer grade during the months of May and June. Unfortunately we cannot wash our stockpile separately from the pit production, but we can, however, conduct our work in such a manner as to realize a considerable tonnage of Bessemer concentrates. We have kept accurate account of the low Bessemer ore in our stockpile and the question of grading our mill output will be watched very carefully. The phosphorus in this year's Non-Bessemer shipments will probably exceed .060.

The general labor situation in the Nashwauk District was somewhat more favorable during 1919 and from present indica-

tions there should be ample men to carry out our 1920 program.

Ore Estimate of January 1st. 1920.

In as much as the silica content of our 208,000 tons of shaft and track pillar ore is estimated at 14%, and in consequence will have to be washed, this tonnage is included with the straight wash material. This ore will not be available until operations from our present shaft are abandoned. It will be necessary to hoist the shaft and track pillar deposit on an inclined tramway from the pit and no doubt a part of it at least can be stripped to advantage and milled.

Owing to the fact that our Bessemer reserve ore is all tied up in the track and shaft pillar, there will be no further shipments of Bessemer grade from the Crosby Mine, subsequent to 1920, for several years at least.

Following is an estimate of the ore in sight January 1st., 1919, the tonnage mined during the past year and our estimate of January 1st., 1920:

	<u>Est. Jan. 1st. '19</u>	<u>Mined 1919.</u>	<u>Est. Jan. 1st. 1920</u>
Stripped & Above Main Level-----	263,000 Tons	113,930 Tons	149,000 Tons
Stripped & Below Main Level-----	412,000 "	74,937 "	337,000 "
From Underground Operations-----	622,000 "	20,993 "	601,000 "
Track & Shaft Pillar-----	<u>208,000 "</u>	<u>-- ---</u>	<u>208,000 "</u>
TOTAL- - - - -	1,505,000 "	209,860 "	1,295,000 "

A considerable part of the ore shown as stripped and above the main level is badly mixed with taconite and it will be impossible to secure a satisfactory extraction with steam shovels. The bulk of this ore is in the West Pit and adjacent to the shaft, and we figure that it will be mined by hand. There is a question as to whether or not all of this ore can be mined profitably.

Of the underground tonnage, it is entirely a question

of being able to secure satisfactory mining costs. The ore for the most part is of very low grade, averaging about 40% iron and in order to show a profit, it will be necessary to conduct our mining operations on an economical basis.

Following is an estimate of the quantity and analysis of the concentrates to be shipped from the Crosby Mine, a gross recovery of 60% being assumed in the washing of our crude ore:

BESSEMER ORE
(Including Shaft Pillar)

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>
153,000	60.00	.045	8.60	7.50	55.50

NON-BESSEMER ORE

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois</u>	<u>Fe.Nat.</u>
624,000	60.00	.060	8.60	7.75	55.35

The above tonnages and grades should be reported to the Tax Commission, as including the reserve ore at the Crosby Mine. We do not anticipate the development of any further Bessemer, Non-Bessemer, or Siliceous ore that can be extracted at a profit from the Crosby Mine. We do not now contemplate any exploratory work during the year 1920.

GENERAL SURFACE

The new shop building was completed the middle of January and the equipment moved and set up the forepart of February. The entire shop was wired in conduit and a permanent heating system installed. Our repair work was simplified to a considerable extent as a result of having ample quarters and of improved arrangements. Previously the machine shop was in a different building from the blacksmith and carpenter shops.

A crew of from 6 to 10 men was engaged in the overhauling of the steam shovels, the six railroad cars, the eight 7-yard rock cars and the steam locomotive during the months of January, February, March, November and December. A number of worn out parts were replaced on the steam shovels and the machines were fitted out with new housings. The necessity of blasting close to the shovels in the pits wrecks the cabs and it is necessary to rebuild them about every other year. The locomotive and railroad cars were scraped and painted and a new frame was put under one side of the locomotive. The old frame had cracked clear through in two places and while this was welded, we were very apprehensive that it would fail at any time and cause us serious delay. The locomotive was thoroughly overhauled and numerous replacements were necessary to the badly worn parts. The shop crew spent some time underground, going over the four locomotives and twenty-four saddle-back side-dumping cars. This equipment was put in first class shape for the season's operations and our repairs this Winter will be considerably less.

The old frame shop buildings were torn down and sufficient material salvaged therefrom for the construction of a four-stall garage and electricians' room. The appearance of our mine buildings has been greatly improved as a result of these changes. The grounds around the buildings have been filled and graded and as usual, the mine roads have received some attention.

The rock which had accumulated from sorting operations on the stockpile was carted away and dumped into the caves at the north end of the property.

We lost approximately 200 cords of lagging as the result of fire. We had had several weeks of very dry weather and as nearly as we are able to ascertain, a spark from our locomotive lodged in the pile of lagging and was fanned by the heavy wind. A considerable fire had started before detected by our watchman and although we secured assistance from the Village Fire Department and had three streams of water playing on the lagging, it had gained such headway that we were unable to check its progress. Fortunately we were able to save all of our mining timber and some fifty cords of lagging, piled a short distance to one side.

We experienced no difficulty in keeping our north surface drainage ditch open last Winter, due to the fact that we handled our mine water here, instead of the small ditch to the south of the pits. Approximately 100 gallons per minute seeps from our storage dam and this flow is not sufficient by itself to keep a channel open.

MINING OPERATIONS

Mining activities were confined to second level development work during the months of January, February, March and April. The two drifts north of the shaft were extended in rock out under the open pit. The first drift was extended approximately 500' under the center of the pit and the second heading, 100' to the east, for 340' under the edge of the pit. Twelve raises were put up from this last drift at intervals of 40', to be used in the prosecution of our underground wash ore operations. The first drift holed to test-pits Nos. 2, 5, 14, 15 and 16, which were used for milling during the past Summer. Four other mills were put up from the drift to the south, at intervals of 40'.

CROSBY MINE.

Two test crosscuts, which had been pushed to the west from the main heading during the Winter of 1914, were enlarged to motor drift size and raises put up at intervals of 40' to tap the underground wash ore lying above. The test drifts followed the bottom rock, which necessitated a grade of 5%. To provide for motor haulage, the crosscuts were carried on a suitable grade, with the result that they had full breasts of rock most of the distance. The first crosscut is 160' north of the shaft and was extended west 150' from the main heading, the second being 260' north of the shaft and pushed to the west for 145'

Two contracts were engaged in development work from these crosscut raises during the months of November and December. The material cut was of very inferior grade and it was found inadvisable to attempt any mining operations on or above the elevation of the first level, for the reason that the proportion of rock was too great.

A force of from 6 to 8 gangs were employed in the No. 2 drift raises during the months of November and December. These contracts are developing the ground 10' under the old first level and to the east of the open pit limits. The raises are 40' apart and an attempt was made to block out pillars of this width. Due to the fact, however, that there were many rock intrusions and the character of the ore at the best was rather inferior, it has been necessary to follow the seams of better material. This has resulted in the blocking out of irregular shaped pillars. The ore averages about 40% in iron and to realize a profitable operation it is necessary to mine only the clean material. Some of the ore is very compact and we are using Jack Hammer and Auger machines in our drilling.

The bulk of our underground product has been secured from operations to the east of Nos. 303, 304, 307, 308, 309, 310, 311 and 312 raises.

The material being mined from the No. 1 drift cross-cuts has been very lean and we are endeavoring to block out a few pillars of 45% material. One contract was employed the last two months of the year in drifting on the bottom rock to the northeast of No. 2 heading. The breast of the second level drift was in solid taconite and in order to drive in ore, the gang started 10' above the floor. This drift, which has a grade of approximately 4%, had been pushed out 240' by the end of the year and had holed to two test-pits put down last Winter from the first level. The character of the material cut in this working is of fair grade only, but we are in hopes of developing some higher grade ore to the north. This would appear likely from our knowledge of the first level workings and the several winzes sunk near the north line of the property from the first level.

The second level drift leading out under the west pit was stripped and equipped for motor haulage. A considerable tonnage from our "36" shovel operations was trammed through this drift during the Summer. No underground operations have been undertaken therefrom during the year.

One gang has been engaged in following a seam of ore to the north from No. 182 raise, 10' above the elevation of the first level. Several cross seams have been encountered in the progress of this work and a second gang will now be added. While there is no considerable amount of ore here, it is of very satisfactory grade and will furnish employment to at least two contracts until May 1st.

The ground to the east of the west pit limits was tested with small crosscuts and as this development work showed up some desirable wash ore, we decided to extend motor drifts to the north and south a short distance back from the open pit.

Contract No. 1 has drifted to the south in fair grade wash material, keeping from 20' to 85' east of the pit. It now looks as though this drift would extend for 400' from the north

heading and will block out a pillar of ore of this length. As no crosscuts have been pushed in to the east, we do not know just what width this pillar will have. The height of the ore varies from 8' to 14' and is capped by a very lean and partly altered taconite.

Contract No. 2 drifted to the north for approximately 240'. We believed that this ore would only extend about 100', basing our opinion on the northern open pit limits and our development work therefrom. There is a seam of ore, however, extending to the north 140' beyond the open pit limits. This deposit has an average width of about 40'. The ore runs close to 50% in iron and two gangs will be employed in slicing it back during the next several months.

The average analysis of the ore stocked from underground operations during the months of November and December is as follows:

<u>Tons</u>	<u>Fe.</u>	<u>Phos.</u>	<u>Sil.</u>
20,993	45.55	.042	27.23

The phosphorus content of the ore mined in December was lower than that for November and our present expectations are that the output for the first four months of 1920 will average still lower. We feel quite confident that our contemplated stockpile of 75,000 tons, as of May 1st., will run well under .040 and we will be able to realize a substantial tonnage of Bessemer ore from a treatment thereof.

TEST-PITTING

Following is the analysis of the four test-pits put down during January, 1919:

Test Pit No. 2D	<u>Footage</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>
	0- 5	49.73	.040	18.78
	5-10	41.16	.051	28.55
	10-15	42.59	.060	30.50
	15-20	42.50	.031	30.55
	20-25	45.00	.060	22.93
	25-28	44.37	.109	26.58
	Bottomed in taconite.			

Test Pit No. 3D	<u>Footage</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>
	0- 5	48.66	.036	22.31
	5-10	50.60	.062	16.62
	10-15	41.49	.043	27.91
	15-20	42.40	.035	33.05
	20-25	36.62	.068	35.00
	25-30	49.14	.143	12.04
	30-32	Taconite.		

Test Pit No. 4D	0- 5	49.95	.039	20.76
	5-10	48.91	.065	17.84
	10-15	40.15	.043	35.25
	15-20	38.90	.051	36.31
	20-25	40.13	.045	32.06
	25-32	48.89	.098	14.18
	32-33	Taconite.		

Test Pit No. 5D	0- 5	47.46	.045	21.54
	5-10	52.13	.044	14.68
	10-15	40.66	.057	33.56
	15-20	38.88	.036	37.47
	20-25	40.50	.050	32.46
	25-31	45.46	.072	23.17
		Bottomed in taconite.		

OPEN PIT OPERATIONS

The model "36" shovel was operated during the Summer months in the channel of ore between No. 142 raise and the Hawkins boundary. This deposit varies in width from 150' to 200' and was mined down to the bottom rock, with the exception of a small area in the vicinity of the old inclined shaft. The ore here extends down to the second level and the few hundred tons remaining will be mined by hand.

While the average iron content of the ore mined with the "36" shovel was quite satisfactory, the phosphorus was high and was responsible for the tonnage of Non-Bessemer shipments exceeding our expectations. Approximately one-half of this ore was mined below the old first level workings. The bulk of it was cast directly into the second level raises by the "36" shovel, the balance being loaded into motor cars and trammed a short distance to the mills. We encountered considerable rock toward the end of the operation and this material was trammed with one

of the electric locomotives and dumped onto the mined out portion of the pit to the north.

Upon the completion of the open pit work in October, the "36" shovel was taken from the pit and transferred to the Hill-Trumbull Mine. It was a considerable task to take the shovel from the pit, as the walls were largely of taconite and it was very difficult for the shovel to cut itself to the top of the pit, even though the face was substantially gopher holed and blasted.

The No. 2, "28", shovel was transferred from the west to the east pit during the winter of 1919 and was engaged with the other model "28" machine in cutting back the ore faces to the north, east and south. Operations in the east pit were confined to digging the ore banks to the eastern pit limits and southward for 180' during the first four months of the season. These cuts were taken down to the first level and as the banks were some distance from the second level chutes, our electric locomotives and saddle back cars were used to transfer the dirt to the mills. The automatic take-up reels operated very satisfactorily on this job. As there was from 15' to 35' of ore below the pit bottom, it was necessary to remove all rock encountered in mining operations from the pit.

Beginning September 1st. the shovels cut down in the bottom of the pit in the vicinity of the second level mills and the ore was cast directly into these openings as far as possible during the balance of the season's work. This lower cut was from 10' to 15' in depth and had been extended some distance from the mills in October, with the result that the electric haulage equipment was again put into service. A greater depth would have been taken in the cuts to the east if it had not been for the fact that the phosphorus content increases materially at the lower elevation.

The bulk of our open pit product during 1920 will come from the south and east sides of the pit and the cuts will be taken to the bottom rock in places. It is our intention to clean a sufficient area down to the rock to afford a dump for waste material encountered in our mining operations. This will do away with the handling of an excessive amount of taconite on our headframe grizzlies from our east pit operations for 1920.

WASHING OPERATIONS

The washing plant was operated from May 2nd to August 7th and from August 27th to October 29th, inclusive; work being conducted on day shifts only, except from September 16th to October 8th. The mill was put on a two shift basis in order to handle the stockpile accumulated while the dock strike was in progress. The mill was idle for a period of 17 days from August 8th to the 26th.

The Great Northern car service was somewhat better than during 1918 and although we were on the anxious seat a good many times, we did not suffer any very serious delays. While the mill was operated one shift, we filled our six railway cars, the mill receiving bin, the shaft pocket and used Great Northern cars when necessary.

The weather conditions were most unsatisfactory for washing during the latter part of October. The crude ore stored in the Great Northern cars during the night shifts was very difficult to dump. Even though the material was quite badly frozen, we could dump our cars to good advantage, on account of the large door opening. The Great Northern cars had to be thawed out and the dumping operation was sometimes most tedious. Further than this, it was impossible to make a clean separation of the frozen chunks of ore in the mill and the grade of our product during the last month suffered in consequence.

It was necessary to maintain a force of from three to four men on the picking belt during a large part of the season, due to the excessive quantity of fine rock in our crude ore. The mill force was not increased on this account, however, the extra hands at the picking belt being taken from other operations, when the occasion demanded. The fine rock came largely from the west pit operations, where the steam shovel cuts were extended right up to the stripping limits.

Our new conveyor belt was installed on the 15th of August. The old belt handled approximately 700,000 tons of crude ore and will still be serviceable for splicing and for use as a picking belt.

Two Deister tables were installed during March, but on account of the excessive vibration, it was found necessary to place heavy timbers between the floor and I-beams. The timbers were bolted to the table foundations and I-beams, thus carrying the shock directly to the heavy steel framework of the building. The mechanical operation of these tables was very satisfactory, but we were unable to obtain a clean separation on account of the excessive quantity of coarse sand. The grooves of the table tops are deeper than the Overstrom and the thrust is decidedly heavier. If the waste material in our crude ore had been of finer texture, these tables would have worked admirably and their capacity would have been equal to the five Overstrom tables.

An average force of five men was employed on repair and replacement work at the washing plant during the months of January, February, March, April, November and December. The motors throughout the mill were thoroughly overhauled and cleaned, the launder linings were replaced, as were the worn out plates in the receiving bin and loading pockets.

