

We loaded 240 tons of material which had been trimmed in the railraod yards by the Swallow & Hopkins Company during their previous operations.

According to the agreement of our Helmer Lease, we should have removed all of the lean ore piled along the dump, loaded out the small pile near the pump shaft, estimated at 500 tons, and cleaned up the ore trimmed from cars in the yards, during 1919. We loaded all the material in the yards to the satisfaction of the Fee Owners' inspector, and would have completed the lean ore job, if the tonnage had been in line with our expectations. The inspector for the Lessors has recommended that we be given until the middle of next summer to remove the lean ore piles, estimated at 2,000 tons. We should be able to complete this work by July, 1920.

Damas cut
cut ————— Bond

SHIPMENTS

Following are the cargoes of Helmer Grade shipped during the past year and the analysis of same as obtained at the Mine and by the Lower Lake Chemists. This grade is made up of 74,657 tons of Helmer and 211,888 tons of Wade ore.

	<u>Fe.</u>	<u>Phos.</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>CADILLAC</u> - - - - -							3,119
Mine-----	57.46	.067	1.40	8.53	-----	-----	
Crowell & Murray--	57.22	---	----	----	12.98	49.793	
<u>ISHPEMING</u> - - - - -							6,811
Mine-----	58.26	.071	1.09	6.85	-----	-----	
Cremer & Case-----	58.30	---	----	----	13.42	50.476	
<u>BREITUNG</u> - - - - -							1,933
Mine-----	58.00	.066	1.06	8.16	-----	-----	
Crowell & Murray--	57.65	---	----	----	13.05	50.127	
<u>PETER WHITE</u> - - - - -							9,124
Mine-----	57.92	.065	1.25	7.49	-----	-----	
Textor-----	57.40	---	----	----	13.41	49.700	
<u>MUNISING</u> - - - - -							3,493
Mine-----	57.86	.064	1.22	7.64	-----	-----	
Crowell & Murray--	57.90	---	----	----	12.42	50.709	
<u>ANDASTE</u> - - - - -							2,738
Mine-----	58.74	.059	.95	8.25	-----	-----	
Emmerton-----	59.60	---	----	----	14.28	51.089	
<u>AMBERG</u> - - - - -							10,821
Mine-----	57.57	.067	1.21	7.80	-----	-----	
Cremer & Case-----	57.40	---	----	----	12.69	50.116	
<u>MARQUETTE</u> - - - - -							7,537
Mine-----	57.75	.065	1.04	8.02	-----	-----	
Emmerton-----	57.30	---	----	----	14.08	49.232	
<u>ROGERS</u> - - - - -							10,624
Mine-----	57.56	.067	.90	7.91	-----	-----	
Cremer & Case-----	58.00	---	----	----	14.17	49.781	
Crowell & Murray--	58.10	---	----	----	14.48	49.687	

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>MUNISING-</u>							3,375
Mine-----	57.53	.068	.95	7.29	-----	-----	
Crowell & Murray--	57.27	---	--	-----	14.89	48.742	
<u>CADILLAC-</u>							3,449
Mine-----	57.44	.061	.66	8.90	-----	-----	
Textor-----	57.35	---	--	-----	14.33	49.132	
<u>MICHIGAN-</u>							3,936
Mine-----	57.65	.059	.62	9.29	-----	-----	
Cremer & Case-----	59.10	---	--	-----	14.14	50.743	
<u>FRENCH-</u>							6,213
Mine-----	57.49	.060	.78	9.18	-----	-----	
Emmerton-----	57.43	---	---	-----	14.51	49.098	
<u>MORRELL-</u>							8,519
Mine-----	57.62	.072	.85	7.80	-----	-----	
Textor-----	56.75	---	--	-----	14.00	48.805	
<u>MARQUETTE-</u>							8,020
Mine-----	57.79	.065	.90	8.13	-----	-----	
Cremer & Case-----	58.10	---	--	-----	12.64	50.756	
<u>SNYDER-</u>							3,969
Mine-----	58.01	.069	1.03	7.18	-----	-----	
Emmerton-----	57.30	---	-----	-----	13.09	49.799	
<u>TURNER-</u>							10,964
Mine-----	57.98	.064	.93	7.61	-----	-----	
Emmerton-----	58.33	---	--	-----	12.53	51.021	
Cremer & Case-----	57.80	---	--	-----	12.31	50.685	
<u>LUZON-</u>							1,724
Mine-----	57.51	.063	.93	7.71	-----	-----	
Textor-----	57.00	---	--	-----	12.67	49.778	
<u>WILPEN-</u>							1,055
Mine-----	56.84	.076	1.02	7.57	-----	-----	
Textor-----	57.85	---	-----	-----	12.11	50.844	
Cremer & Case-----	58.40	---	-----	-----	11.74	51.544	
<u>MICHIGAN-</u>							10,969
Mine-----	59.68	.062	.89	6.54	-----	-----	
Cremer & Case-----	59.40	---	--	-----	11.54	52.545	
<u>ISHPEMING-</u>							11,176
Mine-----	59.52	.067	.87	6.32	-----	-----	
Crowell & Murray--	59.95	---	--	-----	13.45	51.887	

HELMER MINE.

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>CENTRAL WEST-</u>							5,320
Mine-----	58.58	.065	1.02	6.69	-----	-----	
Cremer & Case----	58.70	---	----	----	13.15	50.981	
<u>SHEADLE-</u>							2,939
Mine-----	58.20	.064	1.17	6.99	-----	-----	
Crowell & Murray--	58.00	---	----	----	12.73	50.617	
<u>SHEADLE-</u>							7,168
Mine-----	58.43	.078	.93	7.17	-----	-----	
Cremer & Case----	58.50	---	--	----	11.71	51.650	
<u>H. H. BROWN-</u>							8,027
Mine-----	59.29	.077	.80	6.59	-----	-----	
Textor-----	60.30	---	--	----	12.18	53.016	
<u>JENKINS-</u>							10,011
Mine-----	59.33	.068	.79	6.40	-----	-----	
Crowell & Murray--	59.74	---	--	----	12.64	52.189	
Emmerton-----	59.45	---	--	----	12.38	52.090	
<u>SHEADLE-</u>							3,624
Mine-----	59.68	.067	.76	6.13	-----	-----	
Textor-----	60.05	---	--	----	11.06	53.401	
<u>PONTIAC-</u>							12,440
Mine-----	59.75	.074	.81	6.09	-----	-----	
Cremer & Case----	60.30	---	--	----	11.17	53.560	
<u>GRAND ISLAND-</u>							9,503
Mine-----	59.65	.071	.82	6.06	-----	-----	
Crowell & Murray--	60.06	---	--	----	12.07	52.811	
<u>MUNISING-</u>							6,624
Mine-----	58.05	.074	.93	7.03	-----	-----	
Crowell & Murray--	58.63	---	--	----	12.66	51.207	
<u>W. G. MATHER-</u>							11,277
Mine-----	58.52	.071	.95	6.99	-----	-----	
Textor-----	58.85	---	--	----	11.83	51.888	
<u>MICHIGAN-</u>							10,524
Mine-----	59.63	.069	.68	6.48	-----	-----	
Crowell & Murray--	60.28	---	--	----	12.69	52.630	
<u>MUNISING-</u>							6,549
Mine-----	58.78	.059	.83	6.89	-----	-----	
Cremer & Case----	58.90	---	--	----	13.17	51.143	

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>MIDVALE</u> - - - - -							12,262
Mine-----	59.36	.064	.81	6.21	-----	-----	
Crowell & Murray--	59.85	---	--	----	12.70	52.249	
Emmerton-----	59.05	---	--	----	12.59	51.616	
<u>PIONEER</u> - - - - -							6,375
Mine-----	59.57	.061	.81	6.14	-----	-----	
Cremer & Case-----	59.60	---	--	----	11.05	53.014	
<u>UTLEY</u> - - - - -							10,084
Mine-----	60.28	.059	.73	5.83	-----	-----	
Textor-----	60.18	---	--	----	11.10	53.500	
<u>NEGAUNEE</u> - - - - -							1,346
Mine-----	61.46	.054	.45	5.73	-----	-----	
Crowell & Murray--	60.89	---	--	----	11.80	53.705	
<u>ISHPEMING</u> - - - - -							3,695
Mine-----	59.43	.058	.77	7.06	-----	-----	
Emmerton-----	59.23	---	--	----	11.68	52.312	
<u>PIONEER</u> - - - - -							5,749
Mine-----	58.99	.061	.73	7.43	-----	-----	
Textor-----	58.72	---	--	----	11.04	52.137	
<u>PONTIAC</u> - - - - -							5,879
Mine-----	59.01	.063	.77	7.20	-----	-----	
Crowell & Murray--	58.77	---	--	----	11.61	51.947	
<u>SCHOONMAKER</u> - - - - -							4,294
Mine-----	57.60	.065	1.07	8.00	-----	-----	
Crowell & Murray--	59.00	---	----	----	13.99	50.746	
<u>SHENANGO</u> - - - - -							7,981
Mine-----	57.58	.067	1.03	8.14	-----	-----	
Textor-----	58.05	---	----	----	12.44	50.829	
<u>PETER WHITE</u> - - - - -							5,546
Mine-----	58.43	.070	.98	7.01	-----	-----	
Crowell & Murray--	58.57	---	--	----	12.48	51.260	

Following is the average analysis of the Helmer Grade shipped during the 1919 season, as obtained from Mine and Lower Lake Chemists' sampling:

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
Mine-----	58.01	.066	.89	7.09	-----	-----
Lower Lake-----	58.61	---	--	----	12.71	51.161

The following is a division of the total Helmer shipments for the season and the average analysis, as obtained from Mine sampling:

	Tons	Fe.	Phos	Mn.	Sil.
Pit Production-----	42,188	57.14	.065	1.01	9.27
Pit Stockpile Shipments----	24,655	57.84	.067	1.16	8.49
Swallow & Hopkins Ore Dump--	7,814	55.50	.063	1.15	10.05
TOTAL AND AVERAGES-----	74,657	57.19	.066	1.08	9.12

Following is a complete analysis of the Helmer shipments during 1919, as obtained by Lerch Brothers from a composite sample, covering the year's work:

Fe.	Phos	Mn.	Sil.	Alumina	Lime	Magnesia	Sulphur	Loss By Ignition
56.85	.062	.92	8.98	2.20	.10	.12	.016	5.69

All shipments from the Helmer Mine were suspended from August 8th to the 26th, due to a strike on the Great Northern Ore Docks at Superior.

The estimated production from the Helmer Mine for the 12 months period from November 15th, 1919, to November 15th, 1920, is 50,000 tons; made up of 25,000 tons to be secured from underground operations and 25,000 tons from open pit and scam activities.

ACCIDENTS

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

SAM MARICH

Injured-----February 23rd, 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----7 Days.
Received Compensation-----None.

Remarks: The winter frost raises the boulders in the surface of the walls of the pit. Mild spring weather causes a great many of them to loosen and roll down into the pit. The injured man was building a protection at the entrance of Drift No. 7, to guard against this danger, when a boulder rolled down and struck Marich on the head.

JOHN HAUTALA

Injured-----March 3rd., 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----5 Days.
Received Compensation-----None.

Remarks: Hautala was picking down the loose ground in the breast of Drift No. 6, when a particle flew into his eye.

UNDERGROUND OPERATIONS

Underground operations were conducted during the months of January, February, March, the forepart of April, resumed November 18th and continued during the balance of the year. Six contracts were employed during the first four months of the year and five gangs were engaged during December.

From November 1st. to the 18th, a force of men was employed in cleaning up the tramming level and building a close timbered approach to the underground portal. The almost vertical wall at the east end of the pit makes tramming out and in the underground portal very dangerous and it was necessary to suspend operations the forepart of last April to avoid having men injured by falling boulders and slides of ground. The new approach to the portal is 50' in length and is made up of close timbered sets, which have a covering of several feet of material on top, to take up the shock of falling boulders and masses of earth.

The product from the underground workings is being stocked in the bottom of the Helmer pit in the same manner as a year ago, except that the material is all trammed out of the bottom portal and hoisted for stocking by the model "31" shovel. This stockpile is located some distance from the sides of the pit and there should be no danger of the surface wash extending thereto.

The average analysis of the Helmer ore in stock January 1st., 1920, is as follows:

<u>Tons.</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
6,104	56.18	.069	1.50	9.36

"1453 Foot Sub"

In developing the 1433' sub-level in the vicinity of the shore line, it was found that the ore jumped up on the rock

and it was, therefore, necessary to raise and mine the deposit with a sub 20' above. Two raises were put up along the rock last Spring and two gangs, contracts Nos. 2 and 3, have been engaged in slicing and caving operations here since the latter part of November.

The ore at this elevation is 160' in length and has an average width of 30'. The two gangs will be employed here for an additional month, after which No. 2 will drop down 10' in their raise and No. 3 will mine out the pillar standing between the raises. The ore is of fair grade only, averaging about 55% iron.

"1433 Foot Sub"

This sub was developed from the bottom tranway from three raises, which were put up 100', 170' and 195' back from the open pit portal. The sub was fully developed by April 1st. and the ground to the west and south had been partly caved.

At the present time two gangs are employed at this elevation, No. 4 slicing and caving back in the vicinity of No. 3 raise and No. 1 slicing up against the open pit face to the south.

The deposit at this elevation is 300' in length and has an average width of 100'. As soon as the contracts on the 1453' sub have completed work at that elevation, the pillars to the north of Nos. 1 and 2 raises will be attacked. The material at the west and south extremities of the sub is of rather low grade, but the pillars blocked out in the neighborhood of Nos. 1 and 2 raises and from No. 1 raise to the open pit are of much higher grade. It will take three gangs several months to mine the high grade pillars, and it will probably be March 1st. before we can start attacking them.

"1420 Foot Sub"

After drifting to the Oliver Iron Mining Company's boundary on the 1407' sub, the latter part of 1918, slicing operations were carried between the drift and the open pit to a point 30' back from the line. The height of the ore was such that slicing operations could not be continued from the 1407' sub any further north and a raise was put up to the 1420' sub and development work started at this elevation. One gang was employed on the 1420' sub during March, April, the latter part of November and December. A block of ore 70' long, 35' wide and averaging 12' in height was taken out along the open pit face. This room has now been blasted and filled. Contract No. 6, who have been employed here, will now be moved down to the 1407' sub and the ore under their caved room removed at that elevation.

The ore mined by No. 6 averaged only about 54% iron. The grade improves as the slicing progresses northward and the gang should be in higher grade ore within a month.

Contract No. 5 operated a few shifts at this elevation at the west end of the mine. The ore was of such lean grade, however, that it was necessary to discontinue work here. No. 5 will be engaged in slicing back the deposit on the 1407' sub at the west end of the mine within a short time.

"1407 Foot Sub"

One gang continued slicing and caving between the rock foot wall and sand capping at the west end of the mine during the months of January, February and March. The deposit here was wedge shaped, starting with a width of 6' at the west end and widening out to 60', 100' to the east. The ore was worked out 100' to the east of the most westerly extension of the deposit. As contract No. 5 was unable to develop any merchantable ore at a higher

elevation, they will start slicing operations on the 1407' sub to the east of the old caves. The ore averages approximately 56% in iron and improves somewhat to the eastward.

It will be impossible to attack the 1407' ore to any extent until the subs above are completed, other than the southerly and westerly extensions. The 1400' sub is 400' in length and has an average width of 105'.

It is the intention to maintain an underground force of 6 gangs on account of the narrowness of the deposit and the necessity of mining the ore from the westerly limits and the open pit face toward the center. It would not be safe to mine from the west to the open pit limits, as we would develop a riding pillar, which might collapse with serious results.

ANALYSIS OF COST SHEET

No division is made on the Helmer cost sheets for the years 1918 and 1919 between the tonnages secured from underground or open pit and in consequence the comparatively large open pit output for 1918 has a decided bearing on the lower costs for that year.

The Helmer production from underground and open pit operations for the two years in question was as follows:

Produced from Underground Operations-----	1919 <u>21,829</u>	1918 <u>8,930</u>
Produced from Open Pit Operations-----	50,002	207,498

The charges per ton against the several main captions entering into the production costs for the years 1918 and 1919 follow:

	<u>1919.</u>	<u>1918.</u>
General Expense--	.082	.047
Maintenance-----	.032	.105
Mining Expense---	<u>.947</u>	<u>.490</u>
TOTAL-----	\$1.061	\$.642

GENERAL EXPENSE

All of the items making up the "General Expense" were appreciably higher for 1919, due entirely to the smaller tonnage handled.

MAINTENANCE

There was a decrease of \$.073 for "Maintenance" in 1919 as compared to the previous year. Following were the items showing an appreciable variation:

The 1918 charge to "Boiler Plant" was \$.011 per ton higher than for 1919. The Helmer boiler plant was overhauled in 1918 and a number of replacements made, whereas in 1919 the charges were very nominal.

The charge to "Pumping Machinery" was \$.007 per ton higher for 1919. The work done on the pumping equipment was about the same for the two years, but the larger 1918 tonnage was responsible for the difference.

We did considerable repair work on the "Underground Tracks & Cars" in 1918, whereas there was little done to this equipment the past year. This resulted in a decrease of \$.019 per ton for the charge to "Underground Tracks & Cars" during 1919.

The cost per ton for "Locomotives" was \$.022 for 1918, whereas the equipment was used on Wade operations for the most part in 1919 and the charge to the Helmer Mine was insignificant.

