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7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting (Cont.)

The explosives statements are shown under the following headings:

BREAKING ORE	Quantity Lbs.	Average Price	Amount 1941	Amount 1940
Gelamite Powder #1	239,146	11.50	27,502.99	25,704.14
Fuse - Feet	803,255	5.11	4,105.19	3,702.22
#6 Blasting Caps	114,809	12.20	1,400.64	1,262.09
Tamping Bags	13,500	2.85	38.50	23.30
Fuse Lighters	19,550	6.67	130.31	110.37
Fuse Cartridges	5,375	19.85	106.69	105.26
Primatubes	316	.135	42.66	
Total Fuse Caps, Etc.			5,823.99	5,203.24
Total Exp. Breaking Ore			33,326.98	30,907.38
Product, Tons			558,253	476,934
Lbs. Powder per Ton of Ore			.428	.469
Cost per Ton for Powder			.049	.054
Cost per Ton for Fuse, Caps, Etc.			.010	.011
Cost per Ton for all Explosives			.060	.065
DEVELOPMENT IN ROCK				
Gelamite Powder #1	5,199	11.50	597.88	435.43
Fuse, Feet	20,219	5.14	103.93	75.19
#6 Blasting Caps	2,859	12.20	34.87	24.73
Tamping Bags	500	2.00	1.00	1.00
Fuse Lighters	2,100	6.75	14.18	10.03
Fuse Cartridges	125	19.84	2.48	2.99
Total Fuse, Caps, Etc.			156.46	113.94
Total all Explosives			754.34	549.37
Rock Drifting, Feet			769'	528'
Cost Per Foot for Powder			.777	.825
Cost Per Foot for Fuse, Caps, Etc.			.203	.216
Cost per Foot all Explosives			.981	1.041
Grand Total Explosives Used in Mine			34,081.32	31,456.75
Cost per Ton All Explosives Used			.061	.066
Average Price per Lb. for Powder			.115	.115

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7. UNDERGROUND (Cont.)

g. Ventilation

Ventilation conditions throughout the year continued to be very satisfactory. The ventilation fan which was installed on the 4th Level at the bottom of the Section 6 shaft in June of 1939 was operated 24 hours a day, 6 days per week without failure or break-down. The total delivery of this fan declined somewhat from its rated 20,000 C.F.M. due to the opening of the 7th Level and a general increase in the total length of the air-ways. Accordingly, a new drive pulley was ordered to step up the speed of this fan. It is expected that this new pulley will be delivered and installed early in 1942 and that it will increase the capacity of the fan under our present conditions to 21,000 or 22,000 C.F.M. Throughout the entire year this fan was reversed several times each shift with the operating shaft alternately up-cast and down-cast. The reversing of the fan is done to quickly remove the smoke after blasting which occurs at least twice each shift. After the smoke has been removed, it is reversed to make the operating shaft up-cast. The above system served satisfactorily to keep both shafts almost entirely free of ice. The main ventilation raises between the 5th and 4th Levels were maintained and one new one put up from the 6th Level to the top slicing area. In addition, a new ventilation raise was put through from the 7th to the 6th Level partly in ore and partly in rock. Several additional raises are planned between these two Levels for the coming year.

In general the present system serves to keep most of the mining areas properly ventilated, but in several cases auxiliary fans were used. One small fan was used in the slicing territory above the 4th Level until mining in that area had been completed. Another was used at all times for the shaft sinking crew where good conditions and extremely low dust counts were maintained at all times. After the opening of the South Deposit, a long system of metal pipe with two auxiliary fans was used to ventilate this new area. The headings in the development work on the 7th Level were also served by auxiliary fans at all times.

8. COST OF OPERATING

a. Comparative Mining Costs

	1941	1940	Incr.	Decr.
Product, Tons	558,253	476,934	81,319	
Underground Costs	1.204	.953	.251	
Surface Costs	.166	.128	.038	
General Mine Expense	.251	.218	.033	
Cost of Production	1.621	1.299	.322	
Depreciation	.044	.049		.005
Taxes	.082	.099		.017
Loading and Shipping	.041	.047		.006
Total Cost at Mine	1.788	1.494	.294	
Budget Estimated at Mine	1.659	1.440	.219	
Number of Operating Days	305	261	44	
Number of Shifts & Hours	28, 1-8 Hr.	5, 1-8 Hr.		
	24, 2-8 Hr.	236, 2-8 Hr.		
	253, 3-8 Hr.	20, 3-8 Hr.		
Average Daily Product	2006	1830	176	

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison

	1941 Amount	1941 Per Ton	1940 Amount	1940 Per Ton
1. Exploring in Mine	15151.92	.027	6968.33	.015
3. Development in Rock	9028.64	.016	5153.87	.011
4. Development in Ore	54881.18	.098	37485.90	.078
5. Stoping	267998.51	.480	186649.92	.391
6. Timbering	165357.72	.296	108089.31	.227
7. Tramming	71643.90	.128	45975.85	.096
8. Ventilation	2201.49	.004	930.75	.002
9. Pumping	8563.22	.015	8333.85	.017
10. Compressors and Air Pipes	26106.30	.047	18930.91	.040
11. Back Filling	457.00	.001		
12. Underground Superintendence	20614.67	.037	13675.51	.029
14. Maint. Comp. & Air Drills	997.88	.002	4765.92	.010
15. Scrapers & Mech. Loaders	13033.25	.023	9137.47	.019
16. Electric Tram Equipment	14896.00	.027	8410.58	.018
17. Pumping Machinery	1366.69	.003	207.53	
Total Underground Costs	672298.37	1.204	454715.70	.953
18. Hoisting	29546.21	.053	21620.59	.045
19. Stocking Ore	20506.88	.037	10955.74	.023
20. Crushing at Mine	2259.49	.004	1874.18	.004
21. Dry House	9617.54	.017	7035.82	.015
22. General Surface Expense	9072.22	.016	5424.43	.011
23. Maint. Hoisting Equipment	5609.80	.010	4329.52	.009
24. Shaft	2161.74	.004	1391.17	.003
25. Top Tram Equipment	4885.45	.009	3416.88	.007
26. Docks, Trestles & Pockets	3036.80	.005	461.57	.001
27. Mine Buildings	5905.28	.011	4520.49	.010
Total Surface Costs	92601.41	.166	61030.39	.128
Vacation Expense	12397.06	.022	5102.89	.011
28. Insurance	4104.22	.007	2050.94	.004
29. Mining Engineering	2920.02	.005	3960.93	.008
30. Mech. & Elect. Engineering	1969.31	.004	1753.84	.004
31. Analysis & Grading	13555.95	.024	11650.81	.025
32. Personal Injury	28350.11	.051	12979.90	.027
33. Safety Department	1493.64	.003	1300.26	.003
34. Telephones & Safety Devices	1565.09	.003	1901.16	.004
35. Local & Gen. Welfare	8703.50	.016	5735.57	.012
36. Spec. Exp. Pensions & Allow.	7636.18	.014	15359.65	.032
37. Ishpeming Office	15687.23	.028	12823.41	.027
38. Social Security Taxes	25798.82	.046	16345.42	.034
39. Mine Office	15599.55	.028	12858.25	.027
Total General Mine Expenses	139780.68	.251	103823.03	.218
Cost of Production	904680.46	1.621	619569.12	1.299
40. Taxes	45404.13	.082	47246.11	.099
Total Cost	950084.59	1.703	666815.23	1.398
Budget Estimated Cost		1.578		1.343