A new rock pocket and trestle, for tramming the waste our mill practice were responsible for this increase.

material from the picking belt, was constructed during March. The pocket is now much closer to the rock spout coming out from the mill and there is no danger of chunks injuring the men working below. The trestle was raised sufficiently, so that we will have ample storage capacity for the balance of our operations, without resorting to exceptionally long trams.

An average force of 14 men per shift was employed at the washing plant during the operating season.

Following is the tonnage treated during 1919, the concentrates produced therefrom and the analysis of same as obtained from Mine and Lake Erie sampling:

Crude Ore-----	<u>Tons.</u> 188,867	<u>Fe.</u> 42.97	<u>Phos</u> .038	<u>Sil.</u> 32.09
----------------	-------------------------	---------------------	---------------------	----------------------

CONCENTRATES
(Mine Sampling).

Bessemer-----	<u>Tons.</u> 88,556	<u>Fe.</u> 59.80	<u>Phos.</u> .044	<u>Sil.</u> 9.14
Non-Bessemer-----	<u>28,197</u>	<u>59.25</u>	<u>.055</u>	<u>9.05</u>
TOTAL AND AVERAGES--	116,753	59.67	.047	9.11

CONCENTRATES
(Lake Erie Sampling)

Bessemer-----	<u>Tons.</u> 87,670	<u>Fe.</u> 59.92	<u>Phos</u> .044	<u>Mois.</u> 6.85	<u>Fe.Nat.</u> 55.82
Non-Bessemer-----	<u>27,915</u>	<u>59.29</u>	<u>---</u>	<u>7.20</u>	<u>55.02</u>
TOTAL AND AVERAGES--	115,585	59.77	---	6.93	55.63

The ratio of gross recovery for the season of 1919 was 61.82% and compares with 62.20% for 1918 and 63.43% for 1917. The iron content of the crude ore treated during 1918 was 3.33% higher than that for 1919, whereas the iron content of the concentrates was but .74% lower for 1919. This partly explains the decrease in the ratio of recovery.

The recovery of iron units for 1919 was 85.84% and compares with 81.20% for 1918 and 79.41% for 1917. Improvements in our mill practice were responsible for this increase.

The approximate percentage of product obtained from the several machines was as follows: - Screen, or picking belt, 21%, log 62%, turbo 12% and tables 5%.

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

1 9 1 7 .

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

1 9 1 8 .

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

1 9 1 9 .

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>
Screen-----	58.13	.060	10.60
Log-----	59.63	.050	9.11
Turbo-----	57.15	.035	13.92
Tables-----	65.12	.023	5.67
Tailings-----	23.46	---	----

Following are the cargoes of Crosby concentrates shipped during the 1919 season and the analysis of same as obtained at the Mine and by the Lower Lake Chemists. The cargoes for which no Lower Lake analysis are shown were mixed with Mahoning or Helmer Grade and the average of the Lake Erie Chemists' Analysis does not include these tonnages:

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>ISHPEMING-</u>						2,713
Mine-----	59.15	.040	9.21			
<u>ISHPEMING-</u>						8,106
Mine-----	60.01	.044	8.59			
<u>SNYDER-</u>						10,867
Mine-----	59.87	.045	8.79			
Crowell & Murray---	60.05	.046		8.62	54.87	
Cremer & Case-----	59.60	.045		7.87	54.91	
<u>MICHIGAN-</u>						2,627
Mine-----	59.72	.056	8.87			
Cremer & Case-----	59.50			7.89	54.805	
<u>D. J. MORELL-</u>						2,480
Mine-----	59.26	.042	8.82			
<u>W. G. MATHER-</u>						9,078
Mine-----	60.38	.045	8.80			
<u>SNYDER-</u>						4,043
Mine-----	59.12	.042	9.72			
Emmerton-----	58.53	.042		6.59	54.673	
Crowell & Murray---	59.27	.043		6.85	55.210	
<u>SNYDER-</u>						2,964
Mine-----	60.29	.050	8.68			
Emmerton-----	59.53			6.96	55.387	
<u>WILPEN-</u>						2,876
Mine-----	60.11	.042	8.53			
Cremer & Case-----	60.10	.045		6.16	56.398	
<u>SNYDER-</u>						3,941
Mine-----	61.53	.045	8.19			
Textor-----	61.20	.045		6.02	57.516	
Crowell & Murray---	61.66	.048		6.39	57.720	

CROSBY MINE.

	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>SHEADLE</u> - - - - -						6,506
Mine-----	60.47	.045	8.25	----	-----	
<u>SHEADLE</u> - - - - -						3,791
Mine-----	61.50	.041	7.56	----	-----	
Cremer & Case-----	61.50	.038	----	5.63	58.038	
Crowell & Murray---	62.44	.040	----	5.35	59.099	
<u>BROWN</u> - - - - -						3,242
Mine-----	60.18	.045	8.47	----	-----	
Emmerton-----	60.25	.045	----	6.15	56.545	
Textor-----	60.50	.044	----	6.13	56.791	
<u>J. H. SHEADLE</u> - - - - -						2,568
Mine-----	58.51	.046	9.57	----	-----	
Cremer & Case-----	59.50	.047	----	6.31	55.746	
Textor-----	59.75	.048	----	6.38	55.938	
<u>J. H. SHEADLE</u> - - - - -						4,525
Mine-----	58.56	.053	10.21	----	-----	
Cremer & Case-----	59.00	---	----	6.40	55.224	
Textor-----	59.20	---	----	6.73	55.216	
<u>ISHPEMING</u> - - - - -						10,972
Mine-----	59.19	.045	10.42	----	-----	
Textor-----	60.07	.040	----	6.16	56.37	
Emmerton-----	59.65	.043	----	6.09	56.017	
<u>PIONEER</u> - - - - -						3,358
Mine-----	59.36	.052	9.03	----	-----	
<u>W. G. MATHER</u> - - - - -						10,781
Mine-----	59.15	.045	9.94	----	-----	
Crowell & Murray---	59.80	.046	----	7.27	55.453	
Cremer & Case-----	59.10	.043	----	6.93	55.004	
<u>NEGAUNEE</u> - - - - -						5,157
Mine-----	58.50	.052	10.04	----	-----	
Textor-----	59.20	---	----	7.55	54.730	
<u>PIONEER</u> - - - - -						3,649
Mine-----	59.15	.056	9.06	----	-----	
<u>MATHER</u> - - - - -						6,679
Mine-----	59.12	.047	9.87	----	-----	
Cremer & Case-----	59.30	.045	----	7.35	54.941	
<u>SHENANGO</u> - - - - -						2,880
Mine-----	60.10	.062	7.11	----	-----	
<u>PETER WHITE</u> - - - - -						3,037
Mine-----	59.32	.065	7.98	----	-----	

CROSBY MINE.

ACCIDENTS

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

JOHN ZANKO

Injured-----January 11th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----28 Days.
Received compensation-----\$42.00.

Remarks: Zanko had trammed a car of rock to the shaft and was standing in front of same when it was being dumped. The door closed on his hand, causing laceration on back of left first and second fingers.

WILFRED WIVELL

Injured-----February 10th, 1919.
Occupation-----Motorman.
Nationality-----American.
Time Lost-----3½ Days.
Received Compensation-----None.

Remarks: Wivell was endeavoring to remove a bolt from motor car, when his assistant accidentally hit him with a hammer, causing laceration and bruise of right thumb.

ALEX LECLAIR

Injured-----February 10th, 1919.
Occupation-----Washing Plant Laborer.
Nationality-----American.
Time Lost-----Two Days.
Received Compensation-----None.

Remarks: LeClair and several others were driving shaft through gearing. LeClair put his hand into gearing to ascertain if shaft was in place, when shaft suddenly loosened and **dropped** on his finger. This resulted in severe laceration of end of left middle finger.

ANDRO SOCH

Injured-----February 9th, 1919.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----4 Days.
Received Compensation-----None.

Remarks: Soch was pushing a timber truck along drift and stepped on a nail with right foot.

MARTIN PESHEL

Injured-----February 19th, 1919.
Occupation-----Washing Plant Laborer.
Nationality-----Austrian.
Time Lost-----28 Days.
Received Compensation-----\$42.00.

Remarks: In carrying a concentrating table top, the men opposite Peshel let go their end before he did. Peshel was unable to hold the table and it dropped on his foot, injuring toe.

MIKE ZAKOVICH

Injured-----March 3rd., 1919.
Occupation-----Motor Brakeman.
Nationality-----Montenegrin.
Time Lost-----3 Days.
Received Compensation-----None.

Remarks: In lifting a timber truck onto track, Zakovich placed his right foot forward to brace himself and in swinging the truck onto track, the wheel struck him on the foot.

JIM TORENTO

Injured-----March 10th, 1919.
Occupation-----Miner.
Nationality-----Italian.
Time Lost-----17½ Days.
Received Compensation-----\$23.00.

Remarks: Toronto lifted a piece of rail about 8' long out of ditch along motor track and placed same along the side of the drift. In dropping the rail one end hit his foot.

ALEX LECLAIR

Injured-----March 11th, 1919.
Occupation-----Washing Plant Laborer.
Nationality-----American.
Time Lost-----10 Days.
Received Compensation-----\$8.00.

Remarks: When cutting poles for electric lighting, LeClair's axe glanced off side of pole, striking him on left foot.

JIM PICCOLO

Injured-----March 17th, 1919.
Occupation-----Trackman.
Nationality-----Italian.
Time Lost-----10 Days.
Received Compensation-----\$6.00.

Remarks: Piccolo was shoveling dirt into a motor car, when some loose material fell from back of the drift, striking him on the shoulders.

LOUI WUOVICH

Injured-----March 31st., 1919.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----12 Days.
Received Compensation-----\$10.00.

Remarks: In removing a drill from the air machine, Wuovich's sleeve caught on the handle of the air valve, opening same and setting machine in motion. The drill was knocked from the machine, injuring his finger.

RUSSELL WIVELL

Injured-----June 3rd., 1919.
Occupation-----Machinist Helper.
Nationality-----American.
Time Lost-----22 Days.
Received Compensation-----\$40.00.

Remarks: In cutting a piece of wood for a file handle, Wivell held the block with his left hand and in bringing the axe down on the block, cut his right thumb severely.

JOE KIVI

Injured-----June 26th, 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----13 $\frac{1}{2}$ Days.
Received Compensation-----\$15.00.

Remarks: When picking in the bottom of drift to make hitch for a post, Kivi's pick glanced off a rock, striking him on arch of right foot.

JOHN STANOVICH

Injured-----July 3rd., 1919.
Occupation-----Open Pit Laborer.
Nationality-----Austrian.
Time Lost-----28 Days.
Received Compensation-----\$52.50.

Remarks: While lifting a heavy chunk of taconite from top of motor car in open pit, Stanovich dislodged a fair sized rock, which rolled slightly, smashing his right second finger.

ANDREW PAVICHOVICH

Injured-----August 8th, 1919.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----8 Days.
Received Compensation-----\$2.50.

Remarks: Pavichovich and others were endeavoring to put a side-dump car on the track with block and line, when hook of block slipped, striking him on leg and right hand.

JURO WUKOVICH

Injured-----August 21st., 1919.
Occupation-----Dumpman.
Nationality-----Montenegrin.
Time Lost-----9 Days.
Received Compensation-----\$7.50.

Remarks: Wukovich was dumping a tram car at the shaft pocket, when a rock fell from the car, striking his left hand. This resulted in laceration and contusion of palm.

AUGUST LASSILA

Injured-----August 20th, 1919.
Occupation-----Chuteman.
Nationality-----Finnish.
Time Lost-----46 Days.
Received Compensation-----\$97.50.

Remarks: Lassila pulled out a chute stopper to allow the ore to drop into a tram car. The speed at which the material ran pushed his hand against the car, resulting in contusion and laceration of middle finger of left hand.

PETE NEVODICH

Injured-----September 3rd., 1919.
Occupation-----Dumpman.
Nationality-----Austrian.
Time Lost-----6½ Days.
Received Compensation-----None.

Remarks: When dumping a tram car into shaft pocket, a rock fell off the car, striking Nevodich on left wrist.

VERNE ELY

Injured-----September 13th, 1919.
Occupation-----Steam Shovel Fireman.
Nationality-----American.
Time Lost-----17 Days.
Received Compensation-----\$21.43.

Remarks: Ely was standing on running board near front of steam shovel and in turning around to return to rear of shovel, he lost his balance and fell to ground, causing sprain of left wrist.

JIM PICCOLO

Injured-----September 30th, 1919.
Occupation-----Chuteman.
Nationality-----Italian.
Time Lost-----30 Days.
Received Compensation-----\$60.00.

Remarks: A rock fell from the tram car, near which Piccolo was standing, striking him on right leg.

ALEX HETAS

Injured-----August 9th, 1919.
Occupation-----Swamper.
Nationality-----Greek.
Time Lost-----40 Days in 1919.
Received Compensation-----\$85.00 " "

Remarks: In lifting a large rock, Hetas developed Inguinal Hernia. He remained at work, however, until November 14th, at which time, upon the advice of physician, he submitted to an operation at the Adams Hospital. Had not returned to work January 1st., 1920.

PETE MARANOVICH

Injured-----December 4th, 1919.
Occupation-----Miner.
Nationality-----Montenegrin.
Time Lost-----8 Days.
Received Compensation-----\$5.00.

Remarks: Maranovich was working in No. 5 contract, when a rock rolled down from bank, striking his right foot.

ANALYSIS OF COST SHEET

Mining operations were discontinued during 1918 from October 19th to the end of the year. During 1919 mining activities were inaugurated May 1st. and were continued throughout the balance of the year.

Underground mining operations were conducted on 96 shifts and open pit on 317 shifts during 1919, as compared with 176 underground shifts and 300 open pit in 1918. The fact that the proportion of ore from underground activities was so much greater in 1918 would, of course, tend to increase the cost per ton for that year. The higher average wages prevailing in 1919, the difficulties encountered in open pit operations and the expense of getting our present working places in shape for mining were responsible, however, for showing an increase in the cost per ton.

The production of crude ore for 1919 was 209,860 tons, compared with 262,235 tons during 1918. This was also a factor affecting on a rising scale a number of the items on the cost sheet.

The following statement shows the charges under the several main captions for the years 1919 and 1918:

	<u>1919.</u>	<u>1918.</u>
Tonnage-----	209,860	262,235
General Expense---	\$.063	\$.056
Maintenance-----	.115	.073
Mining Expense----	<u>.752</u>	<u>.628</u>
TOTAL-----	\$.930	\$.757

GENERAL EXPENSE

Of the items entering into this heading, there was only one, "Mine Office", showing any noteworthy variation between the two years in question.

There was an increase of \$.010 per ton against "Mine Office" for 1919, due to the depreciation of the Company automobiles, the changing over from steam heating to stoves and the employment of one extra man in the office.

MAINTENANCE

The items entering into the increase of \$.042 per ton for 1919 were, "Tracks & Yards", "Buildings", "Boiler Plant", "Electric Tram Plant", "Fire Expense & Damage" and "Steam Shovels". There was a decrease in "Pumping Machinery" for 1919 and the items "Docks, Trestles & Pockets", "Shop Machinery", "Hoisting Machinery", "Compressor & Power Drills", "Top Tram Engines & Cars", "Skips & Skip Roads", "Underground Tracks & Cars" and "Telephone & Safety Devices" varied but slightly.

The 1919 increase of \$.08 per ton to "Tracks & Yards" was due to rather extensive repairs to the railroad shaft and coal dock tracks. Aside from this quite an extensive cleaning program was carried on during 1919.