MINING EXPENSE

A considerable amount of air pipes were laid in 1919 and this item shows an increase of \$.016 per ton. During 1918 the underground drilling was done by hand and in consequence the cost for air lines was very nominal.

A considerable part of our 1918 tonnage was loaded directly into railway cars and hauled out of the pit, whereas the entire 1919 output was hoisted. This resulted in showing an increase of \$.018 in the 1919 cost per ton for "Hoisting".

While the Helmer steam pumps were shut down in June and the pit drainage diverted to the electrical pumps at the Wade Mine, the charge against "Pumping" was still \$.083 higher for 1919. We, of course, pumped with steam the first half of the year and the tonnage handled was only about one-third of that for 1918.

The item "Breaking Ore" shows an increased cost of \$.183 per ton for 1919 and this is explained by the fact that practically three times as much ore was mined underground in 1919, and only one-fourth as much open pit product secured.

The 1919 charge to "Tramming" shows an increase of \$.062 per ton, due to the larger proportion of underground ore secured in 1919 and the fact that this involved considerable hand work. The underground ore is trammed and stocked in the pit and is later loaded with steam shovels and hauled to the inclined tramway.

There was an increase of \$.069 to the 1919 item "Timbering", which is explained by the comparatively heavy tonnage of underground product handled. Less than one-twentieth of the 1918 output was secured from underground operations, whereas almost half of that for 1919 was so derived.

The increase of \$.031 for the 1919 item "Captain & Bosses" was the result of the smaller production this year.

The increase of \$.011 for "Top Landing & Tramming" during 1919 was due to the larger proportion of underground production during this period.

The cost for "Stripping" in 1919 was insignificant, whereas it amounted to \$.023 per ton for the previous year.

HELMER MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1919.

GRADE	IRON	PHOS.	SILICA	MANG.
Helmer,	58.21	.061	8.39	1.12
Helmer Pit,	56.96	.066	9.34	.95

(Cargoes all mixed).

ORE STATEMENT & SHIPMENTS FOR YEAR 1919.

	HELMER	TOTAL LAST YEAR
On hand January 1st, 1919,	8,930	0
Output for year,	71,831	216,428
Total,	80,761	216,428
Shipments,	74,657	207,498
Balance on hand,	6,104	8,930
Decrease in output, -67%	144,597	
Decrease in shipments -64%	132,841	
Decrease in balance on hand,	2,826	

1919 - 3-8 Hour Shift - Jan. 1st to Sept. 1st
 2-8 " " Sept. 1st to Dec. 31st
 1918 - 2-10 " " Jan. 1st to Nov. 1st
 3-8 " " Nov. 1st to Dec. 31st.

HELMER MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	71,831	216,428		144,597
General Expense	.032	.047	.035	
Maintenance	.032	.105		.073
Mining Expense	.947	.490	.457	
Cost of Production	1.061	.642	.419	
Explosatory	.024	.010	.014	
<u>DEPRECIATION.</u>				
Original Purchase	.416	.912		.496
Plant	.105	.105		
Equipment	.072	.051	.021	
Total Depreciation	.593	1.068		.475
Taxes	.072	.041	.031	
Central Office	.032	.022		.010
Supply Inventory	-	.001		.001
Winter Expense	.383	.054	.329	
Miscellaneous	.160	.004		
Cost on Stockpile	2.005	1.834	.171	
Loading & Shipping	.091	.023	.068	
Total Cost on Cars	2.096	1.857	.239	
No. Days Operating	216	223		7
No. Shifts & Hours	3-8-24 2-10	2-10-173 3- 8- 50		
Avg. Daily Product	333	970		637
<u>COST OF PRODUCTION.</u>				
Labor	.708	.383	.325	
Supplies	.353	.259	.094	
Total	1.061	.642	.419	

Mine leased in 1918.

HELMER MINE.

HELMER MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	71,831	216,428		144,759
No.Shifts and Hours	3-8hr	2-10-173		
	2-10hr	3- 8- 50		
AVERAGE NUMBER MEN WORKING				
Surface	7	18		11
Underground	23	50		27
Total	30	68		38
AVERAGE WAGES PER DAY				
Surface	5.44	4.75	.69-14.5%	
Underground	5.81	5.15	.66-12.8%	
Total	5.72	5.04	.68-13.5%	
WAGES PER MONTH OF 25 DAYS				
Surface	136.00	118.75	17.25	
Underground	145.25	128.75	16.50	
Total	143.00	126.00	17.00	
PRODUCT PER MAN PER DAY				
Surface	29.69	48.20		18.51
Underground	9.92	17.08		7.16
Total	7.43	12.61		5.18
LABOR COST PER TON				
Surface	.183	.098	.085	
Underground	.586	.302	.284	
Total	.769	.400	.369	
AVG. PRODUCT BRK'G & TRM'G	13.82	26.10		12.28
" WAGES CONTRACT MINERS	Co.acct.	Co.acct.		
" " " TRAMMERS	"	"		
" " " LABOR	"	"		
TOTAL NUMBER OF DAYS				
Surface	2,419 $\frac{3}{4}$	4490 $\frac{1}{4}$		2,070 $\frac{1}{2}$
Underground	7,241 $\frac{1}{4}$	12672 $\frac{3}{4}$		5,431 $\frac{1}{2}$
Total	9,661	17,163		7,502
AMOUNT FOR LABOR				
Surface	13170.27	21323.56		8153.29
Underground	42051.97	65262.81		23210.84
Total	55222.24	86586.37		31364.13

Proportion Surface to Underground Men:
 1919 - 1 to 3.67
 1918 - 1 to 2.77

Mine leased by C.C.I.Co. Jan. 2, 1918.

HELMER MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1919.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1919.	AMOUNT 1918.
4" to 6" Timber				106.20
6" to 8" "				63.72
8" to 10" "	13,810	.0601	830.05	42.48
10" to 12" "	14,198	.0890	1264.17	
Total - 1919	28,008	.0744	2094.22	
Total - 1918	4,328	.04907		212.40
	LINEAL FEET.	PER 100'.		
6' Lagging	79,560	.82	660.00	
Poles	2,091	8.00	167.28	
Total - 1919	81,651	.101	827.28	
Total - 1918	45,900	.364		167.50
Product			21,829	216,428
Feet Timber per ton of ore			1.285	.00199
Feet Lagging "			3.640	.21507
Feet Lagging per Ft. of Timber			2.840	10.6053
Cost per ton for Timber			.0959	.00098
" Lagging			.0302	.00077
" Poles			.0076	
" Timber, Lagging & Poles			.1338	.00175
Equivalent of stull timber to Bd. Measure			46,775	7,117
Ft. Bd. Measure per ton of ore			2.142	.03288
Total Cost for Timber, Lagging & Poles - 1919				2921.50
" 1918				379.90

Production Helmer U.G. 21829

" Helmer Pit and
Swallow Hopkins
Lean Ore Pile

50002

71831

Only the production for Helmer Underground was used as no timber is used in Pit production.

HELMER MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICE.	AMOUNT 1 9 1 9.	AMOUNT 1 9 1 8.
20% Powder				1536.93
30% "	3,400	.16529	561.10	
40% "	9,700	.18009	1746.92	2933.04
60% "	200	.2390	47.80	
Total Powder	13,300	.1771	2355.32	4469.97
Black Powder (Cans)	441	2.20	970.20	2118.56
Total			3326.02	6588.53
Fuse	38,300	8.42	322.52	700.65
Caps	11,100	26.43	293.41	149.54
Cap Crimpers	4	.66	2.63	2.60
Electric Exploders	650	7.57	49.22	455.07
Total Fuse, Etc.			667.78	1307.86
Total Explosives			3993.80	7896.39
Product			71,831	216,428
Pounds Powder per ton of Ore			.185	.2414
Cost per ton for Powder			.046	.0304
" " Fuse, Etc.			.0092	.006
" " All Explosives			.0552	.0365
Avg. Price per Lb. for Powder			.1771	.1261
" " " can " Black Powder			2.20	

WADE MINE

ANNUAL REPORT FOR 1919

"GENERAL SURFACE"

The Great Northern railway contractors completed the laying of track on our shaft and coal dock spur during the early part of the year. The ballasting of the track, however, was not undertaken until Spring, due to the frozen condition of the ground and the fact that no car service was necessary in the Winter. The mine carpenters completed our small coal dock in April. This dock has a capacity of 400 tons, the supply of coal accommodated here being used only in connection with our heating plant.

On account of delayed delivery of our water and heating pipes, these systems were not installed until the winter months, with the result that the cost of doing the work was increased decidedly over our estimated figures. It was also necessary to dig up the pipes in several places to repair leaks. There were two poor lengths of wooden pipe, which gave out under a very low pressure and had to be renewed. The pipe and heating jobs were not entirely completed until the forepart of May.

As the four cesspools would not take care of the surface drainage water, it was necessary to provide two open ditches leading south from the location and emptying into the mine water ditch.

A cow shed was erected for each family living in the location, so as to do away with the usual unsightly buildings, which the tenants erect themselves. These cow sheds were built along the back line of the property and were painted the same color as the houses.

The location water tank was put in commission the forepart of January, temporary connections having been made to the houses and mine buildings. The permanent connections were placed in service during May.

The six dwelling houses and old office building were moved from the Helmer Mine to the Wade location by contractor Lindsley during the month of March. These houses were placed along the south side of the Wade location, facing north, and the standard Cleveland-Cliffs Iron Company shed was built along the back line of the lots. Such repairs as were necessary were made to the houses and they were filled with tenants immediately.

Telephone and electric lines were put into the location and the streets were graded and surfaced with ashes and gravel. We graded several of the lawns and planted grass seed. The work of improving the appearance of the grounds will be carried forward during the coming year, in line with Mr. Manning's recommendations. We also cleaned up all the debris, which had accumulated around the location, during Winter and thereafter made a point of keeping the premises free of rubbish.

The old boiler house, shop building and dry at the Helmer Mine were dismantled in the Fall and the material salvaged therefrom was used in the construction of a locomotive and steam shovel repair house. This building was piped for steam heat and put in good shape for our winter repair work. We are able to get one locomotive and a model "60" steam shovel under this housing at one time and the overhauling of our equipment will be simplified considerably as a result of having a suitable place to work in. This building was placed near our coal dock spur, the tracks leading into it therefrom.

We also erected a garage building from material salvaged from the old Helmer structures. Unfortunately this building was

destroyed by fire and several of the employees' cars, which were stored therein, were burned. We were able to remove the mine truck and Mr. Stevenson's car undamaged.

The delivery of our electrical equipment was delayed to a considerable extent and whereas we had contemplated changing over from steam to electricity early in the Fall of 1918, we did not entirely close our steam plant until April, 1919. The electric haulage was installed the latter part of February and the skips were hung the first of March. Previous to this, we resorted to hand tramping underground and hoisted our product with the old temporary steam equipment and one-ton bucket.

The hoist, compressor and motor generator set foundations were completed in February. The compressor from the McClure Dam was installed in April and also the new generator set. The hoist from the Lake Shore Engine Works was delivered in April, but on account of its having a bent intermediate shaft, we were not able to make the proper repairs and put the hoist in operation until the end of the month. These delays were quite serious and we figured that the cost of operating our steam plant was at least \$1,500 a month in excess of our cost, had we been electrified throughout.

WADE MINE E & A

The delay in the delivery of electrical equipment, the increase in labor and material costs and the encountering of more water than had been anticipated, were the chief factors causing the appreciable overrun from our estimates covering the opening and equipping of the Wade Mine.

At the time our estimate was made, we anticipated sinking our shaft near the ore body. The amount of rock drifting would have been less in this case and the material cut in sinking operations would have been much more favorable. The drilling

WADE MINE.

demonstrated the extension of the ore channel to the southeast and it was, therefore, advisable to shift the shaft location. While the final location of the shaft more than justified the additional expenditure, still the shifting added materially to our costs.

Judging from the results at the Helmer and Deacon Mines, we did not anticipate pumping more than 250 gallons of water per minute while shaft sinking was in progress. We encountered in excess of 400 gallons per minute and the steam equipment provided was not adequate. This resulted in serious delays, which added to the increased cost in addition to the larger charge for pumping itself, over the extended period to the time that we were placed on an operating basis. Due to the fact that our electric pumps were not installed until January, whereas we had figured on September, at the time of making our estimate, based on advice from the manufacturers, this cost item was extremely high.

At the time of preparing the estimates, we did not anticipate that there would be the large increases in wages and supplies that occurred during the opening period, nor did we figure on carrying our development work against an opening account further than the Fall of 1918. The exploratory drilling was not adequate to show all of the irregularities in the formation and while our main level was laid out to good effect, we did not anticipate the considerable amount of rock work, which was unavoidable. While some of the costs have been excessive, it will pay us in the long run to have completed the work in so thorough a manner.

As stated before, all of the electrical equipment was to have been delivered in September, whereas the electric pumps

were not placed in commission until the latter part of January and the motor generator set and electric haulage were not put in service until March. The compressor was placed in commission early in April and the hoist at the end of this month. The result of all this was that we continued using our steam plant seven months beyond the time we had figured on when making our estimate.

Following are the charges to our E & A account No. 360, covering the opening and equipping of the Wade Mine from March 1st., 1918, to December 31st., 1919:

SUPERINTENDENT'S DIVISION

<u>GENERAL EXPENSE</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. '19</u>	<u>UNEXPENDED BALANCE.</u>
Insurance		64.28	
Engineering		3450.60	
Analysis		996.94	
Mine Office		7797.38	
Central Office		8365.96	
Taxes		24918.59	
Mining Captain		2243.66	
Legal		2.50	
Personal Injury		3780.27	
<u>TOTAL</u>	<u>29500.00</u>	<u>51620.18</u>	<u>22120.18</u>
 <u>MAINTENANCE</u>			
Building		1.36	
Boilers		502.51	
Hoisting Machinery		161.54	
Compressor & Air Line		258.25	
Pumps		263.49	
<u>TOTAL</u>	<u>1000.00</u>	<u>1187.15</u>	<u>187.15</u>
 <u>SINKING</u>			
Sinking - Total 223'		21952.95	
Timbering		3238.99	
Prop. of Acct. #7		12533.87	
<u>TOTAL</u>	<u>20000.00</u>	<u>37725.81</u>	<u>17725.81</u>
 <u>DRIFTING TO ORE BODY</u>			
Drifting - Total 1964'		56618.93	
Timbering		9131.01	
Prop. of Acct. #7		38236.95	
<u>TOTAL</u>		<u>103986.89</u>	<u>103986.89</u>
Plats and Pockets	<u>3000.00</u>	<u>3570.62</u>	<u>570.62</u>

WADE MINE.

SUPERINTENDENT'S DIVISION - CONTINUED

<u>PREPARING SITE</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. '19</u>	<u>UNEXPENDED BALANCE.</u>
Building Roads		515.48	
Clearing Lands		3423.10	
Grading & Ditching		129.19	
TOTAL	4000.00	4067.77	67.77
<u>TEMPORARY EQUIPMENT</u>			
Surface Tracks & Cars		95.41	
Undg. Tracks & Cars		178.42	
Derricks and Buckets		7.74	
Miscellaneous		453.00	
Tools in General Use		67.94	
TOTAL	1000.00	802.51	197.49
<u>PERMANENT CONSTRUCTION</u>			
Undg. Tracks & Cars		3706.02	
Electric Haulage Tracks		2240.71	
Power Drills		4189.15	
Pump House and Sump		2814.44	
Ventilating Equipment		2081.40	
TOTAL	11060.00	15031.72	3971.72
Water Supply	4500.00	5383.03	883.03
Office Furniture and Fixtures	420.00	319.75	100.25
<u>EXPLORING</u>			
Exploring		13642.71	
Testing for Shaft Site		2162.12	
Transfer of Explorations		44094.17	
TOTAL	8500.00	59899.00	51399.00
GRAND TOTAL	82980.00	283594.43	200614.43
10% for Contingencies	8298.00	-	8298.00
TOTAL SUPERINTENDENT'S DIVISION	91278.00	283594.43	192316.43

MASTER CARPENTER'S DIVISION

<u>TEMPORARY EQUIPMENT</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. 1919</u>	<u>UNEXPENDED BALANCE.</u>
Engine, Boiler & Com- pressor House	1600.00	2003.01	403.01
Dry House	300.00	311.06	11.06
Laundry	100.00	110.73	10.73
Coal Dock		744.96	744.96
Pulley Stands		86.78	86.78

WADE MINE.