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

	1941		1940	
	Amount	Per Ton	Amount	Per Ton
41. General Supplies	32328.41	.058	26295.11	.055
42. Iron and Steel	8797.74	.016	7581.05	.016
43. Oil and Grease	1979.93	.003	1675.74	.003
44. Machinery Supplies	20418.60	.037	12237.28	.026
45. Explosives	34167.66	.061	31456.75	.066
46. Lumber and Timber	37996.51	.068	32363.94	.068
47. Fuel	1681.52	.003	1718.85	.004
48. Electric Power	49529.21	.089	35504.82	.074
49. Sundries	2909.26	.005	2824.91	.006
50. Other Mines and Accounts	340.57	.001	182.91	.000
Total Per Cost Sheet	189468.27	.339	151475.54	.318

In the following discussion of comparative costs, no explanation is made unless the difference is large enough to be significant.

1. Exploring in Mine
This large increase is due to the extensive diamond drilling program which was carried on at the rate of 2 shifts per day during the greater part of the year and later increased to 3 shifts per day. The cost per ton in 1939 was .001 as compared with .015 in 1940 and .027 for the current year.

3. Development in Rock
This increase is due to the larger amount of rock work necessary in the development program.

4. Development in Ore
This increase is due to the large amount of work necessary in the development of the numerous small deposits which were explored during the year.

5. Stoping
This increase was due for the most part to the general wage increase and the large amount of overtime pay. The details of this account excluding the ore obtained from development work, is as follows:

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

	1941		1940	
	Amount	Per Ton	Amount	Per Ton
General Supplies	10,783.50	.021	7,786.18	.018
Iron and Steel	2,515.96	.005	2,876.79	.006
Oil and Grease	426.42	.001	336.31	.001
Machinery Supplies	4,245.32	.008	3,279.45	.007
Explosives	26,298.58	.058	24,743.54	.056
Lumber and Timber	5.24	.000	13.87	.000
Electric Power	3,969.06	.007	2,718.71	.006
Sundries	279.54	.001	408.27	.001
Expense Accounts	416.12	.001	396.80	.001
Total Supplies	48,939.74	.102	42,559.92	.096
Payroll Labor	213,235.41	.412	140,100.75	.316
Cliffs-Shaft Labor	56.88	.000	247.33	.000
General Shops Labor	1,053.68	.002	736.02	.002
Shops, Labor Etc.	4,712.80	.009	3,005.90	.007
Total Labor	219,058.77	.423	144,090.00	.325
GRAND TOTAL	267,998.51	.525	186,649.92	.421
Production Tons Stoped	517,660		443,862	
Avg. Miners Rate for Stoping	7.99		7.19	
Avg. Tons per Man Stoping	21.62		25.63	

6. Timbering

This increase was due to the increase in the cost of labor and materials.

7. Tramming & 8. Ventilation

This increase was due to the increase in the cost of labor and materials.

9. Pumping

The expenditure under this heading remained practically the same, the decrease in cost per ton being due to the increased production.

	Inland Steel Co.			C.C.I. Co.		
	Amount	Per Cent	Avg. Gal. Per Min.	Amount	Per Cent	Avg. Gal. Per Min.
Total 1941	60,245.97	93.22	898.4	4,225.55	6.78	66.0
1940	70,978.13	90.13	1,155.4	7,769.69	9.87	125.1
1939	44,044.09	81.90	787.7	10,518.71	18.10	174.2
1938	39,606.07	78.09	568.2	11,113.14	21.91	159.7
1937	30,636.14	69.05	360.1	13,731.40	30.95	137.6

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

9. Pumping (Cont.)

For the first time in several years the amount of water pumped at the two properties shows a definite decrease. The total for both mines of 964.4 G.P.M. compares with 1,280.5 G.P.M. in 1940. This substantial decrease is due entirely to the large surface pumping program which has been carried on at the Morris Mine for the last several years. The figure shown in the above table for the average G.P.M. at the Lloyd is 147.7 as compared with 125.1 for the previous year. This is actually not an increase since figures on the second Level water supply pumping were obtained for the first time. The average pumped during the year from the second Level Lloyd to the water supply system was 22 G.P.M. The amount of water available in this area decreased steadily during the year from a high of 30 G.P.M. to 9 in December. The failure of this source of water for domestic use made it necessary to run a 6" line several thousand feet in length from the Inland Steel surface well No. 8 which was used for water supply purposes throughout the latter months of the year.

Early in January, the installation of the new 5th Level pumping plant had progressed sufficiently to permit pumping to be started by the 15th of the month. At the beginning of this operation only a small amount from the 5th Level was handled by this pumping plant. Later, the motor pump on the 5th Level having been installed on the 6th, the water from this lower level was also handled by the new pumping plant. Still later in the year, the water from the 4th Level was run to the 5th Level sump and the water on the 6th Level again turned over to the Morris via 7th Level. Exclusive of the 22 G.P.M. which were handled by the water supply pump on the second Level, 66 G.P.M. were handled at the Morris Mine and 59.7 at the Lloyd. At the end of the year, all of the water on the 5th Level and above was being pumped at the property with the remainder, on the 6th and 7th Levels, being handled at the Morris.

17. Pumping Machinery

This cost was occasioned by the maintenance of the machinery at the new 5th Level pump house.

18. to 27. Inclusive

This increase was due to the wage increase and overtime payments.

Vacation Expense

This charge was substantially increased due to the fact that these payments are based on average earnings which were greater this year.

40. Taxes

This small decrease was due to the increase in production.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS

The large program of exploration which was started in 1940 was continued at a faster pace during 1941 in an effort to discover new reserves to augment the rapidly diminishing Lloyd East Deposit. In addition to a large amount of small drifts and raises which were driven for the purpose of exploring all new areas, diamond drilling was carried on throughout the year. This work was done on a two shift per day basis and stepped up to three shifts per day by the end of the year. Ten holes were drilled totaling 3,756' at a cost of $15,152 or $3.78 per foot. The cost of this drilling was taken into operations at the rate of $.027 per ton without an E & A. The following is a record of this drilling, a comprehensive discussion of which will be found in the report of the Geological Department:

D.D.H. #115

This hole was started on the third of January from the end of the 640 cross-cut on the 6th Level at S. 3238.70 and 2340.0 E., dip -51°, course S. 1° 24' E. This hole, which was drilled south of the Lloyd East Deposit, passed through 158' of S.O.J. encountering a small dike from 105 to 110. The hole was stopped in slate at a depth of 184' on the 20th of the month.

D.D.H. #116

This hole was started from the end of the 670 cross-cut on the 24th of January at S. 3248.35 and 1884.17 E., dip 0°, course S. 3° 59' E. This hole which was drilled to explore the territory lying south of the main deposit passed through numerous seams of S.O.J., very lean ore, dike and slate, and was stopped in slate at a depth of 521' on the 11th of March.