The depreciation of our shop building, the extension to the power house, the cost of the garage and pipe rack resulted in an increase of \$.011 to the "Building" account for 1919.

A second boiler was installed in our dry house heating plant and the pipe lines were re-covered. This resulted in showing an increase of \$.007 to the account "Boiler Plant" for 1919.

There was a decrease of \$.010 in "Pumping Machinery" in 1919. During the Winter of 1918 we operated our steam pumps in the shaft, while in 1919 the new electrical equipment was in service. The repairs to the steam pumps and pipe lines were quite extensive in 1918, whereas the charges to this account, even including the new electrical equipment, were quite nominal the past year.

During 1919 the electric locomotives were given a thorough overhauling and a considerable number of replacements made, including three new armatures. This resulted in showing an increase of \$.010 per ton for the 1919 cost.

The burning of our lagging pile last Summer was the cause of increasing the charges to "Fire Expense" \$.004 per ton.

The increase of \$.006 in "Pit Shovels" was the result of very extensive repairs made to this equipment during 1919.

MINING EXPENSE

The increase of \$.124 in this heading was due largely to the higher wages maintained in 1919 and the difficulties encountered in open pit and underground operations.

The 1919 increase of \$.002 to "Air Pipes" and \$.004 to "Compressors" was caused by the installation of the compressor and the laying of pipe lines into the second level drifts.

The 1919 item "Hoisting" shows an increase of \$.007 per ton, the higher rate paid for current and the lower output secured per shift worked being responsible.

The 1919 charge of \$.037 per ton against "Rock Drifting" covers the expense of several drainage drifts to take care of the pit waters. There was no charge to "Rock Drifting" in 1918.

While wages were higher in 1919, there was a decrease of \$.005 in "Breaking Ore", and this is explained by the fact that the ratio of underground to open pit work was much less for the past year. Of a total of 476 shifts, 176 were operated underground in 1918, whereas out of 413 shifts in 1919, but 96 were confined to underground activities.

The charge to "Tramming" showed an increase of \$.037 per ton for 1919. This was due to the higher rate paid for current and the cost of shifting tracks in the open pits. During 1918 the ore banks were much higher and considerably less track work was necessary.

The 1919 charges to "Timbering" showed an increase of \$.016 per ton. Aside from our regular sub-level timbering, a considerable amount of work was done on the second level tramways.

While the dock strike was in progress at Superior, from August 8th to the 25th, we were forced to stock the product with our railway locomotive and this resulted in showing an increase of \$.006 per ton in the item "Stocking Ore".

On account of the exceptionally large amount of rock handled last Summer on the headframe, there was an increase of \$.007 in the 1919 cost per ton against "Top Landing & Trammig".

CONCENTRATING COSTS

We produced 116,753 tons of concentrates during 1919, as compared with 185,558 tons in 1918. The washing plant operated 167 shifts during the past year, whereas in 1918 we worked 308 shifts. Due to the fact that we had no stockpile, further than that accumulated during the strike, it was deemed advisable to fill the railroad cars and pockets on night shifts and run the mill day shifts only during the past season. We did, however, operate double shift while we were treating the ore stocked in August.

The following statement shows the charges to the several main captions, covering the expense of concentrating Crosby ore for the years 1918 and 1919:

	1919.	1918.
Tonnage-----	116,753	185,558
General Expense-----	\$.048	\$.036
Transportation Maintenance--	.029	.023
Transportation Cost-----	.093	.076
Maintenance Washing Plant---	.056	.042
Operating Washing Plant-----	<u>.155</u>	<u>.138</u>
TOTAL-----	\$.381	\$.315

The average tonnage of concentrates turned out per 10-hour shift in 1919 was 811 tons, as against 1,167 tons for CROSBY MINE.

two 10-hour shifts during 1918.

Under "General Expense" the item "Mine Office" was responsible for the 1919 increase, the higher wages paid and the increase of one man to the force making up the difference.

The increase of \$.006 for "Transportation Maintenance" was the result of comparatively heavy repairs to the locomotive tracks. It was necessary to replace a number of the ties and to do some ballasting.

The higher scale of wages paid the engineers, firemen and brakemen in 1919 was responsible for showing an increase of \$.017 per ton in the 1919 cost for "Transportation".

The 1919 increase of \$.006 per ton for "Maintenance of Washing Plant" was caused by the larger amount of replacements made at the mill during the past year, more especially to the "Bins, Screen, Log and Turbo". Of course, the smaller tonnage turned out is a most important item in this connection.

Under the caption "Operating Washing Plant" the 1919 increase of \$.017 per ton was due to the higher scale of wages prevailing and the higher rate paid for electric current.

CROSBY MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1919.

GRADE	IRON	PHOS.	SILICA
Crosby Crude,	44.38	.042	29.31
Crosby Washed,	59.55	.047	9.39

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1919.

GRADE	Mine			Lake Erie		
	IRON	PHOS.	SILICA	IRON	PHOS.	MOIST.
Crosby,	59.79	.045	9.14	60.06	.044	6.92

ORE STATEMENT AND SHIPMENTS FOR YEAR 1919.

	CRUDE ORE	CONCENTRATES.	SHIPMENTS	PERCENTAGE OF RECOVERY	TOTAL LAST YEAR
On hand Jan.1st, 1919,					36,031
Output for Year,	208,832	116,753	116,753	62	257,661
Stockpile Overrun,	1,028				4,574
Total,	209,860	116,753	116,753		298,266
Crude Ore Treated,	188,867				298,266
Balance on hand,	20,993	0	0		0
Total last Year,		18,558	18,558		
Decrease in output-19%	47,801				

1919 - 2-8 Hour Shifts - May 2nd to Dec. 31st

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

CROSBY MINE.

CROSBY MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	209,860	262,235		52,375
General Expense	.063	.056	.007	
Maintenance	.115	.073	.042	
Mining Expense	.752	.628	.124	
Cost of Production	.930	.757	.173	
DEPRECIATION.				
Original Purchase	.026	.026	-	
Plant Account	.042	.042		
Equipment	.010	.011		.001
Total Depreciation	.078	.079		.001
Taxes	.065	.090		.025
Central Office	.029	.033		.004
Supply Inventory	.001	.013		.012
Miscellaneous	.006	.003	.003	
Winter Expense	.382	.094	.288	
Sundry Expense	.007	.005	.002	
Cost on Stockpile	1.498	1.074	.424	
Loading & Shipping	.038	.052		.014
Total Cost on Cars	1.536	1.126	.410	
No. Days Operating	2-8 159 2-10 49	243 2-8hr	67	
Avg. Daily Product	1009	1079		70
<u>COST OF PRODUCTION.</u>				
Labor	.697	.557	.140	
Supplies	.233	.200	.033	
Total	.930	.757	.173	

Crude ore basis.

CROSBY MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	209,860	262,235		52,375
No. Shifts and Hours	2-10-159 2- 8- 49	2-8hr		
AVERAGE NUMBER MEN WORKING.				
Surface	31	39		8
Underground	46	65		19
Total	77	104		27
AVERAGE WAGES PER DAY				
Surface	5.92	5.06	.86-17%	
Underground	6.24	5.22	1.02-19.5	
Total	6.11	5.16	.95-18.4	
WAGES PER MONTH OF 25 DAYS				
Surface	148.00	126.50	21.50	
Underground	156.00	130.50	25.50	
Total	152.75	129.00	23.75	
PRODUCT PER MAN PER DAY				
Surface	21.28	20.63	.65	
Underground	14.34	12.77	1.57	
Total	8.57	7.89	.68	
LABOR COST PER TON				
Surface	.278	.245	.023	
Underground	.435	.409	.026	
Total	.713	.654	.059	
AVG. PRODUCT BRK'G ORE BASED ON CRUDE ORE	3.80	23.71		19.91
TOTAL NUMBER OF DAYS				
Surface	9,858 $\frac{1}{2}$	12,713 $\frac{3}{4}$		2,855 $\frac{1}{2}$
Underground	14,633 $\frac{3}{4}$	20,531 $\frac{3}{4}$		5,898
Total	24,491 $\frac{3}{4}$	33,245 $\frac{1}{4}$		8,753 $\frac{1}{2}$
AMOUNT FOR LABOR				
Surface	58340.46	64376.19		6035.73
Underground	91303.64	107143.68		15840.04
Total	149644.10	171519.87		21875.77

Proportion Surface to Underground Men:

1919 - 1 to 1.50
 1918 - 1 to 1.66
 1917 - 1 to 2.35
 1916 - 1 to 2.14

CROSBY MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1919.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1919.	AMOUNT 1918.
6" to 8" Timber	7,524	.05757	432.16	252.45
8" to 10" "	12,540	.05757	721.94	420.75
10" to 12" "	2,508	.05757	144.39	84.15
12" to 14" "	1,504	.05757	86.83	50.49
14" to 16" "	1,004	.05757	57.76	33.66
Total - 1919	25,080	.05757	1443.88	
Total - 1918	14,300	.059		841.50
6' Lagging	124,400	.647	806.00	456.86
Poles				50.00
Total - 1919	124,400	.647	806.00	
Total - 1918	57,250	.885		506.86
Product			209,860	298,265
Feet Timber per ton of ore			.1195	.04794
Feet Lagging "			.5929	.19093
Feet Lagging per foot of timber			4.9601	4.0034
Cost per ton for Timber			.00688	.0028
" Lagging			.00384	.0015
" Poles			-	.0002
" Timber, Lagging & Poles			.01072	.0045
Equivalent of stall timber to Bd.Measure			48,707	27,571
Ft.Bd.Measure per ton of ore			.23209	.09243
Total Cost for Timber, Lagging & Poles - 1919				2249.88
" 1918				1348.36
" 1917				2157.85
" 1916				1492.65
" 1913				4068.66
" 1912				1318.84
" 1911				3550.21

NOTE: The 1919 increase in amount and cost per ton was due to fact that a large amount of development work was undertaken during the season and also to the fact that a larger proportion of the ore came from underground operations for this year.

CROSBY MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICE.	AMOUNT 1 9 1 9.	AMOUNT 1 9 1 8.
30% Powder,	37,300	.1508	5626.93	9803.80
40% "	4,500	.1639	737.95	509.81
XXXX " (Black)	38,400	.0782	3002.30	3247.80
Total Powder	80,200	.1168	9367.18	13561.41
Fuse	62,800	.84	529.79	609.96
Caps	16,700	1.43	238.37	311.37
Cap Crimpers	6	.53	3.17	-
Tamping Bags	1,000	1.71	1.71	-
Connecting Wire	6	-	-	4.21
Electric Exploders	3,250	.13	433.23	337.81
Total Fuse, Etc.			1206.27	1303.15
Total Explosives			10573.45	14864.56
Product			209,360	298,265
Pounds Powder per ton of Ore			.382	.336
Cost per ton for Powder			.0446	.0455
" Fuse, Etc.,			.0057	.0044
" All Explosives,			.0503	.0499
Avg. Price per Lb. for Powder			.1168	.1353

NOTE: Operations during 1919 included a considerable amount of development work in rock and the tonnage of open pit ore was less than during 1918.

MEADOW AND FOWLER MINES

ANNUAL REPORT FOR 1919.

The scarcity of labor in the Aurora District was a serious item during the past year and while there were no acute labor disturbances, the shortage of underground miners between June 1st. and November 1st. handicapped our operations. Due to the resumption of underground operations at the St. James Mine during the Summer, we lost a number of miners who had been with us several years. The workings of the St. James Mine are dry and well ventilated, also the property is a mile nearer Aurora than the Meadow-Fowler. A considerable proportion of our employees are single and these men especially lost from 3 to 5 shifts per month throughout the year. Even by carrying extra hands, we were unable to maintain full contracts.

The underground ventilation conditions were quite unsatisfactory during the warm Summer weather, especially on the Fowler side. The humidity was exceptional and while the connections between the hoisting and the old timber shafts were maintained, the movement of air along the tramways was not sufficient to care for the gasoline fumes.

We experienced considerable trouble with our gasoline locomotives, especially the electrical apparatus. We finally took out the generators and batteries and installed magnetos. A third gasoline locomotive was purchased in the Spring and by watching our repair work carefully, we were able to keep two locomotives in operations. These locomotives were quite light and the jar is appreciable, loosening bolts and allowing the gears to get out of mesh.

The water in the surface drainage ditch, which runs along the north and west sides of the property, gave us consider-

able trouble during the winter months. It was necessary to erect dams to the north of the Meadow caves and maintain a pumping station to keep the overflow water from running into the mine. There is very little grade to the ditch and the flow of water was not sufficient to keep a channel open. The freezing weather filled the ditch with ice and then overflowed the banks. We were rather apprehensive that we might have further trouble this Winter, but the moderate temperature and the heavy snowfall has prevented a recurrence of last winter's condition.

The location premises were cleaned from time to time and the sidewalks and fences repaired. The accumulation of debris around the mine grounds was also removed during the Summer.

Some fencing was done around the Meadow caves as a precautionary measure. Children and cattle from the Stein O'Rourke and our locations frequent the grounds in this neighborhood.

It will be necessary to make rather extensive shaft repairs before Spring. We thought at one time that it would be necessary to suspend hoisting operations for from 10 days to two weeks, but we now figure that the work can be done Sundays and cause no interruption to hoisting operations. The timber in the top 70' of the shaft, or from the collar to the ledge, is in quite bad condition. We will be obliged to replace about one-half of the sets, practically all of the lathing and most of the stuttles. This work will be undertaken during January and February.

The production from the Meadow-Fowler Mines for the past year amounted to 100,081 tons; 80,334 tons of which was shipped and the balance, 19,747 tons, placed in stock subsequent to the closing of navigation.

Following is a division of the production and shipments from the Meadow-Fowler Mines for the past year:

	<u>In Stock</u> <u>Jan. 1st. 1919</u>	<u>Produced</u>	<u>Shipped</u>	<u>In Stock</u> <u>Jan. 1st. 1920</u>
Meadow Mine--	4,026 Tons.	47,296 Tons.	30,394 Tons.	20,928 Tons.
Fowler Mine--	<u>7,392</u> "	<u>52,785</u> "	<u>49,940</u> "	<u>10,237</u> "
TOTAL-----	11,418 "	100,081 "	80,334 "	31,165 "

The estimated production for 1920 is placed at 54,000 tons from the Meadow and 36,000 tons from the Fowler; making a total of 90,000 tons.

Meadow Mine Ore Estimate of January 1st. 1920

Following is an estimate of the ore in sight at the Meadow Mine on January 1st. 1920, the tonnage reported January 1st. 1919 and the amount mined during the past year:

A factor of 13 cubic feet per ton was used in this estimate and a 10% deduction made to cover mining loss.

	<u>Tons.</u>
Ore in sight January 1st. 1919--	192,000
Ore mined during 1919-----	<u>47,296</u>
Balance from these figures-----	144,704

The mining of the deposit on and above the main tramway has caused us to increase this estimate by 3,000 tons. The estimated Meadow ore in sight January 1st., 1920, is therefore as follows:

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
148,000	56.70	.075	2.10	10.20	12.00	<u>49.90</u>

Of the above ore reserve 8,000 tons remains on and above the main tramming level and 140,000 tons below this elevation.

We do not consider that there is any prospect of developing any additional ore of shipping grade at the Meadow Mine.

Fowler Mine Ore Estimate of January 1st. 1920

Following is an estimate of the ore in sight at the Fowler Mine on January 1st. 1920, the tonnage reported January 1st., 1919, and the amount mined during the year.