MASTER CARPENTER'S DIVISION - CONTINUED

<u>PERMANENT EQUIPMENT</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. 1919</u>	<u>UNEXPENDED BALANCE.</u>
Power House	4000.00	3784.57	215.43
Shaft House	8500.00	10453.44	1953.44
Office & Warehouse	3800.00	5978.55	2178.55
Shop Building	4250.00	4786.40	536.40
Top Tram Engine House	1000.00		1000.00
Change House	5500.00	7036.04	1536.04
Oil Storage Building	700.00	780.11	80.11
Barn & Carriage Bldg.	2000.00	1471.80	528.20

DOCKS, TRESTLES & POCKETS

Permanent Trestles		4235.10	
Stocking Trestles		1276.39	
Rail		99.00	
Stockpile Plank		908.65	
TOTAL	4300.00	6519.14	2219.14

Coal Dock	1500.00	2088.62	588.62
Pulley Stands	500.00	821.34	321.34
Cooling Tower		52.45	52.45
Garage		1167.68	1167.68
TOTAL	38050.00	48196.68	10146.68

10% for Contingencies 3805.00 3805.00

**TOTAL MASTER CARPENTER'S
DIVISION 41855.00 48196.68 6341.68**

CHIEF MECHANICAL ENGINEER'S DIVISION

<u>TEMPORARY EQUIPMENT</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. 1919</u>	<u>UNEXPENDED BALANCE.</u>
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BOILER PLANT

Boiler		6964.17	
Foundations		2583.29	
Piping & Pipe Covering		377.29	
Pumps		24.34	
Steam and Water Lines		95.12	
Erecting		1195.04	
TOTAL		11239.25	

HOISTING PLANT

Machinery		5103.96	
Foundations		173.28	
Steam Line		157.01	
Erecting		314.41	
TOTAL		5748.66	

COMPRESSOR PLANT

Machinery		2208.03	
Foundations		16.68	
Steam Line		266.45	
Air Line		176.66	
Erecting		240.74	
TOTAL		2908.56	

WADE MINE.

CHIEF MECHANICAL ENGINEER'S DIVISION - CONTINUED

<u>SINKING PUMP</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. 1919</u>	<u>UNEXPENDED BALANCE.</u>
Pumps		295.32	
Steam and Water Lines Installing		1079.87 37.87	
TOTAL		1413.06	
Shop Equipment		5.51	
Heating System		506.93	
TOTAL TEMPORARY EQUIPT.	17000.00	21821.97	4821.97
<u>PERMANENT EQUIPMENT</u>			
<u>HOISTING PLANT</u>			
Skip Hoist		4600.00	
Motor and Control		2500.00	
Foundation		608.39	
Foundation		29.04	
Skips and Cages		2004.82	
Bell Lines & Signals		267.86	
Sheaves & Counterweight		172.28	
Wire Rope		683.07	
Erecting		1517.44	
TOTAL	16650.00	12382.90	4267.10
<u>COMPRESSOR PLANT</u>			
Compr. Motor, Control & Receivers		5114.26	
Foundations		734.98	
Piping		118.97	
Air Line in Shaft		151.58	
Erecting		1154.51	
TOTAL	8200.00	7274.30	925.70
<u>SHOP EQUIPMENT</u>			
Equipment		5336.63	
Installing		567.66	
TOTAL	4500.00	5904.29	1404.29
<u>TOP TRAM PLANT</u>			
Tram Equipment		1609.23	
Erecting		114.69	
TOTAL		1723.92	1723.92
<u>ELECTRIC HAULAGE</u>			
Machinery		4282.76	
Locomotives		8619.26	
Cars		6714.81	
Wiring		945.31	
Erecting		1184.69	
TOTAL	28250.00	21746.83	6503.17

WADE MINE.

CHIEF MECHANICAL ENGINEER'S DIVISION - CONTINUED

<u>PUMPING PLANT</u>	<u>ESTIMATE</u>	<u>CHARGES TO DECEMBER 31ST. 1919</u>	<u>UNEXPENDED BALANCE.</u>
Pumps		5305.92	
Motor and Control		968.16	
Pump House		2138.53	
Water Column		1107.01	
Steam Line to Shaft		142.31	
Electric Line In Shaft		487.73	
Erecting		2055.91	
TOTAL	7100.00	12205.57	5105.57
Safety Appliances		58.53	58.53
<u>HEATING SYSTEM</u>			
Boiler		620.05	
Pipe Covering		559.94	
Piping and Radiation		5465.37	
Ditching and Erecting		996.53	
TOTAL	4000.00	7641.89	3641.89
Fire Protection	1000.00	765.30	234.70
Recording Gauges	100.00		100.00
Oil Storage Tank		547.82	547.82
Surface Lighting	350.00	431.73	81.73
Cooling Towers		360.14	360.14
<u>SUB-STATION & POLE LINES</u>			
Equipment		1032.08	
Transmission Line		2231.73	
TOTAL	3500.00	3263.81	236.19
Auto Truck	1000.00	805.07	194.93
Undg. Electric Wiring		366.41	366.41
GRAND TOTAL	91650.00	97300.48	5144.10
10% for Contingencies	9165.00		9165.00
TOTAL CHIEF MECHANICAL ENGINEER'S DIVISION	100815.00	97300.48	3514.52
<u>SUMMARY:</u>			
Superintendent's Div.	91278.00	283594.43	192316.43
Master Carpenter's Div.	41855.00	48196.68	6341.68
Chief Mech. Engr's Div.	100815.00	97300.48	3514.52
TOTAL	233948.00	429091.59	195143.59
Depr. of Inventory		3141.77	3141.77
GRAND TOTAL	233948.00	432233.36	198295.36
Earnings from Rented Bldgs.		2570.42	
Operating Wade "	"	1433.35	
Net Earnings		1137.07	
Earnings from Shops		783.55	
Ore Produced in Develop- ment		45942.12	
Total Credits		47862.74	
GRAND TOTAL		384370.62	
Reserve for Depreciation		43208.10	
BALANCE		341162.52	

SUMMARY - CONTINUED

Total Charges to December 31st., 1919-----	\$384,370.62
Total Charges to Wade Dwellings-----	75,660.60
Total Charges to Moving Dwellings from Helmer to Wade--	<u>12,588.00</u>
Total Construction as per statement of Wade Mine assets and liabilities of December 31st., 1919-----	\$472,619.22

ORE ESTIMATES

Following is an estimate of the ore in sight at the Wade 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 Jan. 1st., 1919 (West Deposit)-----	1,839,400
Ore in sight Jan. 1st., 1919 (East Deposit)-----	1,515,000
Ore in sight Jan. 1st., 1919 (Deacon Deposit)-----	<u>175,000</u>
TOTAL- - - - -	3,529,400
Ore mined during 1919 (West Deposit)-----	<u>233,455</u>
BALANCE FROM THESE FIGURES- - - - -	3,295,945
Ore in sight Jan. 1st., 1920 (West Deposit)-----	1,590,000
Ore in sight Jan. 1st., 1920 (East Deposit)-----	1,515,000
Ore in sight Jan. 1st., 1920 (Deacon Deposit)-----	<u>175,000</u>
TOTAL- - - - -	3,280,000

There is a reduction of approximately 16,000 tons in the West Deposit. This was made necessary on account of the rock intrusions into the northeast portion of the ore body. The reduction here more than offset the slight extension of the deposit along the north shore line to the west, in the vicinity of Nos. 7 and 9 crosscuts. No exploratory or development work was undertaken on the so-called East and Deacon Deposits during the year, with the result that no change has been made in these figures.

The average grade of the ore in the three deposits, as of January 1st., 1920, is as follows:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>
West Deposit-----	1,590,000	58.00	.074	1.05	6.70	13.25
East Deposit-----	1,515,000	56.91	.075	1.83	7.44	13.50
Deacon Deposit---	(80,000	56.65	.045	1.16	8.04	12.50
	(95,000	55.77	.053	.42	8.43	12.50

Following are the tonnages and grades of ore in the West Deposit above and below the main haulageway, according to our estimate of January 1st., 1920:

	<u>Tons</u>	<u>Fe.</u>	<u>Phos.</u>	<u>Mn.</u>	<u>Sil.</u>
Above Main Level----	1,404,000	58.00	.074	1.33	6.25
Below Main Level----	186,000	58.11	.073	.74	7.03

The results of the development work during the year have substantiated very closely our previous estimates, which were, of course, based entirely on the drill records.

The Wade Mine is now quite thoroughly developed and we do not anticipate showing up any additional tonnage by future operations.

STOCKING

We have used one of the underground locomotives and both the end dump and saddle-back cars in connection with our stocking operations. This is the same system as we have used at the Crosby Mine for the past several years and it works out to very good advantage where the stocking room is limited and the frost around the trestle legs would be excessive. Our present stocking ground at the Wade Mine will accommodate approximately 60,000 tons and it would require quite a considerable amount of grading to enlarge the space appreciably. End-dump cars are used in building out the pile and side-dumping in fanning to the necessary widths. Other than the permanent bents, no trestle timber is used in this method of stocking.

The permanent rock trestle was erected during the year and a small heated motor barn was built on this structure, near the headframe. The waste rock from the mine will be trammed and dumped to the southwest of the shaft, over the ground being caved on this side of our track pillar.

The model "60" shovel from the Crosby Mine was used in loading out the Wade stockpile last summer. The pile was not

entirely cleaned up, however, as it was necessary to send the shovel to the Crosby and later to the Meadow Mine for stockpile loading operations at these properties. It is the present intention to secure a second steam shovel for stockpile loading in 1920, so that all the piles may be cleaned up and shipped as desired. It is quite essential that the Wade stockpile be entirely loaded out this year, as our storage capacity is limited.

Following are the tonnages of Wade ore reported in stock at the opening of navigation and shipped from stockpile during the season, with the average analysis of same:

In Stock at Opening of Navigation--	<u>Tons</u> 17,079	<u>Fe.</u> 58.90	<u>Phos</u> .086	<u>Mn.</u> .95	<u>Sil.</u> 5.37
Shipped from Stockpile-----	13,770	56.93	.082	.84	7.48

The average analysis of the Wade ore in stock January 1st., 1920, is as follows:

<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
25,104	58.29	.069	1.04	6.96

SHIPMENTS

Following are the cargoes of Helmer Grade shipped during the past year and the analysis of same as obtained at the Mine and by the Lower Lake Chemists. This grade is made up of 211,888 tons of Wade and 74,657 tons of Helmer:

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>CADILLAC</u> - - - - -							3,119
Mine-----	57.46	.067	1.40	8.53	-----	-----	
Crowell & Murray--	57.22	---	----	----	12.98	49.793	
<u>ISHPEMING</u> - - - - -							6,811
Mine-----	58.26	.071	1.09	6.85	-----	-----	
Cremer & Case-----	58.30	---	----	----	13.42	50.476	
<u>BREITUNG</u> - - - - -							1,933
Mine-----	58.00	.066	1.06	8.16	-----	-----	
Crowell & Murray--	57.65	---	----	----	13.05	50.127	
<u>PETER WHITE</u> - - - - -							9,124
Mine-----	57.92	.065	1.25	7.49	-----	-----	
Textor-----	57.40	---	----	----	13.41	49.700	
<u>MUNISING</u> - - - - -							3,493
Mine-----	57.86	.064	1.22	7.64	-----	-----	
Crowell & Murray--	57.90	---	----	----	12.42	50.709	
<u>ANDASTE</u> - - - - -							2,738
Mine-----	58.74	.059	.95	8.25	-----	-----	
Emmerton-----	59.60	---	--	----	14.28	51.089	
<u>AMBERG</u> - - - - -							10,821
Mine-----	57.57	.067	1.21	7.80	-----	-----	
Cremer & Case-----	57.40	---	----	----	12.69	50.116	
<u>MARQUETTE</u> - - - - -							7,537
Mine-----	57.75	.065	1.04	8.02	-----	-----	
Emmerton-----	57.30	---	----	----	14.08	49.232	
<u>ROGERS</u> - - - - -							10,624
Mine-----	57.56	.067	.90	7.91	-----	-----	
Cremer & Case-----	58.00	---	---	----	14.17	49.781	
Crowell & Murray--	58.10	---	---	----	14.48	49.687	

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>MUNISING</u> - - - - -							3,375
Mine-----	57.53	.068	.95	7.29	-----	-----	
Crowell & Murray--	57.27	---	--	----	14.89	48.742	
<u>CADILLAC</u> - - - - -							3,449
Mine-----	57.44	.061	.66	8.90	-----	-----	
Textor-----	57.35	---	--	----	14.33	49.132	
<u>MICHIGAN</u> - - - - -							3,936
Mine-----	57.65	.059	.62	9.29	-----	-----	
Cremer & Case-----	59.10	---	--	----	14.14	50.743	
<u>FRENCH</u> - - - - -							6,213
Mine-----	57.49	.060	.78	9.18	-----	-----	
Emmerton-----	57.43	---	--	----	14.51	49.098	
<u>MORRELL</u> - - - - -							8,519
Mine-----	57.62	.072	.85	7.80	-----	-----	
Textor-----	56.75	---	--	----	14.00	48.805	
<u>MARQUETTE</u> - - - - -							8,020
Mine-----	57.79	.065	.90	8.13	-----	-----	
Cremer & Case-----	58.10	---	--	----	12.64	50.756	
<u>SNYDER</u> - - - - -							3,969
Mine-----	58.01	.069	1.03	7.18	-----	-----	
Emmerton-----	57.30	---	----	----	13.09	49.799	
<u>TURNER</u> - - - - -							10,964
Mine-----	57.98	.064	.93	7.61	-----	-----	
Emmerton-----	58.33	---	--	----	12.53	51.021	
Cremer & Case-----	57.80	---	--	----	12.31	50.685	
<u>LUZON</u> - - - - -							1,724
Mine-----	57.51	.063	.93	7.71	-----	-----	
Textor-----	57.00	---	--	----	12.67	49.778	
<u>WILPEN</u> - - - - -							1,055
Mine-----	56.84	.076	1.02	7.57	-----	-----	
Textor-----	57.85	---	----	----	12.11	50.844	
Cremer & Case-----	58.40	---	----	----	11.74	51.544	
<u>MICHIGAN</u> - - - - -							10,969
Mine-----	59.68	.062	.89	6.54	-----	-----	
Cremer & Case-----	59.40	---	--	----	11.54	52.545	
<u>ISHPEMING</u> - - - - -							11,176
Mine-----	59.52	.067	.87	6.32	-----	-----	
Crowell & Murray--	59.95	---	--	----	13.45	51.887	

WADE MINE.

	<u>Fe.</u>	<u>Phos.</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons.</u>
<u>CENTRAL WEST</u> - - - - -							5,320
Mine-----	58.58	.065	1.02	6.69	-----	-----	
Cremer & Case-----	58.70	---	----	----	13.15	50.981	
<u>SHEADLE</u> - - - - -							2,939
Mine-----	58.20	.064	1.17	6.99	-----	-----	
Crowell & Murray--	58.00	---	----	----	12.73	50.617	
<u>SHEADLE</u> - - - - -							7,168
Mine-----	58.43	.078	.93	7.17	-----	-----	
Cremer & Case-----	58.50	---	--	----	11.71	51.650	
<u>H. H. BROWN</u> - - - - -							8,027
Mine-----	59.29	.077	.80	6.59	-----	-----	
Textor-----	60.30	---	--	----	12.18	53.016	
<u>JENKINS</u> - - - - -							10,011
Mine-----	59.33	.068	.79	6.40	-----	-----	
Crowell & Murray--	59.74	---	--	----	12.64	52.189	
Emmerton-----	59.45	---	--	----	12.38	52.090	
<u>SHEADLE</u> - - - - -							3,624
Mine-----	59.68	.067	.76	6.13	-----	-----	
Textor-----	60.05	---	--	----	11.06	53.401	
<u>PONTIAC</u> - - - - -							12,440
Mine-----	59.75	.074	.81	6.09	-----	-----	
Cremer & Case-----	60.30	---	--	----	11.17	53.560	
<u>GRAND ISLAND</u> - - - - -							9,503
Mine-----	59.65	.071	.82	6.06	-----	-----	
Crowell & Murray--	60.06	---	--	----	12.07	52.811	
<u>MUNISING</u> - - - - -							6,624
Mine-----	58.05	.074	.93	7.03	-----	-----	
Crowell & Murray--	58.63	---	--	----	12.66	51.207	
<u>W. G. MATHER</u> - - - - -							11,277
Mine-----	58.52	.071	.95	6.99	-----	-----	
Textor-----	58.85	---	--	----	11.83	51.888	
<u>MICHIGAN</u> - - - - -							10,524
Mine-----	59.63	.069	.68	6.48	-----	-----	
Crowell & Murray--	60.28	---	--	----	12.69	52.630	
<u>MUNISING</u> - - - - -							6,549
Mine-----	58.78	.059	.83	6.89	-----	-----	
Cremer & Case-----	58.90	---	--	----	13.17	51.143	

WADE MINE.

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>	<u>Tons</u>
<u>MIDVALE-</u>							12,262
Mine-----	59.36	.064	.81	6.21	-----	-----	
Crowell & Murray--	59.85	---	--	----	12.70	52.249	
Emmerton-----	59.05	---	--	----	12.59	51.616	
<u>PIONEER-</u>							6,375
Mine-----	59.57	.061	.81	6.14	-----	-----	
Cremer & Case-----	59.60	---	--	----	11.05	53.014	
<u>UTLEY-</u>							10,084
Mine-----	60.28	.059	.73	5.83	-----	-----	
Textor-----	60.18	---	--	----	11.10	53.500	
<u>NEGAUNEE-</u>							1,346
Mine-----	61.46	.054	.45	5.73	-----	-----	
Crowell & Murray--	60.89	---	--	----	11.80	53.705	
<u>ISHPEMING-</u>							3,695
Mine-----	59.43	.058	.77	7.06	-----	-----	
Emmerton-----	59.23	---	--	----	11.68	52.312	
<u>PIONEER-</u>							5,749
Mine-----	58.99	.061	.73	7.43	-----	-----	
Textor-----	58.72	---	--	----	11.04	52.137	
<u>PONTIAC-</u>							5,879
Mine-----	59.01	.063	.77	7.20	-----	-----	
Crowell & Murray--	58.77	---	--	----	11.61	51.947	
<u>SCHOONMAKER-</u>							4,294
Mine-----	57.60	.065	1.07	8.00	-----	-----	
Crowell & Murray--	59.00	---	----	----	13.99	50.746	
<u>SHENANGO-</u>							7,981
Mine-----	57.58	.067	1.03	8.14	-----	-----	
Textor-----	58.05	---	----	----	12.44	50.829	
<u>PETER WHITE-</u>							5,546
Mine-----	58.43	.070	.98	7.01	-----	-----	
Crowell & Murray--	58.57	---	--	----	12.48	51.260	

Following is the average analysis of the Helmer Grade shipped during the 1919 season, as obtained from Mine and Lower Lake Chemists' sampling:

	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Mois.</u>	<u>Fe.Nat.</u>
Mine-----	58.01	.066	.89	7.09	-----	-----
Lower Lake---	58.61	---	--	----	12.71	51.161

Following is a complete analysis of the season's shipments from the Wade Mine:

<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>	<u>Alumina</u>	<u>Lime</u>	<u>Magnesia</u>	<u>Sulphur</u>	<u>Loss By</u> <u>Ignition</u>
58.72	.065	.83	6.45	2.35	.15	.14	.012	5.46

Shipments for the 1919 ore season were started the first of May and were continued to October 25th, with the exception of the period from August 8th to 26th, inclusive, while a strike was in effect at the Great Northern Ore Docks at Superior.