D.D.H. #117

This hole was started on the 19th of March from the 680 cross-cut on the 6th Level at S. 3140.83 and 1705.14 E., dip 0°, course S. 0° 12' W. After passing through numerous seams of very lean ore and jasper, slate, dike, and quartzite, this hole entered an area of concentration which was later developed as the South Deposit. The hole was stopped in slate at a depth of 435' on the 26th of June.

D.D.H. #118 & 119

Both of these holes were drilled horizontally to the southeast from the 640 cross-cut on the 6th Level at approximately S. 3178.8 and 2343.6 E. Both of these holes encountered some very small seams of ore which were not extensive enough to be of any commercial importance.

D.D.H. #120

Hole #120 was drilled vertically from the east side of the 730 cross-cut on the 7th Level at S. 3119.7 and 1725.6 E. The collar of this hole was in a large horse of jasper in approximately the center of the west end of the Lloyd

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9. EXPLORATIONS AND
FUTURE EXPLORATIONS (Cont.)

D.D.H. #120 (Cont.)

East Deposit. Drilling was continued in jasper to a point 35' below the Level after which 100' of high-grade ore was drilled before the hole entered the foot-wall slate at a point 135' below the Level. Drilling was continued a short distance into the slate and stopped at a total depth of 165'. The information obtained from this hole served as a basis for the estimate of the reserves lying below the 7th Level in the Lloyd East Deposit.

D.D.H. #121

This hole was drilled from the end of the 730 cross-cut on the 7th Level to explore the area lying south of the Main Deposit. Drilling was started on the 27th of August at S. 3176.6 and 1720.7 E., dip 0°, course due south. After a 40' run of Lloyddale ore lying against the transverse fault, this hole entered the slate, determined the location of the Main Dike, and was then continued in slate and stopped on the 11th of September at a depth of 387'.

D.D.H. #122

This hole was drilled from the south side of the main drift on the 7th Level at approximately 1400 east in an effort to determine the location of the new South Deposit at this elevation. This attempt was not successful and the hole was stopped in slate at a depth of 459' after passing through a long run of slate, the Main Dike, and several runs of S.O.J. and very lean ore.

D.D.H. #123

This hole was also drilled from a cut-out on the south side of the 7th Level drift at approximately 1,000 E., dip 0°, course S. 0° 15' E. Subsequent surveying of this hole at depth showed that it had swung off quite sharply to the east. This drilling was done in an additional attempt to determine the location of the South Deposit at the 7th Level elevation and was not successful. After a long run of slate, drilling was continued through some 200' of jasper which contained one short run of lean ore. After the location of the main dike was determined, the hole was continued in jasper and finally stopped at 613' on the 29th of November.

D.D.H. #124

Hole #124 was drilled from the drift which was turned off to the east of the 680 cross-cut in the new South Deposit. Drilling started on the 11th of December at S. 3483.77 and 1693.14 E., dip -38° 20', course N. 64° 41' W. This hole, which was completed at a depth of 214' by the end of December, was put down in an attempt to follow the concentration in the new South Deposit to its location at the 7th Level elevation. This attempt was not successful, the hole entering jasper at a depth of 65' or approximately 40' vertically below the Level. A second similar hole from the same location was planned for early January.

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10. TAXES

The following figures show the taxes paid in Ishpeming Township for the past two years on the Lloyd Mine, on Lots in West Ishpeming, and on property in the North Lake Location.

	1941		1940	
Lloyd & Section 6	Valuation	Taxes	Valuation	Taxes
SW¼ of NW¼ of Sec. 6, 47-27) N½ of SW¼ of Sec. 6, 47-27) N½ of SE¼ of Sec. 6, 47-27)	1,665,000	33,986.98	1,805,000	37,909.15
Personal, Ore in Stock, Supplies & Equipment	535,000	10,920.75	420,000	8,820.97
Total	2,200,000	44,907.73	2,225,000	46,730.12
Collection Fees		449.08		467.30
Total Lloyd Mine		45,356.81		47,197.42
C. C. I. Co. Lands Misc.				
S½ of NE¼ of Sec. 6, 47-27	320	6.54	320	6.72
SE¼ of NW¼ of Sec. 6, 47-27 Except R of Way	350	7.14	350	7.35
S½ of SW¼ of Sec. 6, 47-27 Except R of Way	700	14.29	700	14.70
SW½ of SE¼ of Sec. 6, 47-27 Except R of Way	350	7.14	350	7.35
SE¼ of SE¼ of Sec. 6, 47-27 Except R of Way	575	11.74	575	12.09
Total	2,295	46.85	2,295	48.21
Collection Fees		.47		.48
Total CCICo. Misc. Lands		47.32		48.69
Total Lloyd	2,202,295	45,404.13	2,227,295	47,246.11
Lots in West Ishpeming	30	1.31		
North Lake Dwellings				
Houses on Sec. 6, The C.C.I. Co.	6,000	122.48	40,500	850.59
Collection Fees		1.22		8.51
Total Dwellings		123.70		859.10
Total Ishpeming Township	2,208,325	45,529.14	2,267,795	48,105.21
Rate		2.04126		2.10020

There was a substantial decrease in both the total valuation and the total tax paid for 1941 due to the diminishing size of the ore body. There was also a tremendous decrease in the valuation and tax paid on North Lake dwellings since all but a very few had been sold before the end of the taxable year.

	1941	1940	1939	1938
Tax paid per Ton Produced	.082	.099	.143	.198
Tax paid per Ton Shipped	.099	.093	.095	.479

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11. ACCIDENTS AND PERSONAL INJURY

There were seven compensable accidents during 1941 including one fatality. The numerous ramifications of the most regretable fatality have been discussed in previous independent reports. A full-strength third shift contributed largely to an increase of 22,264 man-shifts over last year, the total man-shifts being 88,969 and 62,705 for 1941 and 1940, respectively.

The frequency rate on the compensable accidents for 1941 was .079 based on the number of accidents per thousand man-shifts worked as compared to .048 for 1940 on a similar basis. The severity rate for these accidents in 1941 was 25.13, on a ratio of the number of days lost-time per thousand man-shifts against 1.35 in 1940.

The accidents are listed in detail as follows:

Accident No. 807, Frank Juidici, Timber Foreman. This man while making his week-end shaft inspection, was squeezed between the skip and the first set of timber above the collar. Time lost - 54 days.

Accident No. 808, Steve Festa, Contract Miner. This man was struck in the back and side of the head by falling ore. Time lost - 52 days.

Accident No. 809, Matt Helsten, Contract Miner. This man was struck in the back by a small chunk of falling ore, suffering a fracture of the transverse processes of the lumbar vertebrae. Time lost - 122 days.

Accident No. 810, Walter Mannikko, Contract Miner. While standing a leg for a timber set, this man was struck on the back by a piece of ore which fell from the covering, suffering a fracture of the transverse processes of the lumbar vertebrae. Time lost - 48 days.

Accident No. 811, Joseph Thibodeau, Motorman. While pulling an emptied car back to up-right position at the 6th Level pocket, this man reported feeling a strain across his chest muscles. Time lost - 10 days.

Accident No. 812, Dominic Baldini, Timber lasher. This man was struck in the right leg by a piece of timber he was assisting to hoist, suffering a fracture of both bones of the lower leg. The accident occurred November 15 and disability time is estimated to be 5 to 6 months.