A factor of 13 cubic feet per ton was used in this estimate and a 10% deduction made to cover mining loss:

Ore in sight January 1st. 1919--	84,000	Tons.
Ore mined during 1919-----	<u>52,785</u>	"
Balance from these figures-----	31,215	"

The mining of the deposit on and above the main tramway has proven our previous estimate to be quite accurate, but the development work on the 1325' Sub, 20' below has resulted in

increasing our previous figure by 5,000 tons. The estimated Fowler ore in sight January 1st., 1920, is, therefore, as follows:

<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
36,000	57.00	.060	1.30	11.00	11.00	50.73

We feel that there is very little likelihood of developing any further merchantable ore from the Fowler Mine.

STOCKPILES

Following is the tonnage of Meadow-Fowler ore in stock June 1st., when shipping was started, and the average analysis of same:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
Meadow Stockpile June 1st---	18,506	56.78	.067	2.17	10.06
Fowler Stockpile June 1st---	<u>33,313</u>	<u>57.11</u>	<u>.052</u>	<u>.90</u>	<u>10.84</u>
TOTAL AND AVERAGES-----	51,819	56.92	.057	1.35	10.56

Following is the tonnage of Meadow-Fowler ore shipped from stockpile during the past season and the average analysis of same:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
Meadow Stockpile Shipments--	5,132	56.97	.076	2.46	9.61
Fowler Stockpile Shipments--	<u>29,013</u>	<u>56.13</u>	<u>.053</u>	<u>.95</u>	<u>12.00</u>
TOTAL AND AVERAGES-----	34,145	56.26	.056	1.18	11.64

The tonnage and average analysis of the Meadow-Fowler stockpiles as of January 1st., 1920, follow:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
Meadow-----	20,928	56.64	.066	2.16	10.20
Fowler-----	<u>10,237</u>	<u>56.69</u>	<u>.053</u>	<u>1.11</u>	<u>10.97</u>
TOTAL AND AVERAGES-----	31,165	56.66	.062	1.82	10.45

As we did not ship the entire stockpiles, we were not able to determine the overrun from our skip tally. We were very conservative in estimating our tonnage and feel that if the piles had been cleaned up we would have realized an overrun of close to 10%.

The iron content of the Fowler ore in stock and being mined is somewhat lower than we had anticipated, the manganese, however, is increasing and the silica is in line with our estimate. We believe that our 1920 shipments will approximate 57.00% iron and 2.00% manganese.

SHIPMENTS

Following are the cargoes of Meadow-Fowler ore shipped during the past year and the analysis of same as obtained at the Mine and by the Lower Lake Chemists:

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons</u>
<u>BREITUNG-</u>							5,403
Mine-----	56.72	.059	1.58	10.08	-----	-----	
Cremer & Case-----	55.80	---	----	----	11.84	49.193	
<u>MUNISING-</u>							4,681
Mine-----	58.32	.061	1.51	9.82	-----	-----	
Crowell & Murray---	56.22	---	----	----	11.92	49.519	
<u>PETER WHITE-</u>							9,867
Mine-----	56.34	.058	1.26	11.29	-----	-----	
Cremer & Case-----	55.20	---	----	----	11.41	48.902	
<u>CADILLAC-</u>							6,621
Mine-----	56.14	.058	.97	11.54	-----	-----	
Textor-----	56.15	---	----	----	11.53	49.676	
Cremer & Case-----	55.70	---	----	----	11.16	49.484	
<u>MARQUETTE-</u>							7,540
Mine-----	56.38	.054	1.22	11.61	-----	-----	
Emmerton-----	55.80	---	----	----	10.90	49.718	
<u>GRAND ISLAND-</u>							9,034
Mine-----	56.24	.056	1.43	11.17	-----	-----	
Cremer & Case-----	55.30	---	----	----	11.51	48.935	
<u>GRAND ISLAND-</u>							9,064
Mine-----	56.04	.064	1.61	11.65	-----	-----	
Crowell & Murray---	55.80	---	----	----	11.38	49.450	
<u>LUZON-</u>							5,448
Mine-----	56.74	.066	1.83	10.56	-----	-----	
Textor-----	56.03	---	----	----	13.02	48.735	
<u>CLETUS SCHNEIDER-</u>							5,925
Mine-----	57.00	.073	2.04	10.17	-----	-----	
Emmerton-----	56.80	---	----	----	12.75	49.558	
<u>C. S. HEBARD-</u>							9,754
Mine-----	56.71	.064	1.48	10.77	-----	-----	
Textor-----	56.45	---	----	----	11.39	50.020	

<u>C. W. KOTCHER-</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
							6,996
Mine-----	56.98	.072	1.97	10.11	-----	-----	
Textor-----	57.00	---	----	-----	10.98	50.741	

The average analysis of the season's shipments as sampled at the Mine and by the Lower Lake Chemists were as follows:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
Sampled at Mine-----	80,334	56.84	.061	1.58	10.55	-----	-----
Sampled at Lake Erie---	79,531	55.98	---	----	-----	11.59	49.491

Shipments from the Meadow-Fowler Mines were not started until the first of June. Due to a strike on the Duluth & Iron Range Ore Docks, shipments were suspended from August 8th to the 15th, inclusive. Shipments were discontinued for the year on November 24th.

The following is a complete analysis of the ore forwarded from the Meadow and Fowler Mines during 1919:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Alumina</u>	<u>Lime</u>	<u>Magnesia</u>	<u>Sul-Phur</u>	<u>Loss By Ignition</u>
Meadow-	30,394	56.94	.075	2.46	8.72	1.87	.10	.11	.015	4.00
Fowler-	49,940	56.62	.051	1.04	10.81	1.95	.09	.10	.012	4.41
TOTAL--	80,334	56.74	.060	1.58	10.02	1.92	.09	.10	.013	4.25

ACCIDENTS

Following is a list of the accidents, where the injured parties lost time, which occurred at the Meadow-Fowler Mines during the past year:

LOUIS GRADISHAR

Injured-----February 26th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----15 Days.
Received Compensation-----\$14.00.

Remarks: Gradishar was pushing a tram car and pinched fingers of his right hand between the side of the car and a post, smashing fourth finger of the hand.

TOM DOICH

Injured-----March 6th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----133 Days.
Received Compensation-----\$456.00.

Remarks: While dumping a tram car of ore Doich caught his left hand between the box and the truck, causing a wound one inch in length over dorsal surface of first phalanges third finger. Wound three quarters of inch over dorsal surface second joint second finger and patches skin off palm. Wound became infected and severely crippled his left hand.

STEVE KODIK

Injured-----October 10th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----7 Days.
Received Compensation-----None.

Remarks: Kodik was putting up a cap of timber and pinched his thumb between the cap and leg of timber, causing a bruise of left thumb, involving the nail.

TOM PARACOVICH

Injured-----October 30th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----7 Days.
Received Compensation-----None.

Remarks: While wheeling ore in a barrow Paracovich squeezed his hand between the handle and a post, causing a severe bruise over knuckle of second finger of left hand.

ALFONZO FRITZ

Injured-----December 18th, 1919.
Occupation-----Pumpman.
Nationality-----Italian.
Time Lost-----Not returned Jan.1st,1920.
Compensation Paid-----None to Date.

Remarks: Fritz was climbing down to work and slipped from a ladder. He fell about eight feet. The result of the fall was a sprain to the spine in the lumbar region, also sprain to both feet.

UNDERGROUND

For the first six months of the year four contracts were employed in the Meadow workings and six in the Fowler. From July 1st. to November 1st. six gangs operated on the Meadow side and four on the Fowler and the last two months of the year five on the Meadow and four in the Fowler.

At the end of the year the pillars on the old main tramming level were being attacked in both properties. The deposit at this elevation is so narrow, however, in both cases that it is impossible to work more than a total of four gangs. The main level pillars are being rapidly drawn back and the development of a sub 20' below is now in progress.

The second level (1260' elevation), which was extended out to No. 10 raise during 1918, is used for tramming the product from the 1325' sub. Three raises were put up from the second to the first level during 1919 and the shaft pocket enlarged to accommodate the 3-ton saddle back cars.

Both the Meadow and Fowler deposits narrow toward the bottom and it will be extremely difficult to maintain an operating force of 10 gangs during 1920. We cannot maintain an economical operation with a crew reduced much below 10 gangs and in consequence every effort is being made to develop and mine the balance of the ore so as to engage the maximum force.

MEADOW WORKINGS

"1365 Foot Sub-Level"

Two contracts were employed at this elevation the first few months of the year, slicing and caving back in the vicinity of Nos. 13 and 14 raises. This ore was exhausted by July 1st. and the contracts moved down to the 1355' sub. The ore produced

from this sub during 1919 averaged close to 58% iron and 2.50% in manganese.

"1355 Foot Sub-Level"

The deposit at this elevation was developed and sliced out during the past year, a force of from 2 to 3 gangs having been employed on the work. The quartzite foot wall cuts off the ore body to the north and there is an intrusion of taconite to the west, just under the 1365' sub. In consequence the 1355' workings were very much restricted and were confined to the central part of the deposit.

The grade of ore gained at this elevation during the year was quite satisfactory, averaging better than 57% iron and 2.50% manganese.

"1345 Foot Sub"

At the beginning of the year two contracts were engaged here, one gang starting to slice back the deposit along the quartzite foot wall at the northwest end of the mine and the second gang on development work along the taconite wall to the south. The pillars between Nos. 14 and 205 raises were crushing and it has been necessary to do considerable repair work during the year to keep them open. Aside from the product extracted at this elevation, the output from the 1355' sub has been dumped to and handled through the north foot wall drift and the heading along the south taconite wall.

A force of from two to three gangs was employed in slicing and caving back the deposit throughout the year. On January 1st., 1920, the ore had been gained to No. 201 raise and the ground between Nos. 10 and 13 raises had been extracted, leaving a long narrow pillar to the south of the main haulageway. We estimate that the pillars between Nos. 10 and 201 raises

contain approximately 8,000 tons of ore on January 1st. Two contracts will be engaged in slicing out this ore during the next 4 to 5 months.

The ore mined on the 1345' sub during the year averaged 57% iron and 2% manganese. The material on the 1325' sub, 20' below, shows higher iron, but the average manganese is correspondingly lower.

"1325 Foot Sub"

Contract No. 6 spent the last two months of the year in development work at the south end of the sub. The workings were extended from one of the new second level raises. It is the intention to block out pillars between the taconite walls and follow the narrowing deposit to the south limits.

The working force at this elevation will be increased from time to time during the year as the exhaustion of the pillars on the 1345' level permits.

FOWLER WORKINGS

"1380 Foot Sub-Level"

The 20' x 100' pillar to the south of Nos. 7 F and 8 F raises was mined during the early part of the year, and also a small pillar 15' x 30' to the north of No. 8 F raise.

The ground surrounding the old Fowler shaft was not disturbed, as it was necessary to keep this shaft open for purposes of ventilation, for the handling of timber and to afford a second outlet for the men.

The ore gained at this elevation was of rather low grade, running 55.50% iron and 1% manganese.

"1365 Foot Sub-Level"

Several gangs were engaged at this elevation the early part of the year drawing off pillars in the neighborhood of Nos.

1 F, 2 F, 3 F, 5 F and 7 F raises. The grade of ore from the No. 1 F, 2 F and 3 F raise pillars averaged close to 59% iron and 1% manganese, while the pillars to the north ran considerably lower.

A 40' x 60' pillar was left along the north boundary for protection of the shaft. It is a question whether or not we will ever be able to recover this pillar, certainly not without considerable expense. The grade of the ore is quite inferior, averaging little better than 50% iron and about 2% manganese.

"1355 Foot Sub-Level"

Development work at this elevation was begun in March and mining activities were carried on throughout the year. The working force varied from one to four gangs, the deposit being sliced and caved, with the exception of narrow pillars immediately above the main tramway. This sub was less extensive than the 1365', as the north foot wall is rather flat and the north and easterly workings were thrown back from 20' to 30'.

The grade of ore mined on the 1355' sub averaged 57% iron and 1.50% manganese. The remaining pillars, estimated at 2,000 tons, will be drawn off when operations on the main level will permit. These pillars have been left to protect the main haulageway and as the slices at the lower elevation progress southward, the ground above can be removed.

"1345 Foot Level"

The main level drifts from 3 F raise to the north boundary have shown considerable weight during the year and it has been necessary to do a large amount of repair work. We finally had to abandon the drift leading to the Fowler shaft and drive in through the lean ore along the west shore line. It is important that we maintain adequate ventilation, in order to free the workings from the gasoline fumes. For this reason

it is going to be practically impossible to extract all the ore at this elevation. For purposes of ventilation we will have to leave a small pillar along the west shore line drift.

One gang has been engaged the last few months of the year in slicing and caving to the south of the shaft pillar. While this ore runs only about 56% in iron, the manganese varies from 2% to 3%. The workable ground is so narrow that but one gang can work to advantage.

Contract No. 10 spent the last two months of the year in endeavoring to develop some merchantable ore to the southeast of No. 1 F raise. Development work by contracts Nos. 9 and 11 on the 1325' sub, 20' below, led us to believe that the merchantable ore would extend to the main level near the Meadow boundary. Contract No. 10 did not, however, cut any high grade ore, although they drifted 185' across and along the formation between No. 1 F raise and the Meadow line.

"1325 Foot Sub"

Contract No. 9 spent the last four and No. 11 the last two months of the year in developing the ground at this elevation from one of the new Meadow second level raises. This is the same ore channel as we have been working to the north during the past two years. The dip of the formation is such that the high grade ore does not extend to the main tramway south of No. 1 F raise.

The ore body developed thus far on the 1325' sub has an average width of 60' and a length of 240'. Judging from the results of our main level test-pitting, this sub should be pushed at least 100' further north.

While the ore body is somewhat cut up with seams of taconite, there is considerable material running better than 58% iron and the manganese varies from 1.50% to 4%. This sub can be worked independently of the main Fowler deposit, as there is

a sufficient rock pillar between it and the main level tramway to protect the latter. When the northern limits of the sub have been developed slicing operations will be started and in the meantime, raises will be put up to determine the height of the merchantable material and a second sub opened, if conditions warrant.

ANALYSIS OF COST SHEET

The labor situation during the years 1918 and 1919 was about the same, the average wages prevailing, however, during 1919 were higher. We operated shorthanded most of the time and even by carrying extra hands we were unable to keep our contracts filled.

The production from the Meadow and Fowler Mines for 1919 amounted to 100,081 tons and compares with an output of 93,389 tons for the previous year. The average daily hoist for 1919 was 326 tons, against 303 tons in 1918.

The charges per ton against the several main captions, making up the cost of production at the Meadow and Fowler Mines for the years 1919 and 1918, follow:

	<u>1919.</u>	<u>1918.</u>
Tonnage-----	100,081	93,389
General Expense--	\$.122	\$.182
Maintenance-----	.139	.099
Mining Expense---	<u>1.816</u>	<u>1.552</u>
TOTAL-----	\$2.077	\$1.833

GENERAL EXPENSE

The 1919 charges to this caption were \$.06 less than for 1918, the difference occurring largely in "Personal Injury Expense". The charges to "Insurance", "Engineering" and "Analysis" corresponded very closely.

There was a decrease in 1919 of \$.067 in the account "Personal Injury Expense". This was due to the settlement of two fatal accident cases in 1918. "Personal Injury Expense" was nominal for 1919.

On account of the depreciation of Company automobiles, the charge to "Mine Office" shows an increase of \$.005 per ton in 1919.