The 1919 shipments from the Wade Mine consisted of 13,770 tons of stockpile ore, 14,700 tons of ore loaded directly into railway cars from the upper ore bench, 141,821 tons handled from the bottom of the Helmer pit on the inclined tramway and 41,597 tons from the Wade shaft.

The estimated production from the Wade Mine for the 12 months period from November 15th, 1919, to November 15th, 1920, is 250,000 tons; made up of 120,000 tons to come from underground operations and 130,000 tons from the open pit.

ACCIDENTS

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

LOUIS VUKADINOVICH

Injured-----January 1st., 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----20 Days.
Received Compensation-----\$26.00.

Remarks: Vukadinovich was shoveling dirt into a tram car, when his partner struck him on the fingers with his shovel, cutting second and third fingers of right hand.

TOM BUKKLA

Injured-----February 21st., 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----Left our employ.
Received Compensation-----\$1100.00.

Remarks: While starting to drill a hole for a tie, a piece of rock flew from the drill, hitting him in the eye and causing injury. Bukkla claimed loss of sight of left eye and commenced suit for damages; this suit was settled by a payment of \$1100.00 through H. J. Grannis, Attorney.

JAMES O. BAKER

Injured-----February 19th, 1919.
Occupation-----Mechanic.
Nationality-----American.
Time Lost-----12 Days.
Received Compensation-----\$10.00.

Remarks: Baker was chipping rivets when a piece of steel flew into his eye.

TONY JACOBS

Injured-----April 10th, 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----Still in hospital.
Received Compensation-----\$440.00 to-date.

Remarks: While shoveling dirt a piece of ground fell from back. Several poles had been extended from cap to breast and Jacobs partner was drilling a short hole to blast for a timber, when accident happened.

GEORGE GRUBICH

Injured-----April 10th, 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----3 Days.
Received Compensation-----None.

Remarks: Grubich was picking out some ground for a timber hitch, when a chunk of ore fell from the back and injured his right hand.

ANDREW KETTELA

Injured-----April 10th, 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----Left our employ.
Received Compensation-----\$23.00 Paid. We are still holding check for \$54.00, which he refuses to accept.

Remarks: When starting a hole with a machine, a chunk fell from the back and injured Kettela's hand. We hold that he was disabled to June 1st., while he claims to August 11th. and has sued. Judge Hughes has not as yet handed down a decision.

JOHN DROBNICH

Injured-----March 30th, 1919.
Occupation-----Trackman.
Nationality-----Slovanian.
Time Lost-----41 Days.
Received Compensation-----\$68.00.

Remarks: Droblich was replacing a dump car on track. The door of the car was not quite closed, and in moving it, the door fell on his hand, cutting right index finger.

LOUIS VUKADINOVICH

Injured-----April 18th, 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----32 Days.
Received Compensation-----\$50.00.

Remarks: While putting in cribbing in Raise No. 503, Vukadinovich stepped off the plank staging and sprained his right ankle.

CHAS. SUNHILL

Injured-----April 16th, 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----13 Days.
Received Compensation-----\$12.00.

Remarks: Sunhill and his partner had placed a set of timber and were putting up the lagging. In picking some ground down to make room for the lagging, a chunk of ore struck him and bruised his chest on left side.

STEVE BALIC

Injured-----May 20th, 1919.
Occupation-----Miner.
Nationality-----Croatian.
Time Lost-----11 Days.
Received Compensation-----\$10.00.

Remarks: Balic claims that the damp air and the noise of the machines caused him to loose his hearing. He refused to accept settlement and sued. This case was heard before Judge Freeman in Virginia, who held that there was no ground for further compensation.

SANFRID KAIMU

Injured-----May 16th, 1919.
Occupation-----Pitman.
Nationality-----Finnish.
Time Lost-----46 Days.
Received Compensation-----\$97.50.

Remarks: The crew were moving up a steam shovel. In placing clamp in front of wheel of shovel, Kaimu's index finger on right hand was badly crushed.

CHAS. LAITI

Injured-----June 12th, 1919.
Occupation-----Pitman.
Nationality-----Finnish.
Time Lost-----27 Days.
Received Compensation-----\$50.00.

Remarks: Laiti was sitting along side of track on stripping job, with his back towards a loading train. A rock fell off one of the dump cars, striking him and injuring his back.

JOHN HAUTALA

Injured-----June 23rd., 1919.
Occupation-----Driller.
Nationality-----Finnish.
Time Lost-----17 Days.
Received Compensation-----\$25.00.

Remarks: Hautala was endeavoring to remove a chunk from a drill hole, when powder in the partly charged hole exploded, causing bad burns on face and hands.

OSCAR GRANROS

Injured-----June 23rd., 1919.
Occupation-----Driller.
Nationality-----Finnish.
Time Lost-----14 Days.
Received Compensation-----\$17.50.

Remarks: Granros was working with Hautala in removing a chunk of ore from drill hole. The powder in the partly charged hole exploded, causing bad burns on face and hands.

ANSU WILEEN

Injured-----June 28th, 1919.
Occupation-----Pocketman.
Nationality-----Finnish.
Time Lost-----30½ Days.
Received Compensation-----\$58.75.

Remarks: In rolling a rock off grizzly bars Wileen had his big toe crushed.

AUGUST SMUDE

Injured-----September 4th, 1919.
Occupation-----Pitman.
Nationality-----German.
Time Lost-----Killed.
Compensation Paid-----This case was handled by our Ishpeming Office and we have no report from them showing what compensation was paid. For the reason that Smude had no dependents, our Company paid only the burial expenses and \$100.00 to the State Treasurer.

Remarks: In dropping a loaded car from the shaft pocket it got beyond control and ran out into the yards. A locomotive was moving a steam shovel through the yards and the ore car crashed into the locomotive. Smude was sitting on the locomotive beam and was crushed between the locomotive and steam shovel. Smude died a few hours after the accident.

MIKE COLEFF

Injured-----August 12th, 1919.
Occupation-----Miner.
Nationality-----Bulgarian.
Time Lost-----19 Days.
Received Compensation-----\$30.00.

Remarks: Coleff had started to pick down the loose ground after blasting, when a small piece of ore hit him on the back of the head.

GASPER ORESKOVICH

Injured-----August 30th, 1919.
Occupation-----Miner.
Nationality-----Austrian.
Time Lost-----20 Days.
Received Compensation-----\$32.50.

Remarks: While pulling up cribbing Oreskovich became faint and decided to climb down the raise. He slipped and fell about twenty feet, bruising and straining his back.

CHAS VERBIC

Injured-----August 4th, 1919.
Occupation-----Car Repairer.
Nationality-----Slovanian.
Time Lost-----12 Days.
Received Compensation-----\$12.50.

Remarks: Verbic slipped and scraped leg on door of dump car, which he was repairing.

MATT JOHNSON

Injured-----September 8th, 1919.
Occupation-----Miner.
Nationality-----Finnish.
Time Lost-----18½ Days.
Compensation Paid-----\$262.50.

Remarks: Johnson was helping his partner to grease a car, and in replacing a wheel he caught his finger between the wheel and axel and cut off the end of the right index finger.

HARRY SMITH

Injured-----September 2nd, 1919.
Occupation-----Machinist.
Nationality-----English.
Time Lost-----7 Days.
Received Compensation-----None.

Remarks: While unloading machinery from a flat car, Smith strained his back. He was lifting on a casting.

NICK KOVAK

Injured-----July 31st., 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----15½ Days.
Received Compensation-----\$21.25.

Remarks: Kovac's hand was injured by a chunk of ore which fell from the back of his working place. His left little finger was crushed.

MIKE TITICH

Injured-----July 24th, 1919.
Occupation-----Miner.
Nationality-----Serbian.
Time Lost-----22½ Days.
Received Compensation-----\$38.75.

Remarks: In hoisting timber to the sub-level, Titich placed a chain around a piece of timber. The chain slipped and caught his foot, straining right ankle.

JOHN LACH

Injured-----October 23rd., 1919.
Occupation-----Pocketman.
Nationality-----Austrian.
Time Lost-----43 Days.
Received Compensation-----\$90.00.

Remarks: Lach had just finished dumping stripping cars and was locking them back into place, when he lost his balance. In trying to catch himself he placed his hand on floor of car just as the side closed down and crushed all four fingers on left hand.

CARMON PAOLETTI

Injured-----October 28th, 1919.
Occupation-----Miner.
Nationality-----Italian.
Time Lost-----18 Days.
Received Compensation-----\$27.50.

Remarks: While putting in head poles to make the back secure, a piece of ore hit one of these poles, and in getting out of the way, Paoletti caught hold of a piece of plank. A rusty spike ran into the palm of his right hand.

ALBERT COAD

Injured-----October 22nd, 1919.
Occupation-----Locomotive Fireman.
Nationality-----English.
Time Lost-----9 Days.
Received Compensation-----\$5.00.

Remarks: Coad burned himself on a red hot klinker hook in the cab of his locomotive.

GUST RAITALA

Injured-----October 28th, 1919.
Occupation-----Driller.
Nationality-----Finnish.
Time Lost-----18 Days.
Received Compensation-----\$27.50.

Remarks: While making a gopher hole in the ore bank some hanging dirt dropped and hit Raitala. He suffered a bruised back.

SWENARD NUTTILA

Injured-----November 19th, 1919.
Occupation-----Brakeman.
Nationality-----Finnish.
Time Lost-----17 Days.
Compensation Paid-----\$25.00.

Remarks: Nuttita, while hurrying to turn a switch for a moving train, fell and fractured his left big toe.

SAM KOVICH

Injured-----December 17th, 1919.
Occupation-----Dumpman.
Nationality-----Serbian.
Time Lost-----9 Days.
Received Compensation-----\$5.00.

Remarks: In righting cars after dumping, a pole is used. In this case a pole was braced against a tie and when the train moved, the pressure on the pole caused tie to move up against the tie next to it. Kovich's left foot was between the two ties and was badly bruised.

STRIPPING

Due to the fact that our stripping cuts were very shallow last January, averaging less than 10', it was extremely difficult to make a creditable showing and we considered it advisable to shut down the work until the weather moderated. The Marion "60" shovel will dig and load ore only about 5' under the railway tracks and in consequence we were obliged to arrange our benches so as to take a 10' cut in depth. These cuts were 400' in length and the frost penetrates between the times the shovel would take two cuts and it was necessary to do considerable blasting. The large frozen chunks are hard to handle with our small equipment. The stripping job was, therefore, discontinued the forepart of January and resumed on March 12th. The frost conditions were still very bad and we had some difficulty in getting our work started. We could not dump the large chunks of frost while filling the old bridge, as we feared breaking the tunnel timbers and in consequence a large part of our yardage had to be hauled out to the old waste dump during March.

The following is a tabulation by months, showing the cubic yards of overburden removed at the Wade Mine during the past year:

	<u>Cubic Yards</u>
January-----	6,414
February-----	-----
March-----	15,948
April-----	38,686
May-----	54,460
June-----	39,606
July-----	34,188
August-----	19,752
September-----	35,271
October-----	26,738
November-----	46,838
December-----	<u>52,600</u>
TOTAL- - - - -	370,501

Cubic Yards

Overburden removed at Wade Mine during past two years--- 429,244

The heavy rainfalls during the month of April delayed progress in our stripping to a considerable extent and the work during the months of January, July, August, September and October were largely in the nature of clean-up operations and the establishment of permanent switch backs. The yardage was in consequence rather low and considerable track work was entailed. We obtained our best yardage during the months of May, November and December. At the close of the year we had worked out a system of stripping operations which will in the future minimize the amount of track work and allow us to take cuts of a substantial height. The permanent switch backs will be used in connection with the balance of our stripping work and the cost per cubic yard for future operations will tend to lower the general average as of this date.

The necessity of getting down to the deep ore at the northeast and southeast corners of the pit was a considerable task. Unfortunately the high ore occurs in the center of the pit and has a decided roll near the north shore line and to the south in the vicinity of the Oliver Iron Mining Company's boundary line.

In connection with the removal of the bottom one-half of the stripping bank along the Oliver berm and out of the old Helmer approach, it was found advisable to widen and grade the berm and deepen the approach. The tunnel timbers out of the approach were constantly breaking and we finally decided to remove the fill and erect a bridge across the approach. This work was accomplished during the summer months and the Fall and Winter stripping was handled over the bridge to our new waste dump. The old dump had been filled to the Oliver line and operations had to be discontinued at this point. The new dump, with our present haulage arrangements, is shorter and there is ample room here for the accommodation of the remaining yardage from the Wade property.

With the three locomotives in service during November and December, we made a very creditable showing on the stripping

job, considering the unusually severe weather for that time of year.

We had intended discontinuing stripping operations December 20th on account of the severe weather, but the ground in our stripping bank was blasted farther back than we had intended and it was considered advisable to clean up all broken surface. The stripping job will be discontinued early in January and resumed about April 1st., depending on weather conditions in the Spring. We should be able to handle approximately 50,000 yards per month during the period of stripping activities in 1920.

OPEN PIT OPERATIONS

We hoisted 66,843 tons of Helmer ore from the open pit during the past season, 141,821 tons of Wade product was hauled to and hoisted on the incline tramway and 14,700 tons was loaded directly into Great Northern ore cars along the top ore bench.

Following is the analysis of the Wade ore shipped from the open pit during the 1919 season:

<u>Tons</u>	<u>Fe.</u>	<u>Phos</u>	<u>Mn.</u>	<u>Sil.</u>
156,521	59.74	.064	.78	6.27

During the months of May, June and July the Wade open pit ore operations were restricted on account of the non-completion of the stripping job at the northeast and southeast corners of the pit. There is a high roll in the ore near the center of the pit and this material was cleaned some distance back from the pit face in June, but it was necessary to maintain a substantial railroad berm here until the deeper stripping had been removed from the northeast corner of the pit. Before the top ore bench had been cleaned around the entire east end of the pit, it was necessary for the "60" shovel to dig and cast into the pit a cut varying from 5' to 15' in depth, in order to maintain suitable grades for stripping operations.

It is not at all satisfactory to carry the ore operations too closely on the heels of the stripping and for this

reason the stripping operations will be carried some distance ahead of mining in the future. We also had a number of clean-up jobs in the bottom of our pit this Summer, as the result of digging our ore faces too close to the stripping limits. The heavy rains would wash the surface material down onto the ore.

The model "60" shovel loaded out 14,700 tons of top ore, besides digging and casting an appreciable tonnage during the progress of our stripping job. We aim to load a larger proportion of the open pit ore direct into ore cars in future operations and we are working out our plans with this end in view.

The model "36" shovel loaded 141,821 tons from the east ore face. This material was loaded into 7-yard cars and trammed and dumped into the incline pocked, where it was hoisted and loaded into railroad cars. We are leaving approximately 15' of ore in the pit bottom. As it is, the ore face is very high and has to be blasted in two operations; first, with vertical holes put down from 20' to 25', and second, with horizontal gopher holes running into the bank approximately 25'. The top holes are put down at intervals of 20', approximately 20' back from the ore face.

We had some trouble with lumpy material in the south-east corner of the pit and when our shovel was digging in this locality, the production fell off appreciably, as the amount of chunks that can be broken down on the grizzly is somewhat limited. Fortunately the rest of the ore face contained comparatively few lumps.

We anticipate mining 130,000 tons of open pit ore during the 1920 season. The average grade of this material should be close to 60% in iron and with the underground product, which will carry about 58% iron, we should have no trouble in holding our Helmer Grade to the guarantee figures.

One locomotive in the bottom of the pit is able to handle the capacity of our incline tramway and we decided to take the second engine from the pit and place it in service on the stripping job, where it was needed to speed up the work. The open pit face was, therefore, blasted and the model "36" shovel dug a diagonal course across the broken material. The two Lima locomotives pulled the third machine up this incline with the use of a block and tackle.

UNDERGROUND

The main haulage drift, which was over 500' from the Helmer boundary at the beginning of the year, was pushed out under the Helmer pit and holed thereto for the purposes of draining the open pit area, ventilating the Wade Mine and furnishing a second outlet for the underground employees. This drift was completed the early part of June.