Accident No. 813, Emil Maki, Contract Miner. This man, while working on the ore pile over a raise, was caught in a sudden rush of ore down the raise, and was smothered by a considerable quantity of ore which ran in on him. Compensable time lost - 1800 days.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

One new building was constructed at this property in 1941. This was a frame, corrugated metal affair with a concrete curbing and floor, which was necessitated by the new "collar to collar" checking system. Erected a few feet south of the shaft, this building now serves as a combination waiting room, check room and fuse cutting building and does away with the considerable amount of travel time formerly necessary between the old check room and the shaft. Several items of new construction are contemplated for 1942, these are the erection of a suitable protective structure at the collar of the old Section 6 airshaft, a new protective fence around the shaft and suitable fencing at strategic points around the mine surface.

13. EQUIPMENT & PROPOSED EQUIPMENT

There were a number of pieces of new equipment added to the inventory during 1941, some of which were purchased under E&As and the others absorbed in operating cost. The equipment purchased under E&As are listed below:

No. 857, Pumping Plant - 5th Level. The installation of this equipment was started in 1940 and completed during the current year at a total cost of $23,585.17.

No. CC-53, Trail Builder and Dump Truck. The Trail Builder was purchased at a cost of $945.64 and is used in connection with the Cletrac Tractor for miscellaneous operations such as road maintenance, cleaning up around the stockpile, etc. The one and one-half ton dump truck was also purchased under the above E&A at a total cost of $1,188.07.

No. CC-73. The new check building which has been previously described was constructed under the above E&A at a total cost of $1,058.66.

No. CC-80, Nordberg-Butler Underground Mechanical Shovel. This piece of equipment was purchased at a cost of $2,743.00 for use in connection with driving underground drifts.

The more important items of additional equipment purchased during the year are listed below:

Two - JB-5 Wet Type Jackhamers at $215.00.each.

Two - H-111 Wet Type Jackhamers at $215.00 each.

The above four machines were used in the shaft sinking operation.

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13. EQUIPMENT & PROPOSED EQUIPMENT (Cont.)

One - HC-20-D Auger Drill at $190.00.

Three 2½ H.P. Anaconda Mine Fans at $137.00 each.

Three - 5 H.P. Fan Motors at $230.00 each.

One - No. 7 Sludge Pump and One Size 35 Sump Pump, both of which were used in the shaft sinking operation.

In addition, two new hoisting ropes and a used one from the Negaunee Mine were put into service during the year.

In addition to the above, one underground locomotive was transferred from the Gardner-Mackinaw Mine as were a number of second-hand two-ton dump cars. This equipment was necessary for shaft sinking operations.

Present plans call for the acquiring of several new pieces of equipment during 1942, among these are four new automatic feed 3½" drifters and a Jumbo Drill Rig, one additional underground locomotive and six or eight four-ton cars. All of this equipment is necessary for the driving of the new 8th Level drift which will be started in the latter part of the year. It will also be necessary to purchase a new chlorinating machine, the authorization for which has already been approved.

14. MAINTENANCE & REPAIRS

Underground repair work during the year was considerably heavier and more expensive than usual due to the stepped up work schedule and the necessity for paying rate and one-half for all weekend work. Maintenance was particularly heavy on the 4th Level which is crushing badly. It is absolutely necessary that this drift be kept open since it is the main air-way for the property and carries the power cables for the Section 6 main ventilating fan.

b. Location

Location maintenance would have been considerably lighter during 1941 had it not been necessary to lay a new 6" line some 2,500' in length from the Morris No. 8 surface well to the fire stand-by pump at the Morris shaft. This large expenditure of some $4,400 was necessary to augment the failing water supply on the 2nd Level Lloyd. Deducting this charge from the total for the year leaves some $1,800 as compared with $4,700 in 1940 and $5,000 in 1939.

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14. MAINTENANCE & REPAIRS (Cont.)

b. Location (Cont.)

1. General Maintenance

The following table shows the costs of maintenance of the North Lake Location in 1941 and a comparison with former years.

	Labor	Supplies	Total
1. Prop. Policeman's Time	0	0	0
2. Cleaning	1593.20	14.50	1607.70
3. Sewers & Cess Pools	9.62	121.16	130.78
4. Water		4411.76	4411.76
5. Remove Snow & Ice	0	0	0
6. Fire Hydrants	0	0	0
7. Repair Fences	0	0	0
8. Water Mains	9.03	44.41	53.44
9. Water Tank		7.14	7.14
10. Recreation Grounds		39.33	39.33
11. Cleaning Toilets*	0	0	0
12. Location Xmas Tree		2.87	2.87
13. Fire Protection		8.64	8.64
Total	1611.85	4649.81	6261.66

Year - 1940	4720.39
1939	5044.89
1938	5272.04
1937	6109.82

*Included in No. 3.

One considerable saving in the above items as compared with previous years was the proportion of the mine policemen's time. Due to the necessity of guarding the property more carefully, the watchmen now spend all their time on the premises and no longer go over to the Location.

The custom of providing an illuminated Christmas tree for the Location was continued.

2. Rented Buildings

The expenditures for maintenance on rented buildings was much lighter than usual due to the fact that most of these dwellings were sold to their occupants during 1940 and 1941.

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14. MAINTENANCE & REPAIRS (Cont.)

2. Rented Buildings (Cont.)

Company ownership remained in only 12 of the 117 residences of which six were sold during 1941. At the end of the year the Company still owned four half houses and two cottages or six residences in all. Several of these will probably be sold in 1942. The total expenditure on rented buildings as compared with 1940 and 39 is as follows:

1941	$1,145.53
1940	4,323.23
Decrease	3,177.70

1941	$1,145.53
1939	8,498.58
Decrease	7,353.05

By far, the largest portion of the above expenditure was incurred in the maintenance of the Superintendent's residence in the location. In addition to the six dwellings and the Superintendent's residence, the Company still owns the store building which is rented to J. B. Casper at $50.00 per month.

The North Lake Club House, the expense of which is carried as district welfare, required a considerable amount of maintenance and repair expense . The expense incurred was $2,250 as compared with $17.00 the previous year under this same heading. This had the effect of increasing the total deficit from $3,642 in 1940 to $5,317 in 1941. Most of this added maintenance expense was incurred in the installation of a new roof and extensive redecorating in the interior of the building, both of which were very badly needed.

15. POWER

There was one slight reported production delay of two and one-half hours due to the lack of electric power during a severe electrical storm. The increased production schedule had the effect of materially increasing the total amount of power consumed. This increase in total consumption had the effect of decreasing the rate from .01442 to .0138 per K.W.H. and was accomplished in spite of the peak load carried by running the new 5th Level pump.