MAINTENANCE

The principal items entering into the increase of \$.027 per ton in this caption were "Tracks & Yards", "Buildings", "Boiler Plant", "Hoisting", "Underground Tracks & Cars" and "Gasoline Locomotives"; the expense under "Docks, Trestles & Pockets", "Shop Machinery", "Compressors & Power Drills", "Pumping Machinery", "Top Tram Engines & Cars", "Skips & Skip Roads" and "Telephone & Safety Devices" being nominal for both years and being practically the same in their effect on the cost per ton.

"Tracks & Yards" showed a decrease in 1919 of \$.007 per ton. This was due to a substantial refund by the Duluth & Iron Range Railway on account of track maintenance.

There was an increase of \$.010 to "Buildings" in 1919. This was the result of remodeling our garage and dry house.

In the item "Hoisting", a decrease of \$.006 was shown in the cost per ton for 1919. During 1918 a number of replacements were made to the hoist and the machinery was given a complete overhauling, whereas the 1919 charges to this account were nominal.

There was a decrease of \$.006 per ton to "Boiler Plant" in 1919, due to the fact that rather extensive repairs and a number of replacements were made in 1918.

"Underground Tracks & Cars" shows an increase of \$.021 per ton in 1919. Our main level haulage track was badly worn in places and it was necessary to replace same during the past year. We also made comparatively heavy repairs to this and the second level tracks.

There was an increase of \$.019 per ton for "Gasoline Locomotives" in 1919. We had but one locomotive in operation during a large part of 1918, whereas we had two machines operating steadily during 1919, of the three at the mine. The gasoline locomotives began to show wear during the past year and the upkeep was relatively heavy, including the changing over from batteries to magnetos.

MINING EXPENSE

The 1918 and 1919 charges to the following items, as affecting the cost per ton, were practically the same: "Air Pipes", "Compressors", "Hoisting", "Captain & Bosses", "Dry House" and "Stocking Ore".

Under "Pumping" there was a decrease of \$.013 for 1919. Less water was pumped in 1919 and the production was larger. The cost of keeping the surface drainage ditches open was slightly greater in 1918.

The repairs to the shaft were very light in 1918 and no sinking operations were undertaken. In 1919 the shaft was sunk full size to the second level pocket and quite a little repair work done between the collar and ledge. This resulted in increasing the cost per ton by \$.014.

"Rock Drifting" showed a decrease of \$.041 in 1919. A small amount of rock drifting was attempted in 1919, whereas the second level drift was extended over 300' in very hard material in 1918.

The 1919 increase of \$.18 in the charge per ton for "Breaking Ore" was due to the higher average wages prevailing and the decrease in the tons per man realized.

"Tramming" showed an increase of \$.019 per ton for 1919. The working places were more scattered and it was necessary to operate two of the gasoline locomotives steadily. In 1918 one locomotive took care of the output during the greater part of the year.

Due to extensive repairs on the main tramways, including the close timbering of several hundred feet of drifts, the 1919 charges to "Timbering" showed an increase of \$.074 per ton. Due to the badly crushed condition of the subs, it was also necessary to use a comparatively large amount of covering boards and lagging the past year.

"Top Landing & Trammimg" showed an increase of \$.019 per ton for 1919. This was the result of higher wages and a longer tram on our stocking trestle. The Fowler pile was considerably larger the past year and as the two ores are kept separate, it necessitated a switching of the cars and the building out of narrower piles.

The large quantity of rock which was hand picked from the stockpile during 1919 resulted in an increase of \$.008 per ton for the item "Sorting Ore".

MEADOW MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1919.

GRADE	IRON	PHOS.	SILICA	MANG.
Meadow,	56.98	.071	9.73	2.32

(Cargoes all Mixed).

ORE STATEMENT FOR YEAR 1919.

	MEADOW	TOTAL LAST YEAR
On hand Jan. 1st, 1919,	4,026	10,420
Output for year,	47,296	45,888
Stockpile Overrun,		232
Total,	51,322	56,540
Shipments,	30,394	52,514
Balance on hand,	20,928	4,026
Increase in output-1%	1,408	
Increase in ore on hand,	16,902	

1919 - 2-8 Hour Shifts during year

1918 - 2-8 " " " "

SHIPMENTS FOR YEAR 1919.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Meadow,	25,307	5,086	30,394	52,514
Total,	25,307	5,086	30,394	52,514
Total last Year,			52,514	
Decrease - 42%			22,120	

MEADOW MINE.

FOWLER MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1919.

GRADE	IRON	PHOS.	SILICA	MANG.
Fowler,	56.95	.059	10.95	1.04

(Cargoes all Mixed).

ORE STATEMENT FOR YEAR 1919.

	FOWLER	TOTAL LAST YEAR
On hand January 1st, 1919,	7,392	2,875
Output for year,	52,785	47,219
Stockpile Overrun,		50
Total,	60,177	50,144
Shipments,	49,940	42,752
Balance on hand,	10,237	7,392
Increase in output-11%	5,566	
Increase in ore on hand,	2,845	

1919 - 2-8 Hour Shifts during year

1918 - 2-8 Hour Shifts during year

SHIPMENTS FOR YEAR 1919.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Fowler,	20,927	29,013	49,940	42,752
Total,	20,927	29,013	49,940	42,752
Total last Year,			42,752	
Increase - 12%			7,188	

FOWLER MINE.

MEADOW MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	100,081	93,389	6,692	
General Expense	.122	.182		.060
Maintenance	.139	.099	.040	
Mining Expense	1.816	1.552	.264	
Cost of Production	2.077	1.833	.244	
Extraordinary drifting & Exploratory		.110		.110
<u>DEPRECIATION.</u>				
Plant	.008	.050		.042
Equipment	.003	.004		.001
Total Depreciation	.011	.054		.043
Taxes	.117	.078	.039	
Central Office	.064	.072		.008
Miscellaneous	.013	.023		.010
Sundry Expense	.007	.031		.024
Supply Inventory	-	.024		.024
Cost on Stockpile	2.289	2.225	.064	
Loading & Shipping	.084	.082	.002	
Total Cost on Cars	2.373	2.307	.066	
No. Days Operating	307	308		1
No. Shifts and Hours	2-8hr	2-8hr		
Avg. Daily Product	326	303	23	
<u>COST OF PRODUCTION.</u>				
Labor	1.506	1.237	.269	
Supplies	.571	.596		.025
Total	2.077	1.833	.244	

MEADOW MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 8.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	100,081	93,369	6,692	
No.Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	23	22	1	
Underground	57	51	6	
Total	80	73	7	
AVERAGE WAGES PER DAY				
Surface	5.42	4.55	.87-19.1%	
Underground	6.42	5.50	.92-17%	
Total	6.14	5.21	.92-17.8%	
WAGES PER MONTH OF 25 DAYS				
Surface	135.50	113.75	21.75	
Underground	160.50	137.50	23.00	
Total	153.50	130.25	23.25	
PRODUCT PER MAN PER DAY				
Surface	14.10	13.51	.59	
Underground	5.63	5.89		.26
Total	4.02	4.10		.08
LABOR COST PER TON				
Surface	.385	.337	.048	
Underground	1.139	.932	.207	
Total	1.524	1.269	.255	
AVG. PRODUCT BRK'G & TRM'G	7.63	8.52		.89
" WAGES CONTRACT MINERS	6.84	5.81	1.03	
" " " TRAMMERS	0	0		
" " " LABOR	6.84	5.81	1.03	
TOTAL NUMBER OF DAYS				
Surface	7,092	6,913 $\frac{1}{2}$	178 $\frac{3}{4}$	
Underground	17,758 $\frac{1}{2}$	15,848	1,910 $\frac{1}{2}$	
Total	24,850 $\frac{1}{2}$	22,761 $\frac{1}{2}$	2,089 $\frac{1}{2}$	
AMOUNT FOR LABOR				
Surface	38478.67	31455.42	7,023.25	
Underground	114066.75	87081.15	26985.60	
Total	152545.42	118536.57	34008.85	

Proportion Surface to Underground Men:

1919 - 1 to 1.84
 1918 - 1 to 2.31
 1917 - 1 to 2.8
 1916 - 1 to 3.

MEADOW MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1919.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1919.	AMOUNT 1918.
4" to 6" Timber				361.50
6" to 8" "	15,500	.02	310.00	
8" to 10" "	82,500	.0673	5554.50	4267.25
10" to 12" "	27,500	.105	2887.50	957.84
Total - 1919	125,500	.069	8752.00	
Total - 1918	90,171	.062		5586.59
	LINEAL FEET.	PER 100'.		
5' Lagging	25,500	.911	232.50	
6' "	326,400	.833	2720.00	1599.87
Total Lagging	351,900	.839	2952.50	1599.87
Poles	8,784	1.20	109.30	
Total - 1919	360,684	.849	3062.30	
Total - 1918	274,380	.583	1599	1599.87
Product			100,081	93,389
Feet Timber per ton of ore			1.254	.965
Feet Lagging "			3.516	2.938
Feet Lagging per Ft. of timber			2.804	3.043
Cost per ton for Timber			.087	.060
" Lagging			.030	.017
" Poles			.001	.000
" Timber, Lagging & Poles			.118	.077
Equivalent of stull timber to Bd.Measure			182,225	138,165
Ft.Bd.Measure per ton of ore			1.82	1.48
Total cost for Timber, Lagging & Poles - 1919				11814.30
" 1918				7186.46
" 1917				7085.35
" 1916				2484.70

MEADOW MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 9.	AMOUNT. 1 9 1 8.
30% Powder	1,000	.1690	169.00	
40% "	34,230	.1626	5565.55	5894.44
Total Powder	35,230	.1628	5734.55	5894.44
Fuse	70,700		615.84	495.56
Caps	28,160		406.09	295.53
Cap Crimpers	21		9.00	
Tamping Bags				12.40
Total Fuse, Etc.			1030.93	803.49
Total Explosives			6 765.48	6697.93
Product			100,081	93,389
Pounds Powder per ton of Ore			.352	.344
Cost per ton for Powder			.057	.063
" Fuse, Caps, Etc.			.010	.009
" All Explosives			.067	.072
Avg. Price per Lb. for Powder			.1628	.1832

HILL-TRUMBULL MINE
ANNUAL REPORT FOR 1919.

Engineering work at the Hill-Trumbull property was started in March and a crew of four men was transferred to Marble the latter part of this month. A considerable amount of preliminary work was done by this crew during the Summer, more especially in connection with the washing plant project and the railway tracks leading thereto from the open pit.

RAILWAY TRACKS

A force of men was employed the latter part of September and the work of laying track into the Hill Pit and extending the line to the north from the Great Northern yards, was begun. It was also necessary to re-tie the two westerly tracks of the Great Northern yard, which we have under lease. These jobs were pretty well completed by the middle of October, when our 85-C Bucyrus steam shovel and one of the 45-ton locomotives were received.

Arrangements were made with the Great Northern Railway to build the spur from their main line to our washing plant. The Great Northern Company let this out on contract and the work of grading was completed on the 24th of December. The construction company is now laying steel and will ballast the tracks sufficiently, so that structural steel may be delivered to our washing plant site, on or soon after March 1st. This spur will be about $1\frac{1}{4}$ miles in length, approximately one-half of which will be double tracked, to accommodate sufficient empties and to allow for the switching out of loads. It is the intention to complete the ballasting of this track during March and April, when weather conditions are favorable.

The model "36" Marion shovel was received from the Crosby Mine on the 28th of November and was set up and started
HILL-TRUMBULL MINE.

digging for our railroad grade across the old Hill dump. It was necessary to make a cut, varying from 2' to 8' in depth along 1,100' of the dump, in preparing a grade for our washing plant track. The track was extended from the end of this grade onto the dump trestle, which was put in use on the 15th of December. In order to affect satisfactory and desirable grade conditions and also cut down the height of our trestle, leading from the dump to the washing plant, it was advisable to make the above cut. The ground was frozen down about 3' and we were obliged to blast in front of the shovel. The material was cast along the two sides and will be mucked back with the "36" shovel when weather conditions are favorable in the Spring. While the dump is approximately 40' in height, it is largely of a clay material and we encountered several very soft spots in our cut, necessitating the use of long sill timbers to support the shovel. Apparently the rain water had seeped down to the impervious clay and thereby softening the ground. No material had been placed on this part of the dump for the past seven years and we were very much surprised to find the soft ground in making our cut.

A 28' railway bridge, spanning the County Highway at the approach end of the dump, was started on the third of November and completed on the 13th. A force of carpenters from the Crosby Mine was employed on this job.

A contract was let during October for the erection of our washing plant approach trestle at a price of \$1.65 per lineal foot. It will be necessary to fill the approach from two trestles, the ultimate height being too great for one structure. The lower trestle varies in height from 15' to 40' and the upper structure from 1' to 30'. We furnish all material, the contract price simply covers the erection. The work of erecting the first trestle was well along on January 1st. and should be completed within the

time specified in the contract; namely, February 15th. This job has been carried well ahead of our dumping requirements at all times. The second trestle will be started from the washing plant end upon the completion of the first structure, so as not to interfere with our dumping operations. We will be able to fan out along the dump end of the first fill while the construction of this part of the second trestle is in progress. We will, of course, be obliged to put a substantial shoulder on the first dump before erecting the secondary trestle, where the fill reaches an appreciable height.

In order to take care of the Mud Lake drainage, it was necessary to construct a culvert 180' in length. This culvert was built of 12" x 12" timbers and will be covered with a fill approximately 40' in height. The work was done by contract at a price of \$3.50 per lineal foot. We furnished all the material for this job.

WASHING PLANT

The surveys for our washing plant were completed in the Summer and our definite plans decided upon the latter part of the year.

A contract was let during October for the delivering of gravel on the mill site at a price of \$1.85 per cubic yard. The contractor completed this work on December 5th, the total quantity amounting to 777 yards.

The railroad construction crew was given a contract for the grading of our mill site at a price of 75¢ per cubic yard. This work was started on the 12th of November and completed on the 26th, the material excavated amounting to 1,234 cubic yards.

Excavation for our washing plant piers was started the forepart of November and completed the middle of December.

This job progressed rather slowly, due to the heavy frost and the large quantity of boulders encountered. The forms are to be set during January and the concrete poured as soon as weather conditions are favorable. We have a one-quarter yard concrete mixer, equipped with a heating device, on the ground and the gravel required for the plant piers, also the crusher and receiving bin foundations, has been delivered as noted above. A large quantity of boulders, encountered in the excavation for the site and piers, were piled in the vicinity and will be used in the foundations.

OPEN PIT OPERATIONS

The second-hand 85-C Bucyrus steam shovel, purchased by Mr. McClure in East St. Louis, was received and put in shape for operation the latter part of October. The first job undertaken with this shovel was the casting for the railroad grade just north of the Great Northern yards. Upon the completion of this work, October 24th, the shovel was moved into the Hill approach and was engaged until the 18th of November in digging a drainage cut along the east side of the track. The material from the cut, amounting to 6,372 cubic yards, was removed from the pit and used in raising the new track to the north of the yards. One of the 45-ton locomotives, purchased from Butler Brothers, and the second-hand 12-yard cars were used in this operation. Some delay was encountered in the prosecution of the work, due to a seam of quick sand in the bottom of the cut. It was necessary to do some cribbing in order to keep the sand from washing.

The yardage handled here per shift was very light, due to the fact that the material could not be distributed along the track in any quantity.

Upon the completion of the drainage cut along the approach track, the 85-C Bucyrus shovel was taken out of the pit

and turned around in order to attack the stripping bank to the best advantage. Stripping operations along the north side of the Hill approach were started on November 20th, the early work here being restricted for a time on account of the limited quantity of material, which we could handle to advantage along the tracks to the north. It was extremely difficult to raise the tracks and take care of any amount of frozen material. It was necessary to widen out the approach to the stripping dump and throw our tracks to the east in order to get our tracks lined on the right of way provided for us by the agreement between the Arthur Iron Mining Company and the Oliver Iron Mining Company.