Commercial ore was struck in the main haulageway 100' west of the shaft and crosscuts to develop the deposit were run to the north and south from the main drift at intervals of 50'. Nos. 1, 3, 5, 7 and 9 crosscuts were driven to the north shore line and were spaced 100' centers. Crosscuts numbers 2, 4, 6 and 8 were extended to the south foot wall, taking off from the main drift at intervals of 100'. The north and south crosscuts are staggered, that is, No. 2 crosscut to the south is 50' west of No. 1 crosscut going north. No. 3 crosscut is 50' west of No. 2, or 100' west of No. 1.

The Wade main level was laid out with the idea of extracting the bulk of the west deposit underground ore and at the same time running the drifts in ore. We estimate that there are 186,000 tons below this level, the deeper ore occurring to the south of the shaft in the neighborhood of Nos. 2, 4 and 6 crosscuts and to the east of No. 2 crosscut. The north crosscuts of the main drift are all very close to the bottom rock.

Crosscut No. 1 was driven to the north for 130' and one raise, No. 101, run up into lean formation.

No. 3 crosscut was extended 140' to the north shore line and two raises put up to the taconite capping. These raises are 10' and 60' back from the north shore line.

No. 5 crosscut was driven 195' to the north shore line and three raises pushed up to the taconite. The raises are 10', 60' and 110' from the shore line.

No. 7 crosscut cut the north shore line 240' from the main drift and four raises were put up, No. 704 along the north shore line, 703 fifty feet south, 702 one-hundred feet south and 701, one-hundred fifty feet south.

Crosscut No. 9 was extended 245' from the main haulage-way and four raises put up at intervals of 50'. The northerly two raises hit taconite, while those to the south encountered the sand capping.

No. 2 crosscut was extended to the south shore line, 220' from the main haulageway and a drift was pushed to the eastward in the proximity of the shore line for 185'. Three raises were pushed up to the sand capping, 70', 110' and 195' south of the main drift, and two raises put up from the shore line drift, 75' and 125' east of the crosscut.

No. 4 crosscut was pushed south 150' from the main haulageway and one raise put up to the sand capping 50' from the drift. This crosscut is in the track pillar and no mining operations will be conducted from it for some time, with the exception of the deposit to the west of the raise.

Nos. 6 and 8 crosscuts were driven to the south shore line from the main drift, No. 6 progressing 150' and No. 8 130'. One raise was pushed up to the sand capping from each crosscut. The last 50' of material cut in the crosscuts was of very lean

character, containing seams of hard taconite.

The deposit will be mined by the open pit method within approximately 60' of No. 9 crosscut and in consequence No. 9 crosscut marks the western limits of the underground development work. The top of the deposit was found to be more irregular than indicated by the drilling, with the result that the upper subs were considerably less extensive than we had figured. With the exception of the south two raises in each of Nos. 7 and 9 crosscuts, all of the north raises cut the taconite capping, whereas all of the raises from the south crosscuts were pushed up to the sand capping. Unfortunately the high ore was developed last, this being due to the fact that Nos. 8 and 9 crosscuts were the last ones completed. For this reason, it has been necessary to hold up the mining operations from Nos. 3, 5, 6 and 7 crosscuts until the higher ore has been exhausted from Nos. 801, 901, 902 and 903 raises.

We have used 56 lb. steel, purchased with the Helmer Mine, for our main level Wade tracks. This rail has been used for some time on surface, but will last indefinitely with the light service underground. One electric locomotive handles the main level work to good advantage.

The flow of water was increased 200 gallons per minute when the main level drift holed to the Helmer pit bottom. Our Aldrich electrical pump was able to take care of this increase, however. Our normal pumping now amounts to 600 gallons per minute, which is very close to the capacity of the pump. We have a centrifugal of like capacity, which is turned over every day and can be put in service at any time, should we have to shut down the Aldrich for repairs. We also installed in the Wade pumphouse the compound Prescott steam pump from the Helmer drainage shaft. This pump is held as an auxiliary and can be

operated by our steam plant in case our electrical service is interrupted for more than a few hours.

The excavation for our pumphouse had been completed in 1918. This room has been made fireproof by plastering with concrete. Two concrete bulkheads have been placed in the drifts leading from the shaft and main level to the pumphouse and a raise has been put up from the pumphouse connecting with the shaft 40' above. Suction pipes have been carried through the concrete bulkheads and supplied with gate valves on the pumphouse side. The second bulkhead has been supplied with a steel door, which can be closed and bolted in case of flood.

The sump capacity was increased to take care of a three hour flow at 600 gallons per minute. This would give us time to take our underground locomotives out into the pit and make the necessary preparations for pumping with steam. Our dryhouse heating plant is always in use for heating purposes and the two 150 HP boilers could be put in service within a few hours at any time. The fires are always laid under these boilers.

"1390 Foot Sub Level"

From two to three gangs were employed the last eight months of the year in developing and mining the deposit at this elevation from Nos. 201, 202, 203, 204 and 205 raises. The sub is limited to the west by the track pillar and the taconite shore line to the southeast and north. This sub was 110' in length and averaged 90' in width. At the close of the year two contracts, Nos. 15 and 16 were drawing off the small remaining pillars in the vicinity of Nos. 203 and 204 raises.

The sand capping in the vicinity of the shore line was saturated, the only instance that we have found so far in the Wade Mine. Considerable care had to be exercised at all time to avoid sand runs. The floor has been carefully planked and we do not anticipate any further trouble with the sand. The height of the

ore in this sub varied to quite an extent, running up to 14' in the proximity of the shore line in places, whereas to the south of Nos. 204 and 205 raises the ore was mined down to a slice 4' in height.

Drifts were driven between 501 and 701, and 502 and 702 raises and a 40' pillar sliced out. The ground to the northeast of 702 and 703 raises was mined to the north shore line. Development work to the west and south cannot be undertaken until the deposit has been mined down on the 1400' sub. The height of the taconite back averaged 10'. The ore was of fair grade only, and became leaner in the vicinity of the shore line and capping. The ore at this elevation improves decidedly to the south and west and we expect to derive a very satisfactory product when further developments can be undertaken.

"1400 Foot Sub"

Contract No. 15 mined out a small body of ore 110' long and averaging 40' in width between No. 203 raise and the shaft pillar. This ore was of very satisfactory grade and extended to the sand capping. The gang dropped down 10' in their raise the middle of the year and with Nos. 7 and 16 developed and mined the 1390' Sub, as noted above.

Some development work was undertaken at this elevation from Nos. 902 and 903 raises, but due to the fact that the ore was found to extend to too great a height, it was necessary to do some mining from a higher elevation and work here was suspended, pending a completion of operations on the 1410' and 1420' subs. A room 90' in length and averaging 50' in width was mined out under the taconite capping to the east of Nos. 902 and 903 raises before operations were suspended. The ore mined here averaged only 56% in iron, but the grade improves to the south and west and we will obtain some high grade material from this territory.

WADE MINE.

"1410 Foot Sub Level"

Development work at this elevation is now being pushed, six gangs being employed. The deposit between No. 601 raise and the track pillar has been exhausted and Nos. 2, 4 and 7 are engaged in developing the ground to the west. The development of this area has been retarded on account of mining activities on the 1420' Sub above. The deposit on the 1420' Sub is rapidly being drawn back to 801 and No. 10 raises. Crosscuts will be driven to the north and south at intervals of 25' and step slicing started. Contract No. 4 has encountered the south shore line and has started to slice the 25' pillar along the old caves. Contract No. 7 has started slicing the 25' pillar along the north shore line, while No. 2 is outlining a second 25' pillar to the west of No. 4. No. 2's drift should extend to the Oliver Iron Mining Company's boundary and step slicing started to the south of and behind No. 4.

Contract No. 5 is developing the ground to the west of No. 7 from No. 901 raise. Step slicing will be started here shortly and the ground drawn back to the north.

Contract No. 10 is slicing out the deposit along the open pit limits to the northwest of No. 901 raise, while No. 11 is gouging out a body of lean ore along the taconite wall to the east of this raise.

As the pillars are exhausted on the 1420' Sub, the gangs will be moved down to this elevation and development work pushed.

The average grade of ore being mined on the 1410' Sub is most satisfactory, all gangs, but No. 11, being in material that averages 58% iron, or better.

"1420 Foot Sub Level"

Development work at this elevation was accomplished from Nos. 801, 901, 902 and No. 10 raises. Aside from a small

deposit to the East of 902 raise, 50' x 35', which is isolated and resulted from a roll in the formation, the development work was extended from the shore line to the north of Nos. 10 and 801 raises to the Oliver Iron Mining Company's boundary on the south and the proposed open pit limits on the west.

A force of from 4 to 8 gangs has been employed here during the latter half of the year. On January 1st. the deposit had been caved back from the Oliver line and from the north and east shore lines to the proximity of the dumping raises. It is advisable to exhaust the pillars on this sub as rapidly as possible and the gangs are working as close as it is safe. Operations on this sub should be completed by the first of April and development work on the 1410' Sub pushed well on toward completion.

The ore mined on the 1420' sub has averaged close to 59% in iron, but owing to the irregularity in the formation, the height of the drifts have varied from 5' in the vicinity of the shore line to 15' in the neighborhood of the Oliver line and the open pit limits. On account of the cemented condition of the sand capping, the rooms have not come in as we would have desired and slicing operations have been retarded somewhat in consequence. All the large rooms have now been filled and we do not anticipate any difficulty on this score while drawing off the remaining pillars.

At the end of the year Nos. 6 and 14 were engaged in slicing back the pillars from the Oliver line, No. 11 was slicing and robbing to the north of No. 801 raise and No. 9 was attacking the pillar to the south of No. 10 raise.

ANALYSIS OF COST SHEET

The Wade Mine cost sheet for 1918 was based on a production of 67,577 tons of open pit ore, the 3,537 tons taken from the shaft was extracted before the mine was put on an operating basis, and in consequence was not taken into consideration in the cost sheet figures. During 1919 156,521 tons were taken from the open pit and 76,934 tons were hoisted at the shaft. A separate cost sheet was made out for each operation in 1919.

As there was no cost sheet for the 1918 shaft ore, we will be able to analyze only the costs between the open pit operations for the past two years.

The charges per ton against the several main captions, making up the production costs at the Wade Mine for the years 1918 and 1919, follow:

	<u>1 9 1 9.</u>	<u>1 9 1 8.</u>
	<u>SHAFT</u>	<u>OPEN PIT</u>
Tonnage-----	76,934	156,521
General Expense---	\$.197	\$.024
Maintenance-----	.302	.012
Mining Expense----	<u>2.370</u>	<u>.813</u>
TOTAL-----	\$2.869	\$.882

The following cost analysis is made between the open pit ore produced from operations during 1918 and 1919:

GENERAL EXPENSE

The total charges under this caption were approximately the same for the two years considered, the item "Analysis" being \$.002 lower for 1919 and "Mine Office" \$.003 higher.

The 1919 decrease in "Analysis" was due to the smaller cost per ton for sampling and more than offset the increased rate per determination paid Lerch Brothers. The larger 1919 production

made this possible.

The 1919 increase of \$.003 for "Mine Office" was caused by an increase in the force and the higher wages prevailing.

MAINTENANCE

The necessary work of putting the 7-yard cars and tracks in shape for operation along the Wade open pit bank in 1918 amounted to \$.035 per ton, whereas the 1919 charges against this account were very nominal. The charges to all of the other accounts under this caption were very small during the two years in question and the decrease of \$.036 for 1919 is explained by the charge against "Tracks & Cars", as noted above for 1918.

MINING EXPENSE

While the total charges under this caption for the two years considered was approximately the same, the analysis of the cost sheet shows a large decrease in 1919 for some of the items and a corresponding increase in others. The several items showing an appreciable variation in cost and the reasons therefore are as follows:

There was a decrease of \$.014 for "Hoisting" during 1919, which was due to the larger tonnage handled.

Under "Pumping" the charge for 1919 was \$.035 per ton less than during 1918. This is explained by the fact that the pit water was drained to the Wade shaft and pumped electrically during 1919, whereas in 1918 the pit drainage was handled by the steam equipment at the Helmer shaft. The long steam line between the Helmer boiler house and shaft pumps made the operation quite expensive.

There was a decrease of \$.247 per ton in the 1919 item "Breaking Ore", as compared to the previous year. This was the

Wade Mine
result of our having a more extensive ore bank to work on during 1919 and being able to blast with deep gopher holes to advantage. The blasting gang was smaller during 1919 and we were able to drill with air, whereas all holes were put in by hand during 1918.

The decrease of \$.074 per ton for "Tramming" in 1919 was due to the fact that the tonnage handled was considerably larger and the haulage track system was worked out to better advantage, whereas we were quite cramped in our operations during 1918.

Under the item "Captain & Bosses" the 1919 decrease of \$.012 per ton is explained by the larger product handled.

The "Stripping" account for 1919 shows an increase of \$.408 per ton over that for 1918. In 1918 it was necessary to do comparatively little cleaning along the Wade ore berm, which had been stripped by the former Helmer operators. The stripping depreciation per ton of 1918 ore was, therefore, comparatively low, even with the smaller tonnage involved. During 1919 we carried on a rather extensive stripping program, developing permanent switch backs and taking our top cuts some distance ahead of ore activities. A stripping depreciation charge of 65¢ per ton for our 1919 production was decided upon. The cost per yard for stripping was rather excessive last Winter, due to the heavy frost and the necessity of digging shallow cuts. The 65¢ depreciation factor applies to the ore uncovered by our stripping to the end of 1919.

There was a charge of \$.012 for "Rental of Equipment" in 1919, whereas there was no charge against this item during 1918.

WADE MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1919.

GRADE	IRON	PHOS.	SILICA	MANG.
Wade,	57.99	.076	6.58	1.14
Wade Pit,	59.70	.064	6.27	.78

(Cargoes all Mixed).

ORE STATEMENT AND SHIPMENTS FOR YEAR 1919.

	WADE	TOTAL LAST YEAR
On hand January 1st, 1919,	3,537	
Output for year,	233,455	71,114
Total,	236,992	71,114
Shipments,	211,888	67,577
Balance on hand,	25,104	3,537
Increase in output-228%	162,341	
Increase in shipments-213%	144,311	
Increase balance on hand,	21,567	

1919 - 3-8 Hour Shifts - Jan 1st to May 1st
2-10 " " May 1st to Nov. 1st
1-10 " " Nov. 1st to Dec. 31st
1918 - 2-10 " " Apr. 15th to Nov. 1st
3-8 " " Nov. 1st to Dec. 31st

WADE MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 9.	1 9 1 8.	INCREASE.	DECREASE.
PRODUCT	76,934	67,577	9,357	
General Expense	.197	.023	.174	
Maintenance	.302	.048	.254	
Mining Expense	2.370	.811	1.559	
Cost of Production	2.869	.882	1.987	
Exploratory	.597		.597	
DEPRECIATION.				
Construction	.142	.150		.008
Total Depreciation	.142	.150		.008
Taxes	.175	.110	.065	
Central Office	.029	.020	.009	
Miscellaneous	.003	-	.003	
Cost on Stockpile	1.491	1.162	.329	
Includes Open Pit				
Loading & Shipping	.611	.010	.601	
Total on Cars	2.102	1.172	.930	
Including Open Pit				
No. Days Operating	209	44	165	
No. Shifts and Hours	2-8hr	2-10hr		
Avg. Daily Product	368	1536		1168
<u>COST OF PRODUCTION.</u>				
Labor	1.963	.429	1.534	
Supplies	.906	.453	.453	
Total	2.869	.882	1.987	

Product from Open Pit during 1919 - 156,521
 Mine leased in 1918.

Comparison of Product:	1919.	1918.
From Pit	156,521	67,577
From Mine	<u>76,934</u>	<u>0</u>
Total	233,455	67,577

WADE MINE.

COMPARATIVE WAGES AND PRODUCT.

	1919.	1918.	INCREASE.	DECREASE.
PRODUCT No. Hours and Shifts	76,934 2-8hr	67,577 2-10 hr.	See table	below.
AVERAGE NUMBER MEN WORKING				
Surface	18	17	1	
Underground	56½	61		4½
Total	74½	78		3½
AVERAGE WAGES PER DAY				
Surface	5.75	5.50	.25	
Underground	6.47	6.49		.02
Total	6.28	6.28	-	
WAGES PER MONTH OF 25 DAYS				
Surface	143.75	137.50	5.25	
Underground	161.75	162.25		.50
Total	157.00	157.00	-	
PRODUCT PER MAN PER DAY				
Surface	11.93	66.11		54.18
Underground	4.33	18.57		14.24
Total	3.18	14.50		
LABOR COST PER TON				
Surface	.482	.083	.399	
Underground	1.495	.350	1.145	
Total	1.977	.433	.544	
(a)AVG.PRODUCT BRK'G & TRM'G	15.35	-		
" " WAGES CONTRACT MINERS	Co.acct.	-		
" " " " TRAMMERS	"	-		
" " " " LABOR	"	-		
TOTAL NUMBER OF DAYS				
Surface	6,448	1,022½	5,425½	
Underground	17,769	3,638½	14,130½	
Total	24,217	4,661	19,556	
AMOUNT FOR LABOR				
Surface	37081.69	5,621.32	31460.37	
Underground	115048.04	23639.49	91408.55	
Total	152129.73	29260.81	122969.92	

Proportion Surface to Underground Men:

1919 - 1 to 3.14

1918 - 1 to 3.59

Division of Product;

	1919.	1918.
Open Pit	156,521	67,577
Underground	76,934	0
Total	233,455	67,577

(a) Figured on combined pit and underground; balance figured on underground only.