	Total K.W.H.	Cost	Rate
1941	3,631,200	50,289.84	.0138
1940	2,516,400	36,282.72	.01442

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16. WATER SUPPLY

The mine and location water supply which in former years has been obtained from the 2nd Level Lloyd, decreased very rapidly during the dry months and continued to decrease throughout the remainder of the year. The use of increasingly large amounts of water from the Carp River proved too much for the chlorinating plant on the 2nd Level and it was necessary to install another machine which was borrowed from the Gwinn district. This chlorinator will be replaced by a new one which will be installed early in 1942. The use of the river water from the Carp made it necessary to chlorinate very heavily up to the point where the water was very disagreeable and discolored although proved safe for domestic use. Accordingly, a 6" line some 2,500' in length was installed between the Morris Mine surface well No. 8 and the Carp River pump. The water obtained from this surface well is pumped from ledge some 180' below the surface and is very cold and clear and requires little or no chlorination.

Some maintenance and repair work was necessary on the large concrete reservoir which serves the location and in the next few years it will probably be necessary to replace both the tank and the pipe line between the tank and the location due to probable subsidence in the main top slicing area.

17. CONDITION OF PREMISES

The premises was maintained in excellent condition with the exception of a period during the spring break-up when there was an unavoidable excess of mud. The lawn and flower gardens were maintained in their usual attractive condition although little new planting was done. With the exception of the large expenditure for the new pipe line, very little maintenance work was done at the Location, this work having been taken over by the County Road Commission. The new roof on the club house and exterior decorating have improved the appearance of this building considerably and it is planned to do a small amount of work on the club house grounds early in the summer of 1942.

Plans are going forward for the installation of a sanitary and storm sewer system at the location which has been badly needed for a number of years. It is hoped to accomplish this by means of a combined Federal Public Works and township project, administered by the County Road Commission.

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18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Per Cent
Finnish	74	38	112	35
American	72	0	72	22
Italian	24	34	58	18
French	23	1	24	8
English	16	4	20	7
Swedish	14	4	18	6
Norwegian	8	0	8	2
Austrian	3	1	4	1
Jugoslavian	1	2	3	1
Belgian	1	0	1	-
Czechoslovak	1	0	1	-
	237	84	321	100

In most cases, the percentages as to nationalities remained practically the same as for the preceding year.

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1. GENERAL:

The record of events leading toward development of the Section 2 ore reserve began on January 6th with the start of shaft sinking operations, the temporary surface plant having been built late in the previous year. Then followed completion of the railroad spur to the property on January 22nd, and the concreting of the shaft in the diorite ledge March 28th. Sinking in the rock was resumed on that date, and average progress for the remainder of the year amounted to 103' per month to a depth of 1035' on December 31st.

Construction of the permanent surface buildings started May 19th under contract with the Austin Co. This work was well underway when on August 1st, with appropriate ceremonies at the shaft, the Section Two Development was formally named the Mather Mine in honor of Mr. William G. Mather. The buildings were virtually complete at the end of the year, and installation of machinery was proceeding on a schedule that anticipated use of the permanent cage hoist within 4 to 6 weeks. Although erection of the huge steel headframe by the Worden-Allen Co. was delayed by difficulty in obtaining plate, construction started in October and had advanced far enough to provide temporary mounting for a 12' head sheave which will be used while the remainder of the headframe is under construction.

Diamond drill exploration to further outline ore limits was resumed in July. Two holes north of the previously known reserve and about 1/2 mile northeast of the shaft were drilled from surface, and in December one hole located 40' of ore before entering ferruginous slate. The outcome of the other hole is therefore being awaited with interest.

3. ANALYSIS:

The shaft entered iron formation at a depth of 457'. This first sample returned an analysis of 31.00 iron, .063 phos. and .011 sul. Subsequent analyses made at intervals of approximately 50' to the 1035' depth showed a surprisingly small variation in the iron content. The upper limit was 35.3% iron at 485', and the lowest sample 27.40% iron at 770'.

4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

The geological department in December 1939 estimated approximately 7,000,000 tons of ore developed by drilling in the S½ of the NE¼ of Section 2. The composite analysis of this ore was 60.75 iron, .139 phos., 5.80 sil., and .016 sulphur. Drilling in 1940 added the considerable thickness of ore intersected at deeper horizons by

holes 44 and 45 in the SE¼ of the section, and in 1941 one of 2 holes, drilling had located ore higher on the dip in the N½ of the NE¼.

Last year's report commented on the fact that the tonnage listed above had already been increased appreciably by the deep drilling, and that future possibilities were enormous. This was further emphasized by locating ore in the NE¼. An estimate of the approximate reserve developed by this widespread drilling, however, must be deferred until additional knowledge is gained regarding the structural relationship of the deposits.

5. LABOR AND WAGES:
a. Comments:

The mine labor situation was satisfactory, but both the building and headframe contractors had difficulty in obtaining certain classes of skilled labor. This was particularly true of bricklayers, plumbers, and structural steel workers. The Austin Co. had use for about 20 to 30 bricklayers, but throughout the construction period were unable to procure more than about half this number. The steel foreman for the Worden-Allen Co. was handicapped by a shortage of competent steel workers, but this difficulty was being overcome at the year end. The large over-supply of common labor continued, although the proportion was reduced this year by the high industrial activity rate.

The surface and underground crews for the shaft sinking period were largely men of known capabilities and experience transferred from other Company mines. A very high percentage of these men were members of the Marquette Range Industrial Union, and on December 12th, the Company signed a one year contract granting the union exclusive bargaining rights for the Mather Mine employees. Conferences with the union representatives in regard to grievances and adjustments have been mutually satisfactory, and it is hoped the contract will insure a continuance of this workable and pleasant relationship.

The basic wage schedule of 62½¢ per hour, with rate and one-half for time worked over 8 hrs. per day or 40 hrs. per week, that has been in effect since March 16, 1937 continued until April 1, 1941. On that date a blanket increase of 10¢ per hour brought wages to a new high level for all classifications. The daily company account shaft miner's rate was increased from $7.00 at the start to $7.20, and then to $8.00 on April 1st. The crews have averaged well above this figure, however, on their footage contract rate in the diorite and jasper formations.

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b. Statement of Wages:

	1941	1940 (x)
Number of Shifts & Hours	17 1 8-hr. 47 2 8-hr. 239 3 8-hr.	
Average No. Men Working		
Surface	31	25
Underground	34	
Total	65	25
Average Wages per Day		
Surface	6.51	5.53
Underground	10.33	
Total	8.41	5.53
Wages per Mo. of 25 Days		
Surface	162.75	138.25
Underground	258.25	
Total	210.25	138.25
Labor Cost per Ft. of Sinking		
Sand & Rock	144.91	
Total No. of Days		
Surface	10,570¼	2,326
Underground	9,528½	
Total	20,098 3/4	2,326
Amount for Labor		
Surface	68,860.38	12,860.04
Underground	98,507.75	
Total	167,368.13	12,860.04

(x) September to December only in 1940.

6. SURFACE:

a. Tracks:

The Lake Superior and Ishpeming Railroad Co. track, from the switch on the main line at Bluff St., Negaunee, to the shaft site was completed January 22nd. The first carload of material, corrugated sheets for the shaft lining, was switched in the next day. This first track to the mine will be the center stockpile track east of the shaft in the future, but during the year it connected 3 temporary sidings for the construction period. The first of these extending in a northwesterly direction served the shaft and headframe erection; the center extension supplied materials to the middle of the building site, the track being shortened as building advanced; and the third siding was laid in September on a grade which entered the southeast corner of the engine house to serve with the advantageous combination of an overhead traveling crane for machinery delivery and erection in this building.