The second 45-ton locomotive was placed in operation in November. We handled 9,972 cubic yards during this month, the quantity being comparatively small, due for the most part to the fact that the shovel cut was extremely shallow and our capacity for handling the material was very much restricted. Aside from this, there were the usual number of delays incidental to starting a job of this sort and it was necessary to make some repairs on our 12-yard air dump cars.

The progress of the work during December was also affected to a considerable extent by our being limited in dumping capacity. The grade to our approach trestle was not completed until the latter part of the month and the 22,696 yards of stripping was dumped along the old approach shoulder and our tracks thrown out onto the new fill. We had handled a total of 32,688 yards of surface material by the first of the year.

Progress of our operations were delayed somewhat during December on account of the strike on the coal docks, by the holiday season and very severe weather. One of the 12-yard air dump cars went over the side of the dump and a broken cap on our trestle was responsible for tipping over a second car. The cars were not damaged to any great extent and the necessary repairs were made

within a few days after the accident. The posts on the trestle were shoved out from under the caps and this resulted in breaking the stringers. This difficulty has been largely overcome by the use of wire stays, fastened from the top of each post back of the stringers.

The Bucyrus shovel lost some time due to breaks and derailments. We are working on a very high bank and side slides frequently bury the jack arms. One shift was lost on December 31st., due to the breaking of a jack arm, which was struck by a large chunk of frost. The hoisting chain failed in several places and it was necessary to install a new chain on December 28th.

The first cut will be approximately 1,600' in length and we anticipate that it will be completed the latter part of January. The bank varies from 50' to 70' in height, but the first cut is entirely in slope material and the high bank was not blasted. We expect to get some very good ballasting material along the last 500' of the cut. Preparations were made to blast the bank behind the shovel and we figure on moving back and starting the second cut by the first of February. Due to the considerable height of the bank, the material from the second cut will be loaded on the same track as the first. The track will be shifted in toward the bank for the third cut.

Our washing plant approach fill will require 351,000 cubic yards of material and we now figure on completing the work, also extending and ballasting our track to the washing plant, by the first of July. We also anticipate the completion of an additional 350,000 cubic yards of stripping during the coming year.

Arrangements were made with the Oliver Iron Mining Company to take care of any necessary repairs to our equipment in their old Hill shops and we have also secured our water supply from them. The local management of the Oliver Iron Mining Company has been most accommodating and our arrangements with them have

assisted materially in keeping our operations going.

The general labor situation in and about Marble has been quite satisfactory and it is our opinion that we will be able to secure sufficient hands for the job, after we have erected the four boarding houses, four cottages and captain's house, contemplated.

ACCIDENTS

There was only one accident of a serious enough nature to be reported. The description of this accident follows:

LOUIS LUIVENE

Injured-----November 13th, 1919.
 Occupation-----Laborer.
 Nationality-----French.
 Time Lost-----52 Days.
 Compensation Paid-----No payment to-date.

Remarks: In lifting a track jack Luivene sprained his back. He has received no compensation, due to the fact that the attending physician expressed the opinion that Luivene feigned illness for too long a period after the injury, that he could and should have returned to work within a short time. Luivene has made no complaint thus far and we are not making a report for final compensation until a further investigation is made.

ESTIMATE OF PRODUCTION

The estimate of production from the Hill-Trumbull Mine for the year 1920 is 350,000 tons. This estimate is based on the assumption that our washing plant will be ready for operation on the first of July. Should there be a delay of one month in the starting of our mill, the production will be reduced by 100,000 tons.

Following is a detail of the estimate as to grade and the analysis of same:

	Tons	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Bessemer Direct Shipping-	62,500	58.00	.045	13.00	9.00	52.78
Bessemer Concentrates---	112,500	60.00	.045	8.50	8.00	55.20
Non-Bess.Direct Shipping-	62,500	59.00	.060	11.50	9.00	53.60
Non-Bess. Concentrates---	112,500	60.00	.075	8.50	8.00	55.20
TOTAL- - - - -	350,000	59.46	.057	9.84	8.36	54.49

The silica content in this direct shipping ore is rather high. We have been most conservative in our estimates and we feel that it may be possible to grade our direct shipping ore so as to obtain a lower silica content in the Bessemer especially. Based on our results at the Crosby mill, the silica content of the Hill-Trumbull concentrates should be somewhat lower than we have shown, but we feel that it is advisable to be conservative in that this is a new ore.

Unfortunately the proportion of direct shipping ore to the concentrates is much larger for the year 1920 than it will be any year thereafter, also the tonnage of direct shipping ore in 1920 will be decidedly limited and we will, therefore, have very little leeway in the matter of grading. Subsequent to 1920 we will have a larger tonnage of direct shipping ore uncovered and will be able to do more grading, as regards this particular material. According to our schedule of production, 36% of the 1920 output will be direct shipping ore, whereas it will amount to only 23% in 1921 and 22% in 1922 and 1923.

Hill-Trumbull Ore Estimate of January 1st., 1920.

Following is an estimate of the ore in sight at the Hill and Trumbull properties on January 1st., 1920. A factor of 14 cubic feet per ton was used in the case of the direct shipping ore and 18 cubic feet for the wash material.

	<u>HILL MINE</u>		<u>TRUMBULL MINE</u>		<u>T-O-T-A-L</u>	
	<u>DIRECT</u>	<u>WASH</u>	<u>DIRECT</u>	<u>WASH</u>	<u>DIRECT</u>	<u>WASH</u>
Bessemer-----	1,123,000	2,215,000	85,000	3,453,000	1,208,000	5,668,000
Non-Bessemer-	1,123,000	813,000	365,000	649,000	1,488,000	1,462,000
TOTAL-----	2,246,000	3,028,000	450,000	4,102,000	2,696,000	7,130,000

The above table shows a total of 5,274,000 tons for the Hill Mine and 4,552,000 tons for the Trumbull, or a grand total of 9,826,000 tons for these properties.

The average analysis of the Hill-Trumbull ores are as follows:

<u>TRUMBULL MINE</u>					
<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Fe.Nat.</u>	
85,000	56.40	.040	12.79	51.32	
365,000	58.04	.060	9.85	52.82	
3,453,000	60.00	.043	8.00	55.50	
<u>649,000</u>	<u>60.00</u>	<u>.080</u>	<u>8.00</u>	<u>55.50</u>	
4,552,000	59.78	.050	8.34	55.21	

<u>HILL MINE</u>					
<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Sil.</u>	<u>Fe.Nat.</u>	
5,274,000	56.61	.050	12.54	50.95	

The Hill-Trumbull properties have now been thoroughly explored and we do not expect to add any appreciable tonnage, as the result of development work. We do not anticipate any explorations during 1920, further than for the purpose of grading the material in our shovel cuts.

BOEING MINE
ANNUAL REPORT FOR 1919.

EXPLORATIONS

A drilling campaign was started at the Boeing Mine during the month of February. Our original plan was to put down from 18 to 20 drill holes, but due to the proving up of a deep ore channel along the north shore line of the deposit, it was necessary to sink several additional holes. Twenty-four drill holes were put down, the work being completed the forepart of May.

Our drilling program did not result in materially altering our ore estimate, but it did affect the grading somewhat, raising the iron and lowering the silica content. Further than this, the drilling showed the feasibility of a stripping proposition, by increasing the tonnage of ore to be uncovered by a like yardage.

The deep ore in old drill hole No. 111 at the east end of the deposit did not show any width and whereas we based our open pit ideas largely on the showing here, it was the development to the northwest that caused us to look with favor upon the open pit question. Drill hole No. 111 apparently was at the east end of the deep ore channel and in consequence the open pit will have a minimum width in this vicinity. To the northwest the channel deepens and widens, this being proven by drill holes Nos. 408, 410, 412, 415, 418 and 420. Further than showing the deep channel our drilling campaign did not disclose any extensions of the ore body and the deposit as shown on our cross sections was not changed, with the above exception.

Following is a list of the diamond drill holes, showing the dates, footages of the different material and analysis of the ore cut:

<u>DRILL HOLE NO.</u>	<u>DATE BEGUN.</u>	<u>DATE BOTTOMED</u>	<u>FOOTAGE</u>	<u>MATERIAL</u>				
				<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	
400	2/6/19	2/18/19.	0-124	Surface.				
			124-159	60.18	.076	.32	3.67	
			159-176	46.42	.057	.96	23.82	
			176-186	Taconite.				
			186-191	45.70	.027	.14	31.90	
401	2/6/19	2/19/19.	0-120	Surface.				
			120-150	58.24	.077	.81	4.99	
			150-161	53.05	.083	1.18	9.61	
			161-170	Taconite.				
402	2/10/19	2/20/19.	0-125	Surface.				
			125-135	57.33	.064	.31	5.54	
			135-156	55.07	.093	1.54	4.95	
			156-166	57.49	.088	.68	7.91	
			166-171	45.93	.080	.37	28.12	
			171-176	Taconite.				
			176-180	48.03	.145	.20	24.89	
403	2/11/19	2/22/19.	0-122	Surface.				
			122-157	57.67	.095	.60	6.09	
			157-177	53.35	.090	.99	11.04	
			177-180	Taconite.				
			180-190	45.24	.054	1.16	21.71	
			190-195	50.76	.054	.72	18.88	
404	2/20/19	2/28/19.	0-117	Surface.				
			117-155	57.74	.097	.90	5.18	
			155-160	52.26	.154	.45	13.97	
			160-165	46.69	.088	.65	26.10	
			165-170	58.66	.039	.44	9.23	
			170-177	48.58	.067	1.10	16.11	
			177-187	Taconite.				
405	2/22/19	3/6/19.	0-128	Surface.				
			128-143	54.91	.116	.76	6.65	
			143-150	47.66	.071	3.40	8.89	
			150-155	Mixed Ore & Taconite.				
			155-160	57.00	.048	1.00	10.87	
406	2/24/19	3/10/19.	0-125	Surface.				
			125-140	54.95	.078	1.01	7.90	
			140-165	58.35	.073	1.07	7.52	
			165-170	50.25	.045	1.82	16.30	
			170-177	47.15	.051	1.99	12.25	
			177-180	57.80	.047	.98	6.67	
			180-185	Taconite.				
185-190	46.86	.046	2.08	16.77				

<u>DRILL HOLE NO.</u>	<u>DATE BEGUN.</u>	<u>DATE BOTTOMED</u>	<u>FOOTAGE</u>	<u>MATERIAL</u>			
				<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
407	2/26/19	3/7/19.	0-111	Surface.			
			111-113	56.24	.110	2.59	8.24
			113-121	Taconite and ore.			
			121-133	Taconite.			
			133-139	Taconite and ore.			
			139-154	46.40	.070	1.00	24.33
			154-159	Taconite.			
			159-169	Taconite and ore.			
			169-179	Taconite.			
408	4/28/19	5/9/19.	0-137	Surface.			
			137-155	57.34	.113	1.15	6.48
			155-160	53.94	.069	.80	11.81
			160-165	58.63	.056	.54	8.79
			165-175	51.99	.045	2.61	12.17
			175-180	57.66	.040	2.38	8.36
			180-187	53.15	.062	.73	15.44
409	3/10/19	3/17/19.	0-128	Surface.			
			128-150	55.32	.124	.59	6.94
			150-160	57.56	.067	1.29	8.68
			160-165	47.60	.071	.88	19.08
			165-175	Taconite.			
410	3/10/19	3/24/19.	0-130	Surface.			
			130-145	55.19	.108	.75	9.60
			145-200	57.14	.072	1.27	7.61
			200-239	51.46	.085	2.26	9.75
411	3/11/19	3/21/19.	0-131	Surface.			
			131-151	57.35	.068	.33	10.14
			151-164	55.22	.049	.46	16.28
			164-174	Taconite.			
412	3/13/19	4/12/19.	0-135	Surface.			
			135-140	46.05	.124	.17	26.27
			140-145	54.48	.120	.18	13.04
			145-175	58.53	.067	.63	6.95
			175-200	54.88	.077	2.48	10.46
			200-205	57.56	.074	1.49	8.29
			205-230	53.64	.088	4.40	7.66
			230-295	58.36	.070	1.25	8.10
			295-316	52.17	.038	.20	20.32
			316-346	46.80	.023	.19	27.83
			346-351	50.44	.015	.33	23.71
			351-366	48.49	.020	.23	25.23
			366-381	50.54	.022	.22	24.07
			381-396	57.70	.020	.26	13.24
			396-411	47.14	.022	.21	26.39
			411-416	57.47	.028	.24	11.74
			416-431	54.55	.025	.58	15.04
			431-446	48.61	.031	1.51	18.56
			446-451	52.12	.035	2.92	7.04
			451-471	Taconite.			
			471-481	48.84	.059	.31	24.39
			481-496	53.43	.065	.37	15.56
			496-516	Taconite.			
			516-526	51.86	.071	2.73	14.28

<u>DRILL HOLE NO.</u>	<u>DATE BEGUN</u>	<u>DATE BOTTOMED</u>	<u>FOOTAGE</u>	<u>MATERIAL</u>			
				<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
413	3/20/19.	3/28/19.	0-123	Surface.			
			123-125	52.87	.135	.24	14.90
			125-135	57.15	.115	.33	10.23
			135-140	53.51	.088	1.17	13.32
			140-147	57.58	.063	.70	9.90
			147-160	Taconite.			
414	3/24/19.	4/3/19.	0-137	Surface.			
			137-142	54.75	.122	.24	13.31
			142-157	58.91	.087	.35	7.16
			157-165	54.64	.059	1.42	11.01
			165-170	47.20	.071	.69	23.10
			170-180	Taconite.			
415	3/28/19.	4/29/19.	0-142	Surface.			
			142-155	57.15	.095	.23	8.76
			155-160	54.07	.076	.29	10.70
			160-295	58.86	.083	.95	7.43
			295-310	52.77	.023	.34	16.59
			310-323	57.51	.027	.30	12.75
			323-348	54.71	.028	.21	18.59
			348-358	58.33	.031	.29	13.62
			358-363	54.35	.031	.22	18.29
			363-403	58.10	.035	.28	12.19
			403-418	53.62	.068	1.41	9.72
			418-438	47.71	.091	1.24	18.70
438-443	51.79	.116	.74	14.70			
416	3/31/19.	4/12/19.	0-145	Surface.			
			145-150	52.44	.122	.27	16.41
			150-185	57.84	.090	1.07	8.45
			185-220	53.76	.113	1.64	12.61
			220-225	Taconite.			
			225-230	Taconite and ore.			
			230-235	Taconite.			
417	4/5/19.	4/17/19.	0-145	Surface.			
			145-170	59.88	.082	1.04	4.99
			170-180	52.06	.058	.58	15.33
			180-190	Taconite.			
418	5/1/19.	6/4/19.	0-143	Surface.			
			143-183	54.78	.070	.52	8.43
			183-318	58.00	.069	1.11	8.17
			318-368	52.09	.023	.28	20.39
			368-373	46.39	.053	.34	27.55
			373-393	53.27	.030	.30	17.33
			393-413	58.38	.054	.41	10.14
			413-433	52.95	.062	.47	15.17
			433-438	45.75	.043	.20	22.55
			438-448	51.40	.067	1.39	9.97
			448-463	46.01	.199	4.04	13.03
			463-468	Taconite and ore.			
			468-473	48.66	.048	.56	19.66
			473-488	Taconite and ore.			
			488-508	51.38	.075	2.05	15.92
508-513	Taconite and ore.						
513-553	Taconite and ore.						