WADE MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1919.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1 9 1 9.
8" to 10" Timber	56,159	.0810	4553.99
10" to 12" "	39,929	.0800	3206.77
Total - 1919	96,088	.0807	7760.76
	LINEAL FEET.	PER 100'.	
6' Lagging	320,280	.779	2495.18
Poles	10,665	5.39	575.00
Total - 1919	330,945	.0099	3070.18
Product			76,934
Ft. Timber per ton of ore			1.248
Ft. Lagging "			4,163
Ft. Lagging per Ft. of Timber			3.333
Cost per ton for Timber			.1008
" Lagging			.0324
" Poles			.0074
" Timber, Lagging & Poles			.14
Equivalent of stull timber to Bd. Measure			154,062
Ft. Bd. Measure per ton of ore			2.002
Total Cost for Timber, Lagging & Poles - 1919			10830.94

Production Wade Shaft - 76,934
 " Pit - 156,521
 Total 233,455

NOTE: Only the production for Wade Shaft was used, account no timber is used in Pit production.

WADE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICE.	AMOUNT 1 9 1 9.	AMOUNT 1 9 1 8.
30% Powder	47,100	.17164	8184.60	
40% "	16,230	.17231	2796.66	
Black " (Cans)	1,184	2.113	2501.70	
Total Powder			13482.96	
Fuse	139,900	8.656	1211.08	
Caps	40,500	14.278	578.26	
Cap Crimpers	19	.48	9.14	
Conn. Wire	8	.33	2.67	
Electric Exploders	2,500	7.34	183.51	
Total Fuse, Etc.			1984.66	
Total Explosives			15467.62	
Product			233,455	
Pounds Powder per ton of Ore			.271	
Cost per ton for Powder			.0577	
" " Fuse, Etc.			.0085	
" " All Explosives			.0662	
Avg. Price per Lb. for Powder			.173	

ANNUAL REPORT FOR THE YEAR ENDING DECEMBER 31st, 1919.

Ishpeming, Michigan,

March 11th, 1920.

ENGINEERING DEPARTMENT.

Mr. M. M. Duncan, Vice Pres. & Gen. Mgr.,

Building.

Dear Sir:-

The following report of the Engineering Department is herewith handed to you. The photographic maps and views which form part of this report have been bound and the books labeled as follows:

LIST OF ANNUAL REPORT MAP BOOKS FOR 1919.

Cleveland-Cliffs Iron Company.
Ishpeming and North Lake Districts.

Cleveland-Cliffs Iron Company.
Negaunee, Iron River & Republic Districts,
& Hydro Electric System.

Cleveland-Cliffs Iron Company.
Mesabi District.

Cleveland-Cliffs Iron Company.
Gwinn District.

These books contain the maps of the Company's mines; two sets of them have been prepared, one for the Cleveland Office which is handed to you and the other which is to be kept in the vault in this office.

A special book has been prepared for the Lackawanna Steel Company containing the photographs and maps of the Negaunee Mine. This also is handed to you.

Two books have been made of the mine maps of the Wade, Boeing, Hill and Trumbell Mines for the Great Northern Ry. Company's Office as requested.

For the Negaunee Mine Fee Owners, fourteen copies have been made of the four main levels of that mine and will be sent to Mr. C. D. Mason as in previous years.

A special book of the Wade-Helmer Mine maps has been made for the Struthers Furnace Company. This is handed to you.

Special books have been made for the superintendents which give them copies of the mine maps in their different districts.

On April 1st, Mr. Carl Brewer, who had been the Chief Assistant Engineer in this office, left for Hibbing to take the position as Superintendent of the Boeing Mine. Mr. R. J. Chenneour was appointed to take Mr. Brewer's place. He has written the following pages covering the report on the force employed in the Engineering office.

Following the above, I have added a few remarks on the Abstract Department and various subjects.

Yours truly,

JEJ:MER.

J. E. Jopling
Chief Engineer.

REPORT OF THE ENGINEERING FORCE EMPLOYED DURING THE
1919, AND A BRIEF OUTLINE OF THEIR WORK.

BY REGINALD J. CHENNEOUR, ASSISTANT ENGINEER.

THE FORCE.

There has been a considerable change in the department during the year. The following men were added:

Aleck Ham, draftsman and helper,
Frederick Olson, helper.

Additional men for summer field work only:

C. Nicholls, helper,
C. Feller, axeman,
A. LeFave, axeman,

The following men left the department during the year:

John Heilala, helper and engineer,
Clelland Nicholls, helper,
Charles Feller, axeman,
Albert LeFave, axeman.

Mr. J.E.Hayden returned to this office from overseas on Aug. 1st.
Mr. T.A.Miller returned to this office from training camp Feb. 1st.

The following table shows the personnel of the department during the year, arranged in order of entrance:

N A M E	POSITION	ENTERED	LEFT	SUBSEQUENT POSITION
C. Brewer	Asst. Eng.	3 mos.	April 1	Sypt. Boeing Mine
R.J.Chenneour	Engineer	3 "	April	Asst. Engineer.
	Asst. Eng.	April 1		
H.O.Moulton	Engineer	Entire year		
J.E.Hayden	"	"	Aug. 1	
J.K.Osborne	"	Entire year		
A. Rock	Helper	"		
J. Trosvig	Engineer	"		
T.A.Miller	"	Feb. 1		
J.J.Heilala	Helper		Nov. 1	Doing timber job- bing at Champion, Mich.
S.Malmgren	Helper	Entire year		
W.F.H.Janzen	Engineer	"		
A.Alanen	Draftsman	"	Sept. 13	Illinois University
A.Minnear	Helper	"		
K.C.Pellow	Engineer	"		
P.Denn	Chauffeur	Mar. 22nd	Dec. 3	Geological Dept.
C.Nicholls	Helper	June 18th	Oct. 1	Mich. Agric.College
Aleck Ham	Draftsman	May 7th		
Chas. Feller	Chopper	May 1st	July 21	Cliffs Shaft surface.
Al LeFave	"	June 2nd	July 9	
Fritz Olson	Helper	Nov. 3rd		

All men in the department, with the exception of Sextus Malmgren, Charles Feller and Albert LeFave, were on a salary basis.

The following table shows days worked, days sick, percentage of days worked, etc., for all those on a salary basis. The "vacation" column, shows time granted for regular vacations. All other time lost, other than sickness is included in "absent" column. Eight hours constitute a day. There was no work Saturday afternoons during the year. Where the "vacation" column shows over fifteen days, it is usually due to the fact that there was no vacation taken for the year previous.

N A M E	DAYS WORKED	DAYS VACA-TION	DAYS ABSENT	DAYS SICK	TOTAL DAYS	PERCENTAGE DAYS WORKED
C. Brewer	57		3	9	69	82.60
R. J. Chenneour	276½		2½		277	99.98
H. O. Moulton	246½	21	6	5	277	89.00
J. K. Osborne	252½	22½	1½	1	277	91.20
J. E. Hayden	102				93	109.68
A. Rock	270½		4½	2½	277	97.65
J. Trosvig	272		6½	1½	277	98.20
T. A. Miller	235½	16½	2	1½	253	93.90
J. J. Heilala	221½	5½	4	1½	232	95.47
W.F.H. Janzen	251	22½	2	3½	277	90.61
A. Alanen	184	5½	4	1½	195	94.36
A. Minnear	260½	9		8½	277	94.40
K. C. Pellow	248½	8½	4½	15½	277	89.71
P. Denn	198½	6½		2	207	95.90
C. Nicholls	78½		½		79	99.36
C.S. Stevenson	8				8	100.00
Alex Ham	181½		1		184½	98.38
F. A. Olson	44½				44½	100.00

The following table shows the number of working days lost because of sickness or absence by men in the department during the last five years:

	1915		1916		1917		1918		1919	
	VACA-TION	SICK	VACA-TION	SICK	VACA-TION	SICK	VACA-TION	SICK	VACA-TION	SICK
C. Brewer			0	0	1½	0	14	0	3	9
R. J. Chenneour	15	2½	2½	2	26½	½	12	0	2½	
H. O. Moulton	0	0	0	1	23½	0	1	1	27	5
J. E. Hayden									0	0
J. K. Osborne	1½	2	0	4½	0	15	12½	½	24	1
A. Rock	12	6½	12	1	20	6	14	0	4½	2½
J. Trosvig	0	0	0	0	6	0	11	10	6½	1½
T. A. Miller									18½	1½
J. J. Heilala					16	8½	8½	3	9½	1½
W.F.H. Janzen					0	0	0	5½	24½	3½
A. Alanen					5½	0	2½	5½	9½	1½
A. Minnear					1	0	0	4	9	8½
K. C. Pellow							6	4	13	15½
Alex Ham									1	2½
P. Denn							1	0	6½	2
Fritz Olson									0	0

The following table gives the names of men employed in the department during the last five years, arranged in order of entrance, showing the months worked and the average number employed per month, excluding unskilled men, such as choppers, etc.:

	<u>1 9 1 5</u>	<u>1 9 1 6</u>	<u>1 9 1 7</u>	<u>1 9 1 8</u>	<u>1 9 1 9</u>
C. J. Stakel	12	4			
C. Brewer		8	12	12	3
J. F. Hanst	12	12	3		
R. J. Chenneour	12	12	12	12	12
H. O. Moulton	12	12	12	12	12
J.K.Osborne	12	12	12	12	12
A. Rock	12	12	12	12	12
F. G. Rockwell	8				
J. Trosvig	1	12	12	12	12
E. L. Derby	12	8			
M. F. LaCroix	1				
J. E. Hayden	12	12	4½		
T. A. Miller		11½	12	2½	11
J. J. Heilala		11	12	12	10
S. Malmgren		8	12	12	12
C. W. Nicolson		6	4½		
C. S. Stevenson			7½		
W.F.H.Janzen			9½	12	12
C. Nichols			6	4	3½
A. Alanen			8	12	8½
A. Minnear			6½	12	12
M. C. Connolly			3½	3½	
K. C. Pellow				12	12
P. Denn				9	8
F. Christian				3	
Shu Choe				3½	
Alex Ham					8
Frederick Olson					2
Avg. number of men	11 7/12	8 5/6	13 5/12	14 1/8	13 1/2

Work performed by each man in the department is described as follows:

CARL BREWER, for the first three months of the year, had charge of the office as assistant engineer, during which time he made the annual report for 1918, and cleaned up various work which was incomplete. April 1st he left for the Boeing Mine at Hibbing, Minnesota.

REGINALD J. CHENNEOUR was in charge of the engineering department at the Negaunee and South Jackson Mines for the first three months. At the Negaunee Mine he kept up the underground surveys and geology, and made recommendations for development work after studying the geological

conditions from the cross sections and maps; designed pumphouse, sump and clean-out scheme with the superintendent's approval, and superintended the cutting and concreting of the same. At the South Jackson Mine he made a complete estimate of ore of various grades from drill hole data, etc.

Beginning April 1st as assistant engineer, he did the following: Under his direction the third and fourth levels Holmes Mine were plumbed; checked position and markings on all land corners on the Republic Transmission Line; set concrete-iron pins to preserve Dead River surveys; directed work on surveys for Section 15, Township 47 North, Range 27 West, contours; directed plumbing and checked plumbing Barnes-Hecker Mine, first, second and third levels. Visited all mines with engineers and checked over their work from time to time, directed office work and ordered supplies, etc.

HENRY O. MOULTON, for the first three months of the year, looked after the engineering work at the Maas Mine. The remainder of the year he took care of the engineering work at the Negaunee Mine. He also had supervision of the engineering work at the Maas Mine. His work at the Negaunee Mine consisted mainly of watching development work; taking and posting geology and locating possible ore areas under the hanging-wall, with the aid of geological cross-sections. He made weekly surveys and gave lines in drifts and raises as needed. The development on the 11th level took considerable of his time. He also took care of the engineering work at the South Jackson Mine during the summer. He worked up an analysis map at the South Jackson in order to maintain a uniform grade in the steam shovel cuts.

J. ELZEY HAYDEN returned from over-seas in July. In August he was put in charge of construction work in connection with concrete shaft-houses at Cliffs Shaft Mine for the balance of the year.

J. K. OSBORNE has taken care of the engineering at the Cliffs Shaft and Holmes Mines. At the Cliffs Shaft Mine, made the monthly sur-

veys, located diamond drill holes, and gave lines in various places as needed. At the Holmes Mine, he made the monthly surveys, watched the workings along the boundaries for trespasses, and assisted the geological department in keeping the geology posted. The development of the third and fourth levels and pumphouse lay-out took considerable of his time. He also made specific gravity tests of all carbon purchased during the year.

ALBERT ROCK, a helper, assisted in underground and surface surveys at all the mines at various times during the year. He was foresight man on the Section 15, T. 47 N., R. 27 W., surveys. In the office he made all the annual report blueprints, and did regular mine blueprinting, etc., at other times.

JOHN TROSVIG did the engineering work in the North Lake District. At the Barnes-Hecker Mine he made bi-weekly shaft sinking reports and lined in shaft sets. When shaft sinking was finished he gave lines for level plats, drifts, and pumphouse lay-out. The construction work at this mine, both surface and underground, has required much of his attention. At the Lloyd Mine, he made the monthly surveys, located drill holes and gave lines where needed. At the Morris Mine, he made monthly surveys and gave lines for drifting and raising, and located drill holes as required. He assisted the geological department in geologizing sub-levels.

TOM A. MILLER returned from training camp in February. During February and March, he worked on the Dead River Storage Basin tables, showing capacity of various elevations. Beginning April 1st he had charge of the engineering work at the Maas Mine. At the Maas Mine he made weekly surveys, geologized sub-levels and posted same on the maps; watched work along boundary lines; checked limits of mining above the fourth level, and gave lines for raises and drifts as needed. He also ran part of the survey lines and did most of the levelling preparatory to contouring Section 15, T. 47 N., R. 27 W. During the months of November

and December he did the engineering work required at the Salisbury Mine.

JOHN J. HEILALA took care of the underground surveying and mapping at the Salisbury Mine. He also assisted on surveys at all mines during the year. In the office he has helped with survey calculations and the plotting of field notes, etc. He left our employ in November to do timber jobbing.

SEXTUS MALMGREN has been employed as helper all the year. He assisted with the mine surveys at all mines. In the office he made blueprints, repaired tapes, etc.

WILLIAM F. H. JANZEN did the engineering work at the Athens and Angeline mines all the year, and part of the year at the Lake Mine. At the Athens Mine he made weekly surveys, gave lines in drifts and raises as required, and assisted geological department in geologizing sub-levels. Under Mr. Jackson's direction he made drawings of a proposed sixth level, and a proposed extension of the fourth level. Most of the work at the Athens Mine is of a development nature, and as a consequence, required much engineering. Most of his time was spent at the Athens. At the Angeline and Lake mines he made the monthly surveys. He did very little at the Angeline and Lake, other than making the above surveys.

K. C. PELLOW did the engineering work at the Republic Mine all the year; at the Spies Mine until June, when the mine was closed, and at the Lake Mine part of the year. At the Republic Mine he made monthly surveys, gave lines for shafting sinking and new levels, and made survey for grading at the new stockpile grounds. At the Spies and Lake mines he made monthly surveys. He also ran considerable of the survey lines in connection with Section 15, T. 47 N., R. 27 W., contours.

CLELLAND NICHOLLS was employed during the summer on field work in connection with Section 15, T. 47 N., R. 27 W. contours, and Dead River Water Power.

PETER DENN was the chauffeur for the department during the season and kept cars in repair. Part of his time was spent in collecting

core from the diamond drills for the geological department.

ARVID ALANEN was employed as draftsman, spending most of his time in connection with the Dead River maps. He also assisted engineers in making tracings, etc. He left our employ in September to enter the Mechanical Department of the University of Illinois.

ARCHIE MINNEAR, a helper and surveyor, assisted the engineers in the Negaunee district. He also made many minor surveys and gave lines from time to time. In the office he made tracings, etc.

ALECK HAM was employed as helper and draftsman. His principal work was in connection with surface surveys.

FREDERICK A. OLSON was employed in November as a helper, assisting at various mines. In the office he made blueprints, tracings, etc.

CHARLES FELLER and ALBERT LEFAVE were employed part of the summer as axemen, chopping lines on Section 15, T. 47 N., R. 27 W. Charles Feller also brushed out old survey lines on Sections 4 and 5, in T. 47 N., R. 27 W.

OFFICES EXPENSES.

On the next page is a comparative statement of office expenses for three years.

	1917	1918	1919
Travelling expenses and livery,	\$ 553.89	\$ 492.61	\$428.26
Supplies, (see below)	4,146.79	3,149.34	3,364.89
Operating automobiles,	931.37	1,548.54	1,589.65
Office Expenses	230.73	17.76	27.11
Insurance	22.08	22.08	22.08
Taxes,	37.53	34.29	41.07
T o t a l ,	\$5,922.36	\$5,264.62	\$5,473.06
Total Salaries, General Off- ice Engineers,	21,443.89	24,866.53	* 27,346.77
Total Office Expenses, as above,	5,922.36	5,264.62	5,473.00
Total charges to Mining Dept.	\$27,366.25	30,131.15	\$32,819.83
* (Does not include salary of Chief Mining Engineer and stenographer.)			