The railroad company also completed a portion of the fill necessary for the pocket tracks west of the shaft, using excess material from construction in Section 1. Grading for the pocket tracks, passing and timber tracks is expected to be resumed in the Spring when the temporary shaft buildings have been dismantled and removed.

b. Buildings:

The temporary surface plant for the initial sinking period was completed in December 1940 except for alterations and additions to the rock house and timber headframe which were necessary when the shaft timber and manway tunnels were under construction.

Outline plans for the permanent mine buildings were approved in January, and a contract for completing the design and construction of the buildings was awarded the Austin Co. of Cleveland one month later. The engine house was located south of the shaft with the change house forming the west side of the U-shaped plan, and the shops the east side. These 3 sections are each 60' wide, and 240', 260' and 200' in length respectively. The office building, 30' x 80', is located west of the change wing and connected through a vestibule to the street clothes section for cleanliness. The underground clothes section of the change house connects to the shaft cage compartment through 2 tunnel ramps, and the whole is arranged so that men coming to work advance through the building from the south toward the shaft ready for lowering into the mine.

The buildings are of attractive modern design, faced with brick and glass blocks, and of fireproof construction throughout. The change wing is lined with glazed tile, the shop wing with clay tile, and the engine house with painted cincrete blocks; all affording excellent insulation for the built-in heating and air conditioning systems. The buildings are of sufficient size to house a mine crew of over 800 men, and it is probably safe to say the structural permanency and accomodations provided are unsurpassed among mine buildings anywhere.

Excavation for the dry and shop wings was started by the Austin Co. May 19th, and before the month was over a large part of the concrete footing for the west wing was poured. Construction of these 2 wings went along unhindered, but lack of reinforcing steel delayed pouring the concrete walls and footings in the engine house so that this section was delayed about one month. The difficulty would have been corrected but for the fact that the Austin Co. after August 1st, found it impossible to procure additional bricklayers. The total force at that time numbered nearly 100 men, the roofing, plumbing and electrical sub-contractors having started their work in July. Excepting the engine house, the building exteriors were completed by September 1st, and this was followed by construction of the shaft connecting tunnels and by enclosure of the engine house late in October. Interior building construction proceeded rapidly with the heating system turned on November 8th, and the buildings were finished December 27th, except for a few minor wiring and piping details.

The Austin Co. also constructed machinery foundations in the engine house, turn sheave piers under the back legs of the headframe, and the concrete base for the Cliffs Power and Light Co. substation. The actual time for these and numerous other change orders on the original contract was allowed the Austin Co. because of the fine cooperation of their construction force. This, in return, reduced their extended time penalty about one-half.

Although the buildings were ready for occupancy before the end of the year, all efforts were concentrated on erecting and installing machinery and electrical equipment in the engine house. It is expected that furnishings and equipment will be arranged for the office, dry and shops so that these sections will come into use during the first half of 1942.

c. Headframe:

The contract for the fabrication and erection of the permanent steel headframe and trestle leads was awarded the Worden-Allen Co. in January. The design of this structure was completed at that time, and the copper bearing steel shapes and plate ordered shortly thereafter, but it was not until the latter part of September that the steel was made available under the 2-A priority and erection started. Meanwhile 42 reinforced concrete piers had been constructed by the mine crew, and 2 by the Austin Co. to support the headframe, east trestle lead and the rock trestle. The immense column loads at the shaft collar and the back legs were distributed by steel grillages integral with the tops of these foundations. The weight of the back legs was used to counteract the pull on the turn sheave foundations by joining the footings of these piers with 12" steel I-beam grillages in addition to other heavy steel reinforcing.

The first carload of steel for the headframe arrived at the mine October 7th, and erection of the base columns started immediately. Construction was carried as high as the landing floor, including the pockets, and riveting of this section then got underway while the back legs were joined to the next lift of the main structure at a height of 118'. The Worden-Allen steel crew numbered only 6 men at the start, but a few more men were added in December and progress was satisfactory at the year end. A temporary mounting for a 12' head sheave had already been provided above the landing floor so that sinking can continue, using the permanent cage hoist after January 1942, while the remainder of the headframe is being erected.

d. Roads:

The road to the mine was improved starting at the section line at the east end of Wabash Street in Ishpeming. The location was changed by aligning a 10° curve to 9th Street and continuing due north to the front of the office building. The curve was graded, rock filled and gravel coated at low cost, using a rented tractor and 12 cu. yd. LeTourneau scraper. The depression southwest of the buildings will be filled in the future as the shaft rock fill now

being made south of the building extends in this direction. Paving the first section of the road in the summer of 1942 will provide an attractive all-weather entry to the mine from Ishpeming.

e. Transmission Lines:

The permanent power sub station was built in October near the Southeast corner of the engine house. Several poles were changed to run the 30,000 volt line to the transformers, and the former line continued in use to supply 2300 volt power to the temporary engine house north of the shaft. The main feeders from the transformer station to the basement of the engine house were enclosed below ground in a concrete conduit to preserve the unbroken line of the south building wall.

Power, signal, and lighting conduits have been installed in the building to take care of expected future needs, and inserts provided in the connecting tunnels for the headframe and shaft cables.

7. UNDERGROUND:

a. Shaft Sinking:

Ground was broken for the Mather shaft on the morning of January 6th by Mr. S. R. Elliott, Manager, after a short but impressive ceremony to mark the opening of this future large property. Work was started on a single shift schedule with the object of sinking to a depth of 100' to be ready to place shaft steel which was expected the beginning of March. The schedule was increased gradually to 3 shifts and actually worked out almost to the hour, the surface temporary steel bearer set being unloaded directly from the car March 7th into position at the shaft collar.

The shaft had been timbered 2' outside the steel to a depth of 55', sinking through gravel and quicksand by a combination drop shaft or timbering on the bottom. Three hitches had been cut in the rock for concrete, the bottom one at a depth of 88', and after hanging 13 sets of steel, 388 cu. yds. of concrete were poured to a construction joint 20' below the collar set. Sinking was resumed in the diorite March 29th, entered the jasper at a depth of 457' on July 29th, and continued in this formation to a depth of 1035' at the end of the year. Average progress in the diorite and jasper amounted to 103' per month. A total of 143 sets of steel were installed to a depth of 1000', and 908½ cu. yds. of concrete poured to support the steel including the quantity at the shaft collar, forming the 4 central headframe piers and the tunnel entrances.

The detailed review of sinking operations follows:-

1. Drilling:

Six Cleveland and 6 Ingersoll-Rand 65-lb. sinkers were bought in March on the basis of thorough tests run on 3 weights of 5 makes of drilling machines. These machines gave an excellent account

of themselves, drilling thousands of feet in the diorite and jasper with an almost negligible repair cost in 1941. One inch quarter octagon drill steel was used with standard, Sibley or Copper Country type 1 jackbits in the different hardnesses of rock.