BOEING MINE.

<u>DRILL</u> <u>HOLE NO.</u>	<u>DATE</u> <u>BEGUN.</u>	<u>DATE</u> <u>BOTTOMED.</u>	<u>FOOTAGE</u>	<u>MATERIAL</u>			
				<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
419	4/16/19	4/25/19	0-138	Surface.			
			138-180	58.68	.089	.64	8.79
			180-185	48.73	.069	.53	22.77
			185-194	Taconite.			
			194-209	Taconite and ore.			
420	4/16/19	4/29/19	0-136	Surface.			
			136-146	57.31	.092	1.00	12.52
			146-151	55.22	.070	3.40	8.02
			151-155	Taconite.			
			155-165	51.60	.096	4.19	9.00
165-170	Taconite.						
421	4/21/19	4/30/19	0-125	Surface.			
			125-150	58.21	.077	.79	7.86
			150-170	51.57	.081	1.60	10.69
			170-175	45.39	.090	2.02	10.08
			175-185	Taconite.			
422	5/2/19	5/29/19	0-112	Surface.			
			112-315	Taconite.			
423	5/3/19	5/21/19	0-140	Surface.			
			140-150	54.95	.092	.50	8.35
			150-160	57.05	.062	.38	8.50
			160-180	53.13	.069	.96	12.49
			180-185	58.14	.109	1.36	5.47
			185-190	53.52	.072	2.05	10.96
			190-207	57.05	.079	.95	9.61
			207-212	50.37	.075	.74	17.49
			212-217	Mixed ore and taconite.			
			217-242	57.81	.066	.92	8.63
			242-267	52.80	.047	1.87	16.03
267-287	Taconite.						

SHAFT

The work of grading at our shaft site was started the early part of August. A drainage ditch was excavated around the shaft to take care of the surface water, the excavation for the bearers made and these timbers placed in position and the temporary headframe erected by the 5th of September. The bearing timbers were 12" x 16" x 20' fir, duplicate, and rested on 12" x 12" x 32' sills. We anticipated encountering some quick sand in our shaft and took every precaution to assure adequate strength in our surface bearing sets. The sills for the bearing

timbers were placed 10' below the original ground, so as to insure a solid footing.

Shaft sinking was started on the 5th of September and continued throughout the balance of the year, excepting a period from November 5th to the 26th, when we were engaged in jacking back the sets, which had moved out of place as the result of pressure through the quick sand material.

The material cut was very favorable for sinking operations until we reached the water level, 64' below the collar. From this point to the clay, or a distance of 30', it was very difficult to keep the sets plumb, due to runs of quick sand from the sides. The clay was encountered at 94', but as it contained some seams of sand, it was necessary to continue the spiling and this slowed up the work appreciably and put extra weight on our hanging bolts. It was found advisable to double up the hanging bolts and in order to keep the washers from cutting into the timbers 8" square plates were used. Further than this, we hung cables in the corners of the shaft and took up the weight 80' below the collar directly from the surface bearing sets.

The taconite ledge was encountered at a depth of 109.5' on the east side and 111' on the west side of the shaft. When we started sinking in rock, temporary stuttles were kept under the timber and small cuts with rather light charges were made, so as not to endanger the shaft by loosening any quick sand above. The rock sinking was pushed a sufficient distance ahead of the sets, so that blasting would not injure the timber. Hitches were cut 117' below the collar and two 12" x 16" x 20' bearers were set in concrete. It was necessary to sink 15' in rock, in order to obtain suitable material for our bearing timbers.

As stated above, the time between November 5th and 26th was devoted to jacking the sets back and endeavoring to straighten the shaft. Sinking operations were resumed November 26th and

continued to the end of the year, the shaft being 200' below the collar on January 1st.

According to our time schedule, the shaft should have been bottomed January 1st. Owing to the delay in straightening the shaft, we still had 37' to sink and as we considered it advisable to cut out a portion of our plat and install our pocket in conjunction with sinking operations, it will probably be approximately February 1st., when the bottom is reached.

Fortunately the flow of water is not heavy and a No. 8 Cameron pump is able to handle it nicely.

Following is a tabulation showing the weekly progress made in the shaft:

<u>WEEK</u>	<u>PROGRESS</u>	<u>DEPTH</u>
August	10'	10'
September 5th to 8th	4'	14'
" 8th to 15th	42½'	56½'
" 15th to 22nd	20'	76½'
" 22nd to 29th	7½'	84'
" 29th to 30th	3'	87'
October 1st to 6th	0	87'
" 6th to 13th	9'	96'
" 13th to 20th	13½'	109½'
" 20th to 27th	7'	116½'
" 27th to 31st	8½'	125'
November 1st to 5th	Putting in bearers.	125'
" 6th to 26th	Straightening Shaft.	125'
" 26th to 31st	6'	131'
December 1st to 6th	10'	141'
" 6th to 13th	17'	158'
" 13th to 20th	20'	178'
" 20th to 27th	14'	192'
" 27th to 31st	8'	200'

GRADING

In order to afford a suitable place for our stockpile, timber yards and mine tracks, it was necessary to fill the low ground to the east of the shaft. It required approximately 50,000 cubic yards of filling to bring this ground to the desired grade and a contract was entered into with the Winston-Dear Company to do this work. The contractors were to make the fill with material from the Webb and Susquehanna Mines, at a price of 9¢ per yard. It was understood that the material was to come

definite jobs they were then engaged upon and if the yardage was not sufficient, the balance of the fill would have to be made from material secured in connection with our Boeing operations.

The Winston-Dear Company started this work about the middle of November and had completed approximately 40% of the fill by December 25th. The Webb and Susquehanna jobs were completed at this time and the contractors contemplate securing the balance of the material necessary for the fill from our Boeing job. The material will come largely from the approach cuts to the Sellers dump and we now figure that the grading will be completed by the middle of February.

Some question was raised by the business men of Old Hibbing concerning the removal of the Washington Street highway bridge, which crosses a part of the land to be filled. A petition was circulated and we feared that an injunction might be served upon us. This was not done, however, and the bridge in question was torn down and the filling work carried forward without interruption on this score. The first filling was done along the north line of the property and we built thereon a road to handle the traffic. This road is now being used and we hear no complaints from the people, as a result of our having dismantled the bridge to the south.

It was necessary to do some excavating and grading for our shop building, office and power house. This work was completed in the Fall, but owing to the severe weather, it was considered advisable to wait more favorable conditions for the balance of the grading. We will start filling around the dry and finish the grading around the mine buildings and shaft early in the Spring.

MINE BUILDINGS

Contractor Proksch put in the concrete foundations for the power house, office and oil house during September and completed the shop building foundation in October. The brick was

not delivered until later and the work of raising the shop building was not begun until November 4th. We are more in need of this building than any of the others and it will, therefore, be completed first. The contractor had made good progress on the shop building by the first of the year, and had completed the oil house and made a good start on the power house.

While our present office and dry quarters are rather cramped, we will be able to get along until Spring. The temporary shop building does not answer our purposes to good advantage and we are in hopes of moving into the new structure in February.

One of the 100 HP boilers from the Helmer Mine, which is to be used for heating purposes, was bricked in and a temporary housing constructed over it. This boiler will be situated at one end of the brick change house. The second 100 HP boiler has been installed as an air receiver for our compressor.

The heating and water pipes were laid during the latter part of the year and we contemplate turning on the steam early in January. We have been receiving heat from the Winston-Dear Company and will continue to do so until our installation is completed.

Fortunately we were able to make satisfactory arrangements with the Susquehanna Mine for securing our water supply. It is very pure water and the pressure is sufficient to afford ample fire protection. The pressure main was extended and we put in a fire hydrant, locating it centrally as regards the several buildings.

With the exception of the change house, all the buildings should be completed and the installations made therein, according to our best advice, by the end of April. The dry building will be turned over to us within a short time thereafter.

The concrete foundations for the steel headframe were put in by the middle of November and the contractors started erecting the structural steel on the 20th. The steel members were all in place and the erectors began riveting the first of the year. All work on the headframe, including the housing, should be completed prior to the first of February.

Work on the Great Northern railway spur to serve our shaft will be started early in the Spring, also the timber yard and coal dock switch tracks.

Arrangements have been made with the Susquehanna and Winston-Dear Companies to remove their buildings on the Boeing property. Part of the Susquehanna buildings have already been moved and the Winston-Dear people will dismantle their buildings early in the Spring. The latter Company is preparing new quarters and will make the change as soon as they are completed.

LOCATION

Our location will consist of a captain's house, four standard 6-room cottages and two boarding houses. The captain's house and cottages will be furnished with full basements and the boarding houses with a small concrete basement for storage purposes.

Contractor Proksch started work on the two boarding houses in September. One of these structures was completed and turned over to a tenant in December. Due to the very severe weather and the fact that these houses are heated with stoves, it was inadvisable to plaster the second building. This job will be completed when the weather moderates in the Spring. Our force is comparatively small as yet and the labor supply is ample during the winter months.

The two boarding houses are located along Washington Street to the west of our proposed open pit. The captain's house

and four cottages are situated just off from Washington Street to the south of the boarding houses. The back of these lots will extend practically to the crest of the open pit.

The concrete foundations for these five buildings were completed the early part of October; the buildings were raised and the heating installations completed by the end of the year. It is the intention to start the plastering at once and complete the five houses at the earliest possible date. The delay in delivery of finish material may postpone the completion of the houses somewhat, but we fully expect to have them occupied by April.

The Village of Hibbing extended the water mains for our location and we made the connections to the several houses. We also installed the water connections during October.

At the time we took a lease on the Boeing Mine, there were a number of people living on the property adjacent to the Village of Hibbing. These families had leased their lots from the Arthur Iron Mining Company and some of them had been located on our property for a considerable period. We were able to eject three of the lessors and they have moved their buildings off from the Boeing property. We do not intend to allow any more buildings to be put up on our property and will have other lessors vacate, if it is necessary for our operation.

STRIPPING

The Winston-Dear Company were given a contract to strip the Boeing Mine on a Cost Plus basis. The contract calls for starting stripping operations March 15th and until that time only preliminary work will be undertaken.

It will be necessary to lay tracks from the mouth of the pit onto the Sellers dump and extend a line along this fill to the ground, which has been provided for the accommodation of our stripping.

The contractors did some track work and have made one cut for our approach onto the dump by the end of the year. They had also made arrangements to move one of their 300-ton shovels from the Webb Mine and expect to have this machine in place for operation prior to the middle of March. The other equipment to be used on the job is being overhauled in their shops and put in shape for stripping activities.

Depending on whether or not we are able to carry our stripping over the Susquehanna line at the north end of our property, the amount of overburden to be removed will vary from 5,500,000 to 5,700,000 cubic yards. This is assuming a one to one slope for our stripping banks and allowing for a 25' track berm around the edge of the pit.

It will not be possible to load out any open pit ore until the stripping operations are carried pretty well toward completion, owing to the fact that we have a long and comparatively narrow ore body and our track arrangements will necessarily be such that the last stripping accomplished will have to be handled by switch backs over the ore first uncovered. For this reason, we do not estimate any open pit ore until 1922, when we anticipate forwarding 300,000 tons. Our schedule of production calls for an output of 100,000 tons of underground ore in 1921 and a like production for 1922.

BOEING MINE ORE ESTIMATE

Following is an estimate of the ore in sight at the Boeing Mine on January 1st., 1920:

	<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
Open Pit Steam Shovel Ore-	2,160,000	57.19	.086	.98	8.28	15.00	48.61
Open Pit Milling Ore-----	275,000	58.85	.080	1.24	7.12	15.00	50.02
Underground Ore-----	<u>505,000</u>	<u>58.46</u>	<u>.093</u>	<u>.90</u>	<u>6.64</u>	<u>15.00</u>	<u>49.69</u>
TOTAL AND AVERAGES-----	2,940,000	57.56	.087	.99	7.89	15.00	48.93

We do not believe that any further tonnage of desirable ore will be proven by development work and do not anticipate any additional drilling.

Following is a detailed statement of the Boeing Mine E & A No. 380, covering accounts thereunder from February, 1919, to December 31st., 1919. We contemplate going on an operating basis April 1st., 1921, and our estimates and time schedule are based on this assumption. The stripping, of course, is an entirely separate item and will continue some considerable time beyond this date.

SUPERINTENDENT'S DIVISION

<u>GENERAL EXPENSE</u>	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
Engineering		3817.18	
Analysis		46.80	
Mine Office		7059.28	
Central Office		1248.54	
Mining Captain		1250.00	
Legal		694.75	
Taxes		31946.93	
Personal Injury		153.80	
TOTAL	89,200.00	46217.28	42982.72

MAINTENANCE

Track and Cars		3.70	
Buildings		9.80	
Hoisting		64.87	
Pumps		1142.04	
TOTAL	3,200.00	1220.41	1979.59

SINKING IN SAND

Sinking to-date 110'		9597.26	
Timbering		6896.22	
Prop. of Acct. #7		5493.99	
TOTAL	17,000.00	21987.47	4987.47

SINKING IN ROCK

Sinking to-date 90'		9544.14	
Timbering		4421.99	
Prop. of Acct. #7		8618.51	
TOTAL	29,800.00	22584.64	7215.36

DRIFTING

1150' Rock Drifting at \$33.00 per ft.	37,950.00	-----	37950.00
2800' Ore Drifting at \$13.00 per ft.	36,400.00	-----	36,400.00
100' Rock Raising at \$13.00 per ft.	1,300.00	-----	1,300.00
433' Ore Raising at \$10.00 per ft.	4,330.00	-----	4,330.00
TOTAL	79,980.00	-----	79,980.00

BOEING MINE.

	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
<u>PLATS AND POCKETS</u>			
TOTAL	5000.00	20.88	4979.12
<u>PREPARING SITE</u>			
Building Roads		643.59	
Clearing Land		610.27	
Grading & Ditching		3840.56	
TOTAL	20650.00	5094.42	15555.58
<u>TEMPORARY EQUIPMENT</u>			
Surface Tracks & Cars		450.56	
Derricks & Buckets		942.28	
Miscellaneous		62.79	
Tools in General Use		764.50	
TOTAL	4500.00	2220.13	2279.87
<u>PERMANENT CONSTRUCTION AND EQUIPMENT</u>			
Power Drills		2262.52	
Auto Truck		3992.03	
Stable Equipment		986.36	
TOTAL	31400.00	7240.91	24159.09
<u>WATER SUPPLY</u>			
Water Supply		1632.60	
Sewerage		1490.86	
TOTAL	6000.00	3123.46	2876.54
<u>OFFICE FURNITURE AND FIXTURES</u>			
	750.00	139.57	610.43
<u>EXPLORING</u>			
	21000.00	19651.84	1348.16
TOTAL	308480.00	129501.01	178978.99
Contingencies 10%	30848.00		30848.00
TOTAL SUPERINTENDENT'S DIVISION	339328.00	129501.01	209826.99

CHIEF MECHANICAL ENGINEER'S DIVISION

	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
<u>TEMPORARY EQUIPMENT HOISTING PLANT</u>			
Machinery		1505.55	
Foundation		164.42	
Wire Rope		51.56	
Erecting		768.09	
Electric Wiring		256.67	
Bell Lines & Signals		99.42	
TOTAL	2400.00	2845.71	445.71
<u>SHOP EQUIPMENT</u>			
Installing		97.56	97.56

BOEING MINE.

CHIEF MECHANICAL ENGINEER'S DIVISION
CONTINUED.