The following table shows the detail of extraordinary charges included in "Supplies", year, 1919:

Annual report negatives	\$ 425.90
1 No. 6-D mining transit (C.L.Berger & Sons)	381.45
14 annual map books	52.00
149 sheets mounted drawing paper, assorted sizes, 2/3 proportion	183.33
Repairs to transit	43.33
8 spools, 2600 ft. each #10 music wire, 2/3 proportion	40.53
4 steel tapes (Lufkin Rule Co.) 2/3 proportion	48.79
1 plat book of Northern Michigan, 2/3 proportion	33.33
12 Chicago plumb bobs,	29.65
1 cupboard (built at General Shops)	45.42
Tracing-cloth, blue-print paper, etc.	682.77

AUTOMOBILES:

Ford touring car and truck were put into operation March 26th, and ran continuously until December 1st, when they were stored for the winter. Horses were used for the balance of the year. During the time that autos can be used much more work can be done at the mines in that time spent going and coming from the mines is greatly reduced. This gives us a chance to pick up odds and ends on surface. In September a touring car, and in December a new truck, were purchased. The old car and old truck being turned in for credit. The new truck was not used being purchased at the end of the season.

On the next page is a comparative statement of livery and team expense for three years:

Engineering Department.

	1 9 1 7	1 9 1 8	1 9 1 9
Company horses	\$ 436.94	\$ 353.72	\$ 409.66
Company automobiles			
Salaries	220.05	453.75	507.57
Expenses	711.32	1,094.79	1,082.08
Livery hire	11.00	6.00	
Auto hire	21.00	54.00	
T o t a l ,	\$1,400.31	\$1,962.26	\$1,999.31

The operating cost of the automobiles is as follows:

Chauffeur's salary	\$211.69	\$453.75	\$507.57
Gasoline, oil, etc.	154.35	262.53	239.46
Tires and tools,	159.69	208.72	193.68
Repairs	76.22	231.86	263.98
Miscellaneous,	22.16	231.67	40.52
Insurance			123.36
Depreciation	164.48	160.01	221.08
Building garage	143.08		
T o t a l ,	931.37	1,548.54	1,589.65

DISTRIBUTION OF TIME:

The next table shows the distribution of time at the various properties for three years.

ENGINEERING DEPARTMENT.
DISTRIBUTION OF ENGINEERING LABOR FOR YEARS 1917, 1918 AND 1919.

	1 9 1 7			1 9 1 8			1 9 1 9			PER CENT INCREASE	PER CENT DECREASE		
	LABOR	TIME IN DAYS	PER CENT	LABOR	TIME IN DAYS	PER CENT	LABOR	TIME IN DAYS	PER CENT				
Angeline, Athens,) Bunker Hill,) Barnes-Hecker, Boston, Boeing, Cliffs Shaft, Crosby, Francis, Gwinn, Great Northern Properties, Helmer, Hill-Trumbull, Holmes, Jopling, Lake, Lloyd, Mackinaw-Gardner, Maas, Meadow & Fowler, Morris, Negaunee, Princeton, Republic, Salisbury, South Jackson, Spies, Wade,	\$693.48 2268.47 402.16 81.14 2360.40 1269.67 1218.29 With Morris 2686.28 2676.82 3006.94 810.80 734.80 387.78 367.54	125½ 309½ 82½ 115 385 212 220½ 346½ 382½ 227½ 460½ 172½ 134½ 61 72½	3.04 7.50 2.00 2.79 7.34 5.14 5.33 8.40 9.28 5.51 11.17 4.18 3.26 1.48 1.74	\$422.79 2532.44 755.67 124.42 1899.87 1504.49 998.79 1080.70 2662.04 829.09 3174.56 1086.74 796.94 352.11 459.07	53 336 128½ 16 273½ 21½ 161 206 344 135 393 179 160 34 219	1.30 8.38 3.27 .40 6.82 5.30 4.02 5.14 8.58 3.37 9.83 4.46 4.00 .85 5.46	\$697.75 3126.57 1393.68 2469.66 35.56 18.13 21.64 7.91 6.92 64.97 2183.97 13.60 1089.14 815.49 18.12 2655.96 27.18 1174.76 3976.41 22.66 1638.91 1060.03 511.82 240.88 42.70	84½ 393½ 216½ 342½ 4½ 2 2½ 2 1½ 17 292½ 1½ 129 115¾ 2 342¾ 3½ 167½ 493½ 2½ 232½ 179 57½ 32½ 5	2.26 10.53 5.78 9.16 .12 .05 .07 .05 .04 .46 7.82 .04 3.45 3.09 .05 9.19 .09 4.48 13.20 .07 6.21 4.79 1.54 .88 .14	.96 2.15 2.51 2.34 .12 .05 .07 .05 .04 .46 2.52 .04 .57 2.05 .05 .61 .09 1.11 3.37 .07 1.75 .79 .69 4.58 .14			
TOTAL MINES, WATER POWER.				18679.44	2850½	71.18	23379.59	3130¾	83.72				
Au Train, Carp River, Dead River Storage, McClure Plant, Dead River, MISCELLANEOUS. Carbon & Drill, inventory, Ishpeming Hospital, Mesaba Range, Drill Locations, Sampling Isabella, Mine, Sec. 15 surveys for contours, Republic Transmis- sion Line, E&A 379 Cliffs Shaft, Miscellaneous,	45.08 1798.38 64.69 691.81	6½ 528 15 9 6½ 78½	.16 12.80 .36 .22 .16 1.89	114.90 138.32 4619.43 1058.20 80.81 48.34 127.09 6187.09	26 45½ 864½ 145 14½ 38 25½	.65 1.14 21.52 3.62 .36 .95 .58	21.23 248.74 606.07 59.38 904.86 68.46 1254.23 408.47	5½ 41 80½ 7 6½ 31 37¼ 79	.15 1.10 2.15 .19 .17 5.09 .19 3.30 2.11	.19 5.09 .19 3.30 2.11	.65 .99 20.42 1.47 16.28	.65 .99 20.42 1.47 16.28	
Total other than mines,				6187.09	1157	28.82	3967.18	608½	16.28				
GRAND TOTAL	21443.89	4132	100.00	24866.53	4007½	100.00	27346.77	3739	100.00				

M I N E S .

ANGELINE MINE.

Monthly surveys were made each month. There was no special work. Mining in the pits is completed. Sub-levels under the east-end were opened, and in the west-end the old 7th level was re-opened.

ATHENS AND BUNKER HILL MINES:

Work at the Athens was practically all development and exploratory. A number of raises were put up from various levels, and eighteen sub-levels partially developed to outline the ore-body. This work required constant surveying. Geology had to be noted and mapped every few days. Unusual geological conditions were reported to Geological Department and verified by them. Analysis maps of main levels were prepared and kept up to date. Monthly report blueprints were furnished the Cleveland office each month. No division has been made of the charges for Athens and Bunker Hill mines.

BARNES-HECKER MINE.

During the sinking and concreting of the shaft, all shaftsets were lined in and bi-weekly reports of sinking and concreting progress submitted to the superintendent. Elevations and lines were given for level plats. First, second and third levels were plumbed three times, plumbings checking very closely. On the surface, lines and elevations were given for concrete piers for one-leg stocking trestle. Rock trestle and buildings required some survey work.

CLIFFS SHAFT MINE.

The monthly surveys were made and lines given from time to time. Drill holes were located as required.

Surface: The plan and elevation of wooden shaft houses was made in connection with new concrete shaft-houses. These concrete shaft-houses were practically completed at the end of the year, an engineer being on this job the entire time.

Additional stocking grounds were staked out.

HOLMES MINE.

Monthly surveys were made. All workings in Section 16 mine were watched and surveyed for possible trespasses. A number of small trespasses were found and noted on the maps. Lines were given for drifting and raising as required. Shaft sinking was completed, and third and fourth levels started. These levels were plumbed and lines given for level plats and pumphouse lay-out. Shaft sets were lined in as shaft sinking progressed. On the surface, cracks caused by Section 16 workings were surveyed and mapped. Elevations were taken on iron pins, which were established to check surface subsidence.

LAKE MINE.

There is nothing unusual to report. Monthly surveys were made and development work surveyed as it progressed.

MAAS MINE.

Weekly surveys were made and lines given for raises, drifts and drill holes. Working places above the fourth level, where mining limits are complex, had to be watched constantly. Workings along the Negaunee Mine boundary required attention. The engineers at the Maas and Negaunee mines checking through from mine to mine as mining progressed. All areas directly under the hanging-wall were given close attention for probable ore extensions. Geology was kept up and mapped. Some main level sampling was done.

On the surface an extension to the enginehouse was staked out. Lines for foundations for a new skip and cage hoist were also given.

MORRIS MINE:

Monthly surveys were made, drill holes located and lines given for raises and drifts as were needed. Shaft was sunk from the 6th level to the 7th level. All shaft sets were lined in. Sub-level geology was kept up.

NEGAUNEE MINE.

Weekly surveys were made and lines given for all cross-cuts,

drifts and raises. Drifting and raising on the 11th level required a large part of the engineer's time. Lines were given for pumphouse lay-out, and the cutting and concreting of same supervised. Work in No. 2 shaft pillar had to be watched very closely as old rooms and stopes were frequently encountered, of which there were no maps. Workings along the Maas-Negaunee boundary was watched. Surveys being run from one mine to the other. Geology was taken and posted on the maps. Areas directly under hanging-wall were given close attention for probable ore extensions.

On the surface an addition to the enginehouse was staked out, and lines given for a new compressor foundation.

REPUBLIC MINE.

Monthly surveys were made and lines given for drifting. At the winze on the 2070 ft. level, No. 9 shaft, an excavation was made and lines given for hoist foundation. Winze was sunk an additional 100 ft. from the 2170 ft. level to the 2270 ft. level, and lines given as work progressed. Pascoe shaft was sunk from the 2270 ft. to the 2370 ft. level, and from the 2370 ft. level 100 ft. below. This shaft was started from the 2270 and then sunk to the 2370 ft. level and from here a pentice was left and sinking continued below. Lines in the shaft were given and continually checked.

On the surface a new stocking ground was staked out, graded, and estimate of cut and fill made. Lines and heights for bents were given. Foundations and hoisting equipment were put in in No. 9 shaft engine-house. Drawings were prepared for No. 9 shaft screening plant, under supervision of Mechanical Department.

SALISBURY MINE.

Monthly surveys were made and lines given to sink a winze from the 14th level south deposit to the proposed 15th level. After reaching the elevation of proposed 15th level, level was cut out and surveys carried down for lines.

SOUTH JACKSON OPEN PIT.

At this mine drill holes were located for blasting down the banks, and grades given for steam shovel cuts. An analysis map was prepared of the entire pit in order that uniform grade of ore might be maintained.

SPIES MINE.

Monthly surveys were made and an addition to the engine-house staked out to accommodate new hoist. Mine was closed down in June.

DIVISION OF SMITH'S BAY.

Mr. Charles Cummings made surveys and re-located several of the section corners. In this office we prepared maps, tracings and blueprints.

WATER POWER.

DEAD RIVER STORAGE BASIN.

Elevations from west end of basin were run to tie into Ishpeming's bench marks. These elevations checked very close.

HOIST PLANT. Iron pin survey stations were concreted to preserve surveys and bench marks.

McCLURE DAM.

Contour map was made showing cave area below dam. Caretaker's house was staked out and iron pin survey stations concreted.

McCLURE PLANT.

Iron pin surveys were concreted. Pipe line as constructed, was measured, noting position of valves, vents, etc. Steel pipe and wood pipe were measured separately. A profile was run over the top of the pipe line. New road and houses were staked out and mapped. Profile was run for proposed change in tail-race and stakes set showing cut.

MISCELLANEOUS.

SECTION 15, T. 47 N., R. 27 W., CONTOURS.

In the SE $\frac{1}{4}$ of the section survey lines were run and elevations established. All cross lines were chopped.

DRILL HOLES.

All drill hole locations were surveyed and elevations run to collar of holes.

CARBON.

Specific gravity tests were made of all carbon before purchasing.

TAX COMMISSION MAPS.

Blueprints were prepared of all mines. Considerable time was spent with the superintendent on the ore estimates.

ANNUAL REPORT.

The months of January, February and a part of March, were spent in preparing annual report maps. We have had considerable trouble securing good blueprint paper for our annual report prints.

REPORT ON THE ABSTRACTS FILED IN THE MINING DEPARTMENT FOR THE YEAR 1919.

The records in the Abstract Department consist of a series of books showing the abstracts of the Company's holdings on the iron formation and also the water power rights. Mr. C. H. Echler was in charge of this work and was assisted from time to time by stenographers until September 30th when he left to take a position in the Cleveland office of this Company. He completed for the most part the work on these abstracts and brought up to date the entries in the various books. There still remains to be abstracted some of the water power lands in the Dead River District and also in that of the Au Train. Much of this work could not be obtained promptly and it was considered that there was not enough to keep an abstracter busy any longer in the department. The abstracts as they stand make a valuable record for reference. The current work of the department, such as entering of documents, is being kept up.

Copies of the abstract books and maps have been supplied to the Cleveland office and also to the Land Department.

OPTIONS FOR MINING LEASES.

The option on a mining lease upon the Jennings land West of the Helmer Mine, Mesabi Range, expired January 1, 1920. The contract in which the option was embodied grants the use of the surface to this Company.

The option on the Spies Mineral Land Company's property adjoining the Spies Mine expired in November. The condition of holding this option without exploration was the payment of the taxes. It was thought best to allow the option to expire. There only remain the option on the one half interest of the Michigan Mineral Land Company's property and the one third interest in the Aitkin County lands which this Company holds with Mr. Samuel Snider. There is no time limit on these options.

MINING LEASES.

The lease from the Cleveland-Cliffs Iron Company to the Empire Iron Company was renewed on January 20, 1919. This is the only mining lease outstanding on C. C. I. Company lands.

The lease of the Imperial Mine at Michigamme which this Company held in partnership with Pickands, Mather & Company expired on April 1, 1919.

The following mine leases were acquired from the Great Northern Railway interests:

No.49. Boeing Mine, Hibbing, Minnesota, dated February 10, 1919. Arthur Iron Mining Company; term till October 1, 1928. Description covers two forty acre tracts, namely, the SW $\frac{1}{4}$ of the SE $\frac{1}{4}$ and the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 6, 57-20.

No.50. I. Trumbull Mine, Marble, Minnesota, dated February 10, 1919. North Star Iron Company to C.C.I.Company; term till January 1, 1949. Description is the N $\frac{1}{2}$ of the SW $\frac{1}{4}$ of Section 17 and the NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 18, 56-23.

II. North Star Mine, Taconite, Minnesota, dated February 10, 1919. North Star Iron Company to C.C.I.Company; term till January 1, 1949. Description is the N $\frac{1}{2}$ of the NE $\frac{1}{4}$ of Section 21, 56-24.

III. Bingham Mine, Taconite, Minnesota, dated February 10, 1919. North Star Iron Company to C.C.I.Company; term till January 1, 1949. Description is the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 21, 56-24.

IV. Hill Mine, Marble, Minnesota, dated February 10, 1919. Polk Iron Mining Company to C.C.I.Company; term till January 1, 1949. Description is an undivided one half of the NE $\frac{1}{4}$ ~~of~~ and the SE $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 17, 56-23.

V. Auxiliary Lands for washing plants or waste dated February 10, 1919. Polk Iron Mining Company to the C.C.I.Company; term till January 1, 1949. Various descriptions in 56-23 and 56-24.

VI. Washing Plant Lands dated February 10, 1919. Arthur Iron Mining Company to the C.C.I.Company; term till January 1, 1949. Various descriptions in 56-23.

DOCUMENTS RECORDED.

The following list of documents is a summary of those placed on the records in the files during 1919:

	<u>Number Received.</u>	<u>Last File No.</u>
Offers	50	1215
Authorizations	0	115
Deeds	10	666
Easements	4	129
Rights of Way	8	171
Water Rights	3	12
Surface Leases	124	1543
Applications for Sale	3	34
Sales	18	148
Tax Histories	3	506
Legal Opinions	1	134

LAND OFFERS AND LAND OFFER PLAT BOOK.

The land offers included those of mineral lands in Michigan and Minnesota which were upon the different iron ranges. A few of these were the subject of personal examination, but most of them were declined by reason of previous information. These offers included mineral lands in all stages of exploration or development. A few are from other states and also from Canada. Houses and lots were included, most of them being in Negaunee. Two offers of coal lands were made and also one water power on the Escanaba River. The pyrites offers are separately reported.

OUTSIDE EXPLORATIONS.

No new outside explorations were listed, although considerable work has been done in cross referencing.

AUTHORIZATIONS.

No new authorizations were made in 1919. The last number is 115.

DEEDS AND MISCELLANEOUS DOCUMENTS.

The ones listed this year refer mostly to the various rights on the Mesabi Range.

EASEMENTS.

These consisted of easements on the Republic transmission line and one on the line to the shops in Marquette.

RIGHT OF WAY DEEDS.

These are rights of way granted to railway companies across this Company's mineral lands.

WATER RIGHTS.

This includes water rights of various kinds, such as permits for construction of dams, flowage rights for mine water, etc.

FARM AND LOT LEASES.

Most of these are in the Ishpeming and Negaunee Districts. It has been ruled that all leases to various parties upon land which lies on the iron formation be recorded in this Department. The leases in this book include those upon all the Company's mine operations. The leases recorded each year are not so great in number as formerly because in most cases the new leases include an automatic renewal clause.