The depth of cut in the diorite ranged from 4' to 10.5', and averaged 8.5' in normal ground. The small Copper Country 1-5/8" and 1-3/4" jackbits improved penetration in this hard rock, there being less than 1/8" gauge loss with 1/2" to 5/8" loss on the cutting edges in 6 or 7 usages of the bit. Several cuts in extremely hard diorite required the sharpening of over 900 bits, and the average was about 600. About 72 vertical holes were drilled, using the 9" churn drill hole as the initial opening to a depth of 337', and a combination burn and V-cut below.

The standard 2-1/8" and 2-1/4" jackbits finally came into regular use in the jasper after experimenting with the Sibley jackbit and the Timken standard. The depth of cut in iron formation was reduced to 6½' to mimimize hole caving, but the full round of 70 to 72 holes continued to secure good breakage.

The drill header was lowered, or raised out of the way of the blast, by an air hoist moved down the shaft in 100' intervals. The header connected individual line oilers, air and water hoses for 12 drilling machines, plus 2 air lines for pumps. Bowes snap-on couplings and Cleco valves were used at the drilling machines and with this arrangement drilling was underway on the shaft bottom in from 15 to 20 minutes after the completion of mucking.

2. Blasting:

Immediately after drilling, holes were blown with compressed air and charged with 90% and 80% strength dynamite in about equal proportions. Electric delay caps detonated the charge, the use of instantaneous caps being cut out shortly after sinking started because of misfires. Delays ranged from 1 to 12, the 12' lead wires being connected in parallel to a tinned copper bus wire, and the bus wire to the separate blasting cable extending up to the shaft collar. The shift boss had sole responsibility for the blast, and after all connections were checked, the men rode to surface where the boss unlocked and threw the blasting switch which was always shorted in the off position.

Powder consumption was about 300 lbs. for a 6½' cut in the jasper, and this resulted in about 140 cu. yds. of broken rock in the shaft bottom. The use of 90% powder was vitally necessary in the diorite, and resumed in the jasper after it was found that larger size rock pieces resulted when 80% and 60% strengths were used.

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The statement of explosives used in 1941 follows:-

Kind	Quantity	Avg.Price	Amount
50% Gelatin Extra	50	.115	5.75
60% " "	5,000	.115	575.00
80% " "	28,789	.14	4,030.46
90% " "	17,750	.165	2,928.75
Total Powder	51,589	.146	7,539.96
Elec. Blasting Caps	11,517	.1301 ea.	1,499.13
Connecting Wire	33	.45 lb.	14.85
#14 Duplex Wire	6,750	15.77 MFt.	106.50
#1 Powder Bags	6	1.35 ea.	8.10
#14 Tinned Copper Wire	598	.1538 lb.	91.99
Total Caps, etc.			1,720.57
Total All Explosives -			9,260.53

3. Mucking:

The shaft was usually cleared of blasting smoke in from 30 to 45 minutes after blasting. The crew then cleaned down the shaft steel and trimmed loose rock from the side walls. Mucking was done by hand, shoveling or scooping into a 1 cu. yd. tray on the rock pile. The tray was raised by an I-R model KUA air hoist along the side of the sinking cage where 2 prongs on the front of the tray engaged the rock slide on the cage, tilting the tray upward to discharge its load into a 2 cu. yd. car. The process was repeated and the cage sent to surface for an empty car while the first tray for the next load was being filled.

The original intention was to muck mechanically, using a Nordberg-Butler shovel to load the tray. The shovel worked well in the gravel surface material, but difficulty was encountered in rooting up chunks in the diorite in spite of the fact that blasting was as heavy as possible. The loader was then tried for part of the mucking cycle (after trimming walls thoroughly and before cleaning up the bottom) and here again the competition of 12 men, any one or two of which could spend time digging up chunks while the others filled the tray, showed that the shovel did not keep pace unless the dipper was filled on the first or second stroke. It was quite disappointing to find that a loader could not be converted to some use in shaft sinking when they have been so successful in Company drifting operations. The care used in selecting the men for the shaft crews, however, was repaid by the fact that their hand mucking for the year was at the rate of nearly 0.8 cu. yd. per man hour.

4. Installing Steel:

The steel sets were carried at a distance of from 15' to 45' above the blasted shaft bottom, depending on the walls. At least every third set was concreted, and the usual proceedure was to place and block 2 sets at a time, and then follow this after blasting by

installing one set and concreting. The shaft crews worked on a steel stage set lowered by four one-ton chain blocks, and this was covered over with 3" fir planks when installing steel. The outline stage set was always below the bottom set and therefore furnished protection when blasting. Bearer sets, composed of four 12" 50-lb. I-beams concreted in hitches cut in the rock walls, were spaced at intervals of about 175', and these together with the concreted sets provide vertical support for the shaft steel, pipes and conduits. The shaft steel was completed to a depth of 1000' as sinking progressed, except for the installation of the 80-lb. skip rail guides and the ladder road screening.

The importance of properly aligning the steel for future heavy duty hoisting has been borne in mind from the start. Two things that have aided greatly in this respect have been the small screw jacks used to block the steel while the concrete hardened, and the circular lining discs, invented by Captain Anderson, to quickly and accurately line each new set with the last concreted set above. The engineering department checked the vertical alignment of the shaft steel at each bearer set, and at the last one (979' depth) found the steel to be within 1/16" of the vertical in an east-west direction, and 1/4" south of the collar set.

5. Concreting:

The original intention of blocking each set with sacked concrete was augmented in the diorite to include the pouring of a beveled concrete ring at least at every third set. The blocky north wall particularly needed this support, although the shaft steel was amply secured in the always tight corners. The mixing of concrete was rigidly controlled to insure high strength, and a study of the support furnished by these sets indicated they were stronger than steel bearers at 100' intervals. The maximum 21' distance was chosen for two reasons: first, to insure safety for the men in the sinking operation by completely closing the opening outside the steel, and second, to guide the 18' skip bails on steel backed up by concrete throughout the full depth of the shaft. The shaft crews became so adept at placing concrete in forms hook bolted to the steel, that concrete was placed wherever there was the slightest question as to necessary future support in both the diorite and jasper formations.

The shaft was concreted in the ledge before sinking in rock was resumed the latter part of March. Steel sheet piling was driven outside the shaft limits below the 20' construction joint, and the complicated upper section, including the 4 tunnel entrances, 4 offset central headframe column piers and heavy reinforcing as designed by the Bethlehem Steel Co. engineering department, was then poured in June. The work was completed with a minimum of interference with the shaft sinking, only 2 shifts being lost when the shaft crews placed the inner 3" fir forms on May 31st. The concrete poured for this upper section amounted to 210 cu. yds., or a total of 598 yds. to the 90' depth carrying the headframe column loads into the 3 rock hitches. The Austin Co. joined the 2 tunnels connecting the shaft and buildings in October and November.

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6. Ventilation:

Forced ventilation to within a few feet of the shaft bottom was supplied by a 5 H.P. Coppus fan on surface discharging into the 14" counterweight pipe and flexible Ventube extensions. About 3,000 CFM circulated across the shaft bottom, and air conditions have been so good and dust counts so low that the men have not been required to wear respirators since the shaft has been in iron formation. The ventilation partition between the skip and ladder roads was sealed shortly after entering the jasper by placing sacked concrete at the ends of the 3/16" plates to fill up the opening to the rock walls. A stack effect was first secured by housing the skip roads, and later by enclosing the temporary headframe over the cage road as a protection under the Worden-Allen steel crew. Natural ventilation started on October 22nd, and has since continued during the cold weather at a rate of about 15,000 CFM.