<u>SINKING PUMPS</u>	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
Pumps		575.00	
Steam & Water Lines		434.37	
Installing		402.39	
TOTAL		1411.76	1411.76
Heating System		378.92	378.92
Surface Elec. Lighting		264.99	264.99
<u>PERMANENT EQUIPMENT</u>			
<u>HOISTING PLANT</u>			
Motor and Control		11.34	
Skips and Cages		1521.18	
Sheaves & Counterweight		9.27	
TOTAL	15200.00	1541.79	13658.21
<u>COMPRESSOR PLANT</u>			
Compressor & Motor		8745.31	
Foundation		358.05	
Receiver		1056.19	
Piping		35.66	
Air Line in Shaft		549.47	
Erecting		837.60	
TOTAL	11650.00	11582.28	67.72
<u>SHAFT HOUSE (STEEL)</u>			
Foundations		287.26	
Head Frame		14559.00	
TOTAL	16100.00	14846.26	1253.74
<u>SHOP EQUIPMENT</u>			
Equipment		4943.72	
TOTAL	10500.00	4943.72	5556.28
<u>TOP TRAM PLANT</u>			
Tram Equipment		2300.53	
TOTAL	7850.00	2300.53	5549.47
<u>ELECTRIC HAULAGE</u>			
Machinery		5014.00	
Wiring		7.69	
Erecting		39.52	
TOTAL	29400.00	5061.21	24338.79
<u>PUMPING PLANT</u>			
Pumps, Motor & Control		9294.00	
Erecting		174.05	
TOTAL	15200.00	9468.05	5731.95
<u>HEATING SYSTEM</u>			
Boiler		829.80	
Piping & Radiation		1072.33	
Erecting and Ditching		2568.41	
TOTAL	5000.00	4470.54	529.46
BOEING MINE.			

CHIEF MECHANICAL ENGINEER'S DIVISION
CONTINUED.

	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
<u>FIRE PROTECTION</u>	1000.00	893.59	106.41
<u>RECORDING GAUGES</u>	100.00	---	100.00
<u>TESTING MACHINERY</u>	250.00	---	250.00
<u>OIL STORAGE TANKS</u>	450.00	463.55	13.55
<u>TELEPHONE SYSTEM</u>	500.00	---	500.00
<u>SURFACE ELEC. LIGHTING</u>	1500.00	---	1500.00
<u>COOLING TOWER</u>		580.84	580.84
<u>TOTAL</u>	11710.00	61151.30	55948.70
Contingencies 10%	11710.00		11710.00
<u>TOTAL CHIEF MECHANICAL ENGINEER'S DIVISION</u>	128810.00	61151.30	67658.70

MASTER CARPENTER'S DIVISION

	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
<u>TEMPORARY BUILDINGS</u>			
Boiler House		144.86	
Engine House		201.75	
Compressor House		363.15	
Dry House		182.01	
Shop Building		441.52	
Office & Warehouse		362.46	
Lauder		1.17	
Barn, Garage & Storeroom		708.81	
<u>TOTAL</u>	4000.00	2405.73	1594.27
<u>PERMANENT BUILDINGS</u>			
<u>POWER HOUSE</u>			
Building		487.06	
<u>TOTAL</u>	5500.00	487.06	5012.94
<u>OFFICE AND WAREHOUSE</u>			
Building		616.33	
Piping		70.00	
<u>TOTAL</u>	7400.00	686.33	6713.67
<u>SHOP BUILDING (BRICK)</u>			
Building		3796.74	
<u>TOTAL</u>	6150.00	3796.74	2353.26
<u>TOP TRAM ENGINE HOUSE</u>	1000.00	----	1000.00
<u>CHANGE HOUSE (BRICK)</u>	10200.00	-----	10200.00
<u>OIL STORAGE HOUSE (BRICK)</u>	1000.00	461.55	538.45
<u>BARN FOR 4 HORSES (WOOD)</u>	2000.00	-----	2000.00
BOEING MINE.			

<u>PERMANENT BUILDINGS *</u> <u>CONTINUED</u>	<u>ESTIMATE</u>	<u>TOTAL TO-DATE</u>	<u>UNEXPENDED BALANCE.</u>
--	-----------------	----------------------	--------------------------------

Garage - 3 stall (Wood)	1500.00	-----	1500.00
-------------------------	---------	-------	---------

2 BOARDING HOUSES (WOOD)

Grading & Clearing Ground		11.98	
Buildings		5547.88	
Water Supply		581.96	
Outbuildings		290.70	
Furniture		843.00	
TOTAL	13600.00	7275.52	6324.48

CAPTAIN'S HOUSE (WOOD)

Building		1268.41	
Water Supply		115.52	
TOTAL	5500.00	1383.93	4116.07

TENEMENT HOUSES

Grading & Clearing Grounds		20.96	
Buildings		3196.85	
Water Supply		750.84	
TOTAL	17800.00	3968.65	13831.35

DOCKS, TRESTLES & POCKETS

350' Permanent Trestle	5250.00	----	5250.00
300' Stocking Trestle	3000.00	----	3000.00
350' Rock Trestle	4500.00	----	4500.00
10 Tons Rail	450.00	----	450.00
Stockpile Plank	200.00	----	200.00
TOTAL	13400.00	----	13400.00

<u>COAL DOCK (200')</u>	4000.00	----	4000.00
-------------------------	---------	------	---------

<u>PULLEY STANDS</u>	800.00	----	800.00
----------------------	--------	------	--------

TOTAL	93850.00	20465.51	73384.49
--------------	-----------------	-----------------	-----------------

Contingencies 10%	9385.00		9385.00
-------------------	---------	--	---------

TOTAL MASTER CARPENTER'S DIVISION	103,235.00	20465.51	82769.49
--	-------------------	-----------------	-----------------

SUMMARY

Superintendent's Division	339,328.00	129501.01	209826.99
Master Carpenter's "	103,235.00	20465.51	82769.49
Chief Mech. Engr's "	128,810.00	61151.30	67658.70
TOTAL	571,373.00	211117.82	360255.18

Amount Arthur Mng. Co. A/c			
1/2 expenses Opt. Boeing Mine		149.62	
Depreciation - Supply Inventory		37.94	
Depreciation - Supt's Automobile		26.87	
GRAND TOTAL	571,373.00	211332.25	360040.75

HELMER MINE

ANNUAL REPORT FOR 1919.

Operations at the Helmer Mine from January 1st. to the opening of navigation, May 1st., consisted in repair work on the open pit equipment, alterations and improvements on the inclined pocket, tramway and shaft, the changing over of the pit drainage question to the Wade Mine, removing of the Helmer surface buildings to the Wade location and underground work to the west of the open pit.

The Thew revolving shovel was given a complete overhauling to fit it for service in connection with the loading out of the old Swallow & Hopkins lean ore piled along the stripping dump. It was rather a tedious, as well as expensive job to put this shovel in shape for operation and included the re-fluing of the boiler, as well as the replacing of a number of the working parts. The two Lima locomotives and four cars, which were used for pit operations during the latter part of the previous shipping season, were overhauled and all badly worn or broken parts renewed. The models "31" and "36" Marion revolving shovels were put in very good shape for the season's open pit activities. Both shovels were fitted out with new cabs, the old ones having been badly shattered by blasts.

It was possible to handle the open pit ore product to advantage with one locomotive and for this reason the second engine was hauled out of the pit the latter part of the shipping season. The Wade ore bank was blasted for this purpose and the "36" shovel dug a bench diagonally across the face of the pit. The grade of this bench was quite abrupt, but we were able to haul the locomotive to the top of the ore berm, by the use of block and tackle and pulling with the two other locomotives. The engine taken from

the pit was used on the Fall and Winter stripping, with the result that that job was speeded up appreciably.

Repair work on the one Lima locomotive, four 7-yard dump cars and models "31" and "36" steam shovels, which remain in the pit bottom, will be undertaken next Spring. With the exception of the "36" shovel, these repairs will be quite nominal. It will be necessary to thoroughly overhaul the "36" shovel, as it saw rather severe service during the shipping season of 1919. The Model "31" shovel is being used this winter in connection with Helmer stocking operations. The underground ore cars are trammed to the mouth of the underground portal and hoisted up an inclined dump by using the engine and drum on the "31" Marion. There will be only slight repairs to be made on this shovel following the suspension of underground operations next May.

Repair work on the inclined tramway, leading out of the Helmer pit, were begun in March and completed the early part of April. The tramway tracks were straightened and a number of the rotted stringers and ties were replaced.

The old shaft house and loading pocket were torn down and a larger structure erected. This work was completed the latter part of April. We had considerable difficulty in loading cars at the pocket during 1918 and the new structure greatly facilitated the hoisting and dumping of the skips and the loading of railway cars.

The old incline power plant housing was torn down and a new structure erected. This job was undertaken during April and May. It is the intention to electrify the hoist this winter and the battery of three 50 H. P. boilers will then be available for heating plants at our other properties. These boilers are about the right size for general heating plants at our mines.

The old grizzly rails in the pit loading pocket were replaced by 1" x 6" bars. It was found, however, that the center

sections were too light and they were in turn replaced by 2" x 6" bars and the spacing cut down to 6". The old rail grizzly had 10" openings and allowed quite sizable chunks to pass through. Further than this, the large pieces of ore would constantly wedge between the rail flanges. Owing to the fact that there was some complaint on lumps during 1918, considerable attention was given to the breaking down of the chunks and to the maintaining of a maximum spacing of 6" between the bars. While this matter was given close attention, the men at the pocket often grew careless, especially on night shifts and we frequently had to discharge hands who were detected in driving long slabs between the bars, or in prying the bars apart to afford larger openings. With slight repairs the pocket can be put in shape for 1920 operations.

The drainage drift from the Wade shaft was holed to the bottom of the Helmer pit the forepart of June and the necessary ditches were excavated to carry the pit waters into the Wade underground workings. This relieved the Helmer shaft pumps and the fires were pulled and the pumps removed to surface by June 25th. The Helmer pump was handling approximately 200 gallons per minute. The closing down of the Helmer pumping plant liberated two 125 H.P. boilers and a compound Prescott pump. The boilers were sold to the Boeing Mine at Hibbing last Fall and the pump was transferred to the Wade pumphouse, where it will be used as a steam operated auxiliary to our electric pumps.

The six dwelling houses and old office building were moved from the Helmer to the Wade location by Contractor Lindsley during March. The houses were placed along the south side of the location, facing north. The moving of the old boarding house was found to be impractical, due to the fact that the sill timbers and floor joist were in bad shape. The boarding house building was used during the year for the housing of open pit employees, who boarded in the Wade location.

The old Helmer power house, shops and dry were dismantled and such material as we were able to salvage was used in the erection of a locomotive-steam shovel repair building and storehouse at the Wade Mine.

Damascus
~~Band~~ Band

Helmer Mine Ore Estimate of January
1st., 1920.

Following is an estimate of the ore in sight at the Helmer Mine on January 1st., 1920, the tonnage reported a year ago and the amount mined since the previous report.

A factor of 13 cubic feet per ton was used in this estimate, with a 10% deduction for mining loss in the case of the underground ore, a deduction of 20% for rock in the open pit ore and a deduction of 25% for rock and mining loss in the case of the ore to be scammed along the open pit banks.

	<u>Tons.</u>
Open Pit Ore In Sight January 1st., 1919-----	73,000
Scram Ore In Sight January 1st., 1919-----	40,000
Underground Ore In Sight January 1st., 1919-----	<u>120,000</u>
TOTAL ORE IN SIGHT JANUARY 1ST., 1919-----	233,000
Ore Mined From Open Pit During 1919-----	41,088
Scram Ore Mined During 1919-----	3,190
Underground Ore Mined During 1919-----	<u>19,739</u>
TOTAL ORE MINED DURING 1919-----	64,017
Open Pit Ore In Sight January 1st., 1920-----	32,000
Scram Ore In Sight January 1st., 1920-----	34,000
Underground Ore In Sight January 1st., 1920-----	<u>100,000</u>
TOTAL ORE IN SIGHT JANUARY 1ST., 1920-----	166,000

There has been no change in the estimated tonnage as of January 1st., 1920, in the case of open pit and underground ore, as compared to the previous year, other than the deduction of the quantity mined during 1919. On account of the extremely low grade material encountered along the north shore line, it has been deemed advisable to decrease the scam ore by 3,000 tons. There would have been a balance of 37,000 tons of scam ore in sight January 1st., 1920, if the 3,000 tons had not been deducted.

While the average grade of Helmer ore mined during 1919 showed 57.19 iron, and this was extremely close to the grade estimated for the remaining tonnage on January 1st., 1919, the mining operations and development work have shown that it will be

extremely difficult to maintain this average in extracting the balance of our tonnage and our estimate of the 166,000 tons in sight January 1st., 1920, is, therefore, as follows:

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
166,000	56.00	.070	1.35	9.50	12.67	48.904

It is our opinion that exploratory and development work on the Helmer property has exhausted any possibility of showing any additional tonnage by future operations.

*Danmasch
Bond*

OPEN PIT OPERATIONS

Open pit mining was inaugurated May 1st. and continued until October 25th. Most of the activity during the past season, however, was on the Wade side of the line, the bulk of the Helmer tonnage being handled during the first and last of the shipping period.

At the beginning of the season the model "36" shovel was used in loading out the Helmer stockpile accumulated in the pit bottom during the previous winter. This shovel later dug a few feet of merchantable ore remaining along the north side of the pit bottom and when the Wade drainage drift holed to the open pit it was possible to attack the material in the bottom of the pit to the north and east of the loading pocket. The bottom contours of the deposit are extremely irregular and it is difficult to clean the ore to the rock without a considerable shifting of the tracks and shovel. On account of the rather lean character of the bottom ore, this clean up work was not pushed during the past year. We had some difficulty in maintaining a desirable grade during the forepart of the year and it was decided advisable to let the final clean-up work in the bottom of the Helmer pit go until the Wade bank had been dug back some distance to the east, which would allow for a more favorable operation, as the lower ore occurs in channels running in an east-westerly direction.

When the Wade stripping had been completed at the northeast corner of the pit, it was possible to secure a block of high grade Helmer ore with the model "36" shovel, and if our operations had not been suspended so abruptly, we could have forwarded several thousand additional tons of high grade material from this point.

The remaining tonnage of Helmer open pit ore is of rather low grade for the most part and it can only be loaded out

in such quantities as we are able to sweeten with the higher grade material from the Wade Mine. With the exception of the northeast and southeast corners of the pit and a small tonnage in the bottom, along the Wade line, the open pit Helmer tonnage remaining averages under 55% in iron content. No attempt was made to load out the narrow face of ore along the Oliver Iron Mining Company's land during 1919. This ore is of rather low grade and contains an excessive amount of lumpy material.

Before open pit operations could be inaugurated, it was necessary to clean a considerable amount of boulders and surface wash from the edges of the pit bottom. This material trickled into the pit during the Spring thaw, or was washed down by the freshets. It has always been necessary to do more or less cleaning along the north side of the pit after heavy rains. The ore in this vicinity has now been pretty well cleaned up and it will not be necessary in the future to remove the surface wash from the pit. The steam shovels will be able to cast the material back against the shore line. We trammed and hoisted considerable surface wash from the Wade-Helmer pits during the past summer, as we had no available place for a waste dump. As the bottom ore is cleaned to the rock, space will be available for the dumping of waste material.

SWALLOW & HOPKINS ORE PILES

Preparations were made during August to attack the old Swallow & Hopkins lean ore pile along the stripping dump to the south of the pit and the Thew shovel was overhauled and moved onto this job. It was impossible to make an accurate estimate of the ore of shipping grade and in consequence our former estimate of 3,800 tons was most conservative. We loaded out 7,814 tons of this ore and we estimate that there is still 1,500 tons remaining.