APPLICATIONS FOR SALE.

This covers applications for sale which are entered on special blanks sent to this office by the Land Department for approval.

SALES.

These cover lots and lands in Michigan and Minnesota where the property is within the limits of the iron formation or is included within the limits of the Mining Department lands.

TAX HISTORIES.

Tax histories are acquired on all property purchased by this Company or upon which rights have been obtained.

LEGAL OPINIONS.

Legal opinions filed in this Department usually refer to questions raised in the examination of abstracts.

INDEX PLAT BOOK.

This book shows by plats the lands of the Company and upon the squares which represent the forty acre tracts signs indicate the documents recorded in the office which affect the title. This was posted up to the end of September.

UNRECORDED PLATS, FARM LEASES, ETC.

These show the position of leases at the Company's locations.

LAND OWNERSHIP PLAT BOOK.

The ownership of lands on the iron formation in Michigan and Wisconsin are mostly covered in this book. The work has not been kept up to date because the information was largely obtained in taking out options for explorations; also the ownership of lands on proposed water power developments was shown.

A book of land ownerships has been obtained from W. W. Hixson & Company of Rockford, Illinois. This consists of printed maps upon which ownerships are shown. It covers the entire Upper Peninsula of Michigan. The information is fairly reliable although there are always particular instances where an abstract of title must be obtained to show a divided ownership. This book in a large measure covers the information needed in this office as to outside land ownership. Consequently no attempt has been made recently to post the land ownership books above mentioned.

U. S. GOVERNMENT PLAT BOOKS.

No new plats were obtained this year.

MISCELLANEOUS DOCUMENTS FILED.

A few miscellaneous documents have been filed.

ATHENS MINING COMPANY ABSTRACTS.

The book of the Athens abstracts has not been completed. We are waiting for the acceptance of documents relating to the establishment of boundary lines which have been prepared and sent to the fee owners of the Mitchell and Corbet Leases.

MAAS-NEGAUNEE ABSTRACTS.

A few additional entries have been made relative to lots that have been acquired in the Maas, Lonstorf and Mitchell Addition. This book needs a general abstract covering the various documents relating to the Maas and Negaunee mines leases, more particularly relating to the arrangements under the abandoned railway right of way.

C. C. I. COMPANY ABSTRACTS.

The two books cover the abstracts of most of this Company's mineral interests. They were posted up to September 30th. This is the principal work which Mr. Echler completed.

HYDRO-ELECTRIC ABSTRACTS.

These cover the abstracts of water power lands and transmission lines and were posted up to September 30th.

PYRITES.

The following offers of pyrites were received during the year:

No.151, Mr. William Jackson Fuller, District Engineer of the Public Works, Sault Ste. Marie, Ontario, wrote on February 26th claiming that he had a property for sale in the Michipicoten District. He asked a number of questions relative to the requirements of this Company. His letter was referred to Mr. Austin Farrell.

No.152, Senator L. McMeans of Winnipeg wrote in May describing a property on the Canadian Northern Railway in the Rainy River District near Fort Francis, Ontario. The recommendation which I made was to the effect that unless the presence of zinc might be considered an objection, the property has enough merit to warrant an examination.

No.153, Mr. J. E. Marks of Port Arthur on October 7th wrote describing a property 75 miles West of Port Arthur and which contained nickel, copper and cobalt. The maps accompanying his letter were sent to Mr. Smyth. Later Mr. Mather wrote instructions to decline the property.

No.154, Messrs. Joseph Winter of Negaunee and Joseph Gannon of Marquette came to the office October 29th offering property at Goudreau in the Michipicoten District in Ontario. This offer was declined because the ore was low in sulphur.

SUMMARY.

Mr. Echler spent most of his time in completing the abstracts of the Company's mineral and hydro-electric lands. At the Register of Deeds office in Marquette he made several abstracts which were completed in this office. He was in consultation with Mr. Berg as to legal points and also as to the scope of the work necessary. No abstracts have been made since the date of his leaving, but the rest of the recording in the office has been kept up to date.

SUNDRY ITEMS BY J. E. JOPLING.

WATER POWER.

No extensive surveys were made in connection with water power projects. For the proposed storage basin dam at the Hoist on Dead River new drawings were made. Maps of the proposed storage basin were completed. A copy of the general map was given to Mr. J. M. Longyear.

No other water powers were examined.

TRANSMISSION LINES.

The transmission line from the Furnace at Marquette to the Railroad Company's shops was built during 1919. The easement covering this right was obtained from the D.S.S. & A. Railway. Mr. Charles Cummings of Marquette did the surveying.

LAKE SUPERIOR IRON COMPANY.

No thorough examination was made of the workings of the Lake Superior Iron Company which now consists only of the Section 16 Mine. Portions of the mine were examined in connection with the Holmes Mine.

REGENT IRON COMPANY.

As mentioned in last year's report, the only business of the Regent Iron Company which was brought up in this office was the old contract with the C. & N. W. Railway relative to changes in Partridge Creek at the Blue Mine. The Superintendent of the Breitung-Hematite Mine continues to examine the condition of this ditch so as to avoid any accidents due to backing up the water.

MICHIGAN STATE TAX COMMISSION.

The estimates of the ore tonnages in the Company's mines were made as usual and maps were prepared for the Tax Commission. Mr. O. W. Wheelwright, Engineer for the Commission, was in this district early in March, going over all the estimates and maps with the mine superintendents.

MINES ON THE MESABI RANGE.

During January in company with Mr. J. H. Farrell, I visited the Boeing, Hill and Trumbull properties on the Mesabi Range. The estimates and proposed developments of these properties were discussed with Mr. Barber and reports made.

ISABELLA MINE.

An examination of the Isabella Mine on the Cascade Range was made during March with Mr. Jackson and Captain J. H. Rough. The data obtained, together with the result of sampling the ore in the mine, was embodied in a report on this offer.

COUNTY ROAD COMMISSION.

The proposed plans of the County Road Commission for the Marquette-Negaunee road and the Baraga Trunk Line were carefully gone over in the office by me. The proposed roads do not conflict with this Company's plans of developing water powers.

SMITH'S BAY, REPUBLIC.

Some progress was made in the proposed division of the mineral rights on the Smith's Bay, Republic, between this Company's lands and Lot 7 which belongs to the Michigan Iron & Land Company. At a conference in Marquette on September 27th, Mr. J. M. Longyear, the Agent for the Michigan Iron & Land Company, and Mr. W. P. Belden, Representative of this Company, agreed to have a report made by Mr. R. S. Rose, Mining Engineer for Mr. Longyear, and by myself.

Surveys were made by Mr. Charles Cummings acting for both parties and land corners established. The boundary line between the mineral rights has not yet been agreed upon.

MICHIGAMME COMPANY.

On December 1st, I was present at a sale of the Michigamme Company's lands at the Court House in Marquette.

GENERAL.

The principal work of the Department consists in keeping up to date the mine surveys and maps. During the war there were not men enough to continue the surface surveys upon the Company's mineral lands. This work has been delayed; furthermore, some of the old surveys of these lands never have been completely mapped. The engineers have spent 84% of their time at the mines against 71% last year.

THE CLEVELAND CLIFFS IRON COMPANY.

REPORT OF THE GEOLOGIST FOR THE YEAR ENDING DECEMBER 31, 1919.

STAFF.

The staff of the Geological Department for 1919 is given in Table I below. Mr. Fred Royce resigned September 30th and moved to Chicago, primarily on account of illness in his wife's family who reside there. He is now employed as a mining engineer by the Goodman Manufacturing Company, Chicago. Mr. C. W. Nicolson returned from overseas service with the A.E.F. as Captain of the Artillery early in March. He was engaged by this Department as an assistant geologist and began his duties March 8th. Mr. Leif Erickson resigned August 26th to accept a clerical position with a manufacturing concern in Detroit, Michigan. Mr. Peter N. Denn was transferred to the Engineering Department on March 22nd but was again employed in the Geological Department from and after December 3rd as collector of diamond drill samples.

TABLE I.

STAFF OF GEOLOGICAL DEPARTMENT IN 1919.

<u>NAME.</u>	<u>OCCUPATION.</u>	<u>DURATION OF EMPLOYMENT IN 1919.</u>	<u>DAYS LOST. SICKNESS.</u>	<u>VACATIONS.</u>	<u>% OF WORKING DAYS WORKED.</u>
E.L.Derby, Jr.	Geologist in charge of department.	Entire year.	0	18½	93.4
Fred Royce	Assistant Geologist.	9 months.	4½	18	89.1
C.W.Nicolson	Assistant Geologist.	10 months.	2	14½	92.6
Gustav Afuhs	Draftsman.	Entire year.	3½	6¾	96.3
E.A.Allen	Assisting Geologists; also testing diamond drill holes, collecting core, etc.	Entire year.	5	10½	94.5
Leif Erickson	Collecting core, etc.	8 months.	21¾	1	87.0
Peter N.Denn	Collecting core, etc.	3 months.	0	0	100.0

The year was divided into the factors shown in Table II below.

TABLE II.

Total days of eight hours worked	- -	276½ days.
Sundays	- - - - -	52 "
Days resulting from Saturday afternoons		26 "
Holidays	- - - - -	10½ "
Total		365 days,

The following Table, No.III, shows the average number of men regularly employed on the staff of the Geological Department during the last five years:

TABLE III.

YEAR.	AVERAGE NUMBER OF MEN.
1915	3.96
1916	3.17
1917	3.35
1918	4.85
1919	5.44

DIVISION OF WORK AMONG THE MEMBERS OF THE DEPARTMENT.

H. L. Smyth. The work of the Geological Department continued under the direction of Mr. H. L. Smyth as Consulting Geologist.

E. L. Derby, Jr. Most of my time during the past year was taken up with general oversight and supervision of the work of the Department. This has included, besides certain office routine work, surface drilling explorations in the Ishpeming and Negaunee Districts and on the Mesabi Range; underground drilling in the Angeline, Athens, Bunker-Hill, Cliffs Shaft, Francis, Gwinn, Lake, Maas, Morris-Lloyd, Negaunee and Republic mines; underground geological surveys in the Angeline, Athens, Cliffs Shaft, Francis, Gwinn, Holmes, Jopling, Maas, Mackinaw-Gardner, Morris-Lloyd, Negaunee, Princeton and Republic mines; and in visiting and reporting on the explorations of other companies on the Michigan and Wisconsin iron ranges. I have accompanied the men making the underground surveys frequently and have constantly kept in touch with and supervised their detailed studies of the results of these surveys.

The time not taken up with these duties was spent chiefly as follows:

In January, I went to Hibbing, Minnesota, and, with Messrs. Concklin and Calvin, Chief and Assistant Chief Engineer, respectively, of the Arthur Iron Mining Company, made a joint estimate of the ore remaining within the present limits of the Hill Mine Open Pit at Marble, Minnesota. The lease of this mine to the Company provides for a bonus charge of 25¢ per ton on

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this tonnage to cover its proportionate charge of the original stripping.

In February, I completed the above joint estimate of the Hill Pit at Hibbing and also made an estimate of the ore on this property outside of the pit limits; also the stripping necessary to remove it. I examined all the maps and other data of the Isabella Mine and adjacent lands in company with Mr. Jopling. These were offered to the Company by the Cascade Mining Company, operators of the Isabella Mine, through their General Manager, Mr. O. B. Warren. Mr. Jopling and I submitted a joint report covering the entire offer.

In March, I made an examination of the Isabella Mine jointly with Messrs. Jopling, Jackson and Rough; also numerous estimates concerning the property. I also directed the work of sampling certain representative areas in the mine as a check against the Cascade Company's analyses submitted to us. The results of this examination, estimates, etc, are embodied in a separate report which I attached to the joint report of Messrs. Jopling, Jackson and Rough.

In April, I went to Hibbing, Minnesota, and, with Mr. Calvin, Assistant Chief Engineer of the Arthur Iron Mining Company, made a joint estimate of the ore remaining within the present limits of the Walker Mine Open Pit in connection with a proposed exchange of fee interests between the above company and the Oliver Iron Mining Company in the Hill and Walker mines. The Arthur Company desired to exchange all its interest in the Walker for all of the Oliver Company's interest in the Hill, thereby simplifying the leasing of the latter to this Company.

In May, I made an estimate of ore on the Feigh Mine property on the Cuyuna Range offered to this Company by the Northern Pacific people in connection with the Norpac and Impro properties at Hibbing. This was covered by land offer No. 1182.

In August, in conjunction with Mr. Adams of the Accounting Department, I prepared a preliminary estimate of the cost of opening the Norpac and Impro properties mentioned above.

In October, I spent ten days in Cambridge, Massachusetts, consulting Mr. Smyth and going over with him all the Company's current explorations, but more particularly the surface drilling on Section 3, 47-27 at Ishpeming.

In December, I made an estimate of the prospective ore in the Francis Mine below the 5th level, based on observed underground conditions and recent diamond drilling. As a result of this Mr. Graff decided to cut a lower level and drift from the shaft instead of developing the remaining ore from an incline from the 5th level in the ore body itself.

Fred Royce. Mr. Royce continued as assistant geologist and during the first two months of the year spent most of his time making the underground geological surveys and posting the maps and cross-sections of the Company's operating mines in the Ishpeming, North Lake and Gwinn Districts, and in addition, the Athens Mine in the Negaunee District. It was impossible for him to keep this work up to date in all cases but after Mr. Nicolson came into the Department early in March, Mr. Royce concentrated his time on the mines of the Negaunee and Gwinn Districts. He was then able to do the current work and gradually catch up on the back work at these properties. He made ore estimates of the Norpac and Impro properties of the Hibbing, Minnesota, District offered to us by the Northern Pacific people. He also made the daily reports of current drilling and looked after the office on two occasions during my absence. He spent the remainder of his time in the routine work of the office. He resigned September 30th to accept a position in Chicago, as mentioned in the first paragraph of this report.

G. W. Nicolson. Mr. Nicolson entered the Geological Department on March 8th following his release from military service in France and became an assistant geologist. To him was assigned all geological work connected with the Company's operating mines ~~and~~ in the Ishpeming and North Lake Districts. He also made one underground geological survey at the Republic Mine. In attempting to catch up the back work at the other properties, he was unable to continue the work at Republic during the remainder of the year. It is anticipated that the latter work will be resumed the coming year and brought up to date. After Mr. Royce left, he spent all

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the time he could on the geological work of the Athens and Gwinn District mines. He assisted Mr. Royce on the estimates of ore on the Norpac and Impro properties, mentioned above. He also made the daily reports of current drilling and looked after the office during my absence in October. The rest of his time was consumed by office routine.

Gustav Afuhs. Mr. Afuhs continued as draftsman throughout the year. His work has been chiefly that of preparing cross-sections of drilling, monthly drill reports and geological maps and cross-sections, but he has also ably assisted in making several ore estimates and occasionally helped in labeling and filing diamond drill core and samples.

E. A. Allen. Mr. Allen continued as a member of the Department throughout the year. At different times he looked after the core room, labeling and filing core and sludge samples of the current drilling. This occurred during the absence of Mr. Erickson by illness and the interval between Erickson's leaving and Mr. Denn's joining the Department. During the months of February, March and April he looked after the surface check drilling at the Boeing property with headquarters at Hibbing, Minnesota. He made the regular monthly carbon reports and surveyed all drill holes where necessary with the Maas Compass. He also visited and reported on the Outside Explorations being conducted on the Michigan and Wisconsin iron ranges. He spent the rest of his time as a regular geologist's assistant, assisting in underground geological surveys and routine office work.

Leif Erickson. Mr. Erickson continued in the Department for the first eight months of the year, resigning August 26th to accept a better position in Detroit. Until then he collected, labeled and filed all the core and sludge samples from the current drilling and looked after the core room.

Peter N. Denn. Mr. Denn, regularly a member of the Engineering Department, was temporarily employed in the Geological Department the first five weeks of the year and again for two weeks in the middle of March, assisting Mr. Erickson in the core room and in collecting the drill samples, there being as many as sixteen drills operating on the Company's property during these periods. Mr. Denn was engaged as a regular member
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of the Department the 3rd of December and looked after the core room, collected, labeled and filed the drill samples the remainder of the year.

SURFACE GEOLOGICAL SURVEYS.

ISHPEMING DISTRICT.

The only surface geological work done during the year was the locating and sampling of several occurrences of asbestos outcrops on the Company's and the adjoining lands North of Ishpeming in the Deer Lake region. A separate report covers this work.

UNDERGROUND GEOLOGICAL SURVEYS.

Until Mr. Nicolson joined the Geological Department early in March, we were unable to keep the current underground geological work up to date. From this time on, however, we gradually caught it up and were in a fair way to get all of it brought up to date when Mr. Royce left the last of September. During the remainder of the year we bent every effort to visit the mines where the more important development work was going on and keep the geology of these properties posted on both maps and cross-sections. If all the work could be brought up to date once, I am convinced that one first class assistant geologist and his assistant, with the aid of the Chief Geologist in charge, could keep up to date all underground geological work, both surveys and general study of geological conditions in advance of actual development work.

ANGELINE MINE.

Underground mining was carried on at this property in the pillars of what is known as the Middle Deposit. A small amount of exploratory drifting has also been done. Mr. Nicolson has kept the geology fairly well posted.

ATHENS MINE.

Both mining and development work progressed steadily at the Athens mine throughout the year. Detailed geological surveys have been made and the maps and cross-sections posted regularly by Messrs. Royce and

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