This reduced the blasting time considerably, the men reentering the shaft usually about 30 minutes after blasting in a near normal atmosphere. Added to the rapid air change were 2 combination air and water sprays used to wet down the muck pile and take any remaining traces of gas into solution. The initial heavy spray wet the pile so thoroughly that it aided the men throughout the mucking period.

7. Pumping:

The ground water level was disclosed in the sand at 42', and about 14 gals. per minute raised by air pumps until the concrete seal was completed above this point. The shaft then remained virtually dry through the diorite and to a depth of 480' in the jasper. The flow entering the north wall then built up gradually to about 10 gals. per minute, and as sinking progressed the quantity remained about the same, decreasing overhead as new channels were opened below.

Three automatic electric centrifugal pumps were handling the shaft water at the year end. The first, an I-R 2-stage 40 g.p.m. motor-pump at 460'; the second, a duplicate at 923'; and the third an Allis-Chalmers single stage shifting down to its limit of 150' below the second. The water pumped by an air pump from the shaft bottom enters sludge settling tanks ahead of the 2 lower centrifugals, and these are cleaned about every second day. The life of centrifugal pump impellers has thus been lengthened to nearly 2 months, but nevertheless pumping difficulties caused by sludge, automatic float switch or power failure, etc., have been the most frequent cause of shaft delays during the past 4 months.

Drain holes have been provided at each concrete set to carry the water along the rock walls outside the corrugated lath. In this way most of the water is led directly to the pumps without reaching the shaft bottom, resulting in enormously improved working conditions for the men.

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8. Progress:

The following table shows the progress of sinking in sand and rock for the year 1941:-

Month Month	No.Days Worked	Foot-age	No.Cuts Blasted	No.Steel Sets In-stalled	No.Sets Concreted	Cu.Yds. Hoisted	Advance per 24-hr. Day
January	21	35				900	2.8'
February	24	52	8			1584	2.5'
March	26	20	3	13	10	701	2.5'
April	26	75	11	9	3	2004	3.0'
May	27	84	11	13	4	2238	3.3'
June	26	107	13	13(b)	7	2698	4.3'
July	25	90	14	16	5	2466	3.8'
August	26	109	20	14(b)	5	2434	4.4'
September	25	117	20	17(b)	5	2506	4.8'
October	27	121	20	18	10	2754	4.8'
November	24	106	17	14(b)	6	2562	4.7'
December	26	115	19	16(b)	10	2706	4.9'
Total -	303	1031	156	143	65	25553	

The 4' concrete addition to the shaft collar in July resulted in the total depth of 1035'. The cu. yds. of material hoisted amounted to 1461 of sand and gravel in January and February from 45' of sinking in surface material, and 24,092 yds. of rock during the balance of the year. (b) indicates bearer set.

The time of each cycle in the sinking operation may be of interest. The time division for each of the 19 cuts blasted in December showed the following average:-

Drilling	-	3-1/2 hours
Blasting	-	2 "
Trimming Walls	-	1-1/4 "
Installing Steel	-	3-3/4 "
Concreting	-	2-3/4 "
Mucking	-	15 "
Delays	-	1/4 "
Total -		28-1/2 hours for a 6½' cut, three 12 man crews.

8. COST OF OPENING, EQUIPPING AND DEVELOPING THE MATHER MINE:

A revised estimate of the cost of developing the Mather Mine to the production stage was prepared late in January. The account was opened under Master E&A NM-10, classified under the standard headings of sinking, drifting, temporary and permanent buildings, etc., and then further divided into sub E&A's numbered as high as 10-26 at the end of the year.

The following page lists the detailed cost of the shaft sinking operation.

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a. Shaft Sinking:

	ESTIMATED COST	SUB E&A'S AUTHORIZED NO.	AMOUNT	EXPENDITURE TO 1/1/42	COST PER FT. IN ROCK	AMOUNT UNEXPENDED
1. GENERAL EXPENSE						
Insurance				955.49	.97	
Engineering				5,392.29	5.47	
Analysis				911.89	.92	
Mine Office				4,674.04	4.74	
Central Office				11,075.52	11.24	
Superintendence				10,796.20	10.96	
Legal				182.57	.18	
Personal Inj. Exp.				1,647.16	1.67	
Social Sec. Taxes				7,171.72	7.27	
Employees Vaca. Exp.				3,504.93	3.55	
Total -	97,000.00	NM-10-13	97,000.00	46,311.81	46.97	50,688.19
2. MAINTENANCE						
Buildings				344.22	.35	
Shop Machinery				140.93	.14	
Boilers, Heating				159.53	.16	
Hoisting Machinery				827.95	.84	
Compressors & Pipes				997.20	1.01	
Pumps				1,175.78	1.20	
Total -	9,000.00	NM-10-14	9,000.00	3,645.61	3.70	5,354.39
3. SINKING IN SAND						
Steel Sets & Lath		NM-10-5	1,511.00	1,438.65		72.35
Drainage Well		NM-10-11	1,896.00	1,896.00		
Sinking	)			10,772.78)		
Timbering	)			1,226.98)		
Concreting & Forms	)			2,449.37)		
Install. Steel Sets	)			609.20)		
Miscl. Expense	)			)		
Compressor	)	NM-10-15	11,593.00	260.78)		4,709.44
Hoisting	)			402.23)		
Sand Disposal	)			287.09)		
Dry House Expense	)			294.01)		
Total	15,000.00		15,000.00	19,637.09)		4,637.09
4. SINKING IN ROCK						
Steel Sets & Lath		NM-10-5	141,683.00	53,939.65	54.71	87,743.35
Sinking	)			98,987.68	100.38)	
Timbering	)			3,056.47	3.10)	
Concreting	)			13,486.60	13.68)	
Install. Steel Sets	)			17,744.84	18.00)	
Miscl. Expense	)			)	)	
Compressor	)	NM-10-16	396,317.00	7,120.28	7.22)	227,555.64
Hoisting	)			9,792.59	9.93)	
Pumping	)			3,688.94	3.74)	
Rock Disposal	)			7,758.15	7.87)	
Dry House Expense	)			5,944.25	6.03)	
Ventilation Seal	)			1,181.56	1.20)	
Total -			538,000.00	222,701.01	225.86	315,298.99
Cost per foot, 986' Rock					276.53	
Estimated Cost per foot					248.60	

The total cost of $276.53 per foot of sinking in rock is made up of $141,139.59 (53%) for labor, and $125,227.68 (47%) for supplies.

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The total estimate of the cost of opening the property was $2,621,863.00, and nearly $2,000,000 of this amount was authorized in 1941. The sums for cutting pockets, drifting, and haulage equipment have not yet been requested. The total expenditure to date amounted to $1,112,322.38 and the following pages list the remaining details.

b. Developing & Equipping:

	ESTIMATED COST	SUB E&A'S AUTHORIZED NO.	AMOUNT	EXPENDITURE TO 1/1/42	AMOUNT UNEXPENDED
5. DRIFTING TO ORE BODY					
Drifting & Timbering	240,000.00				
6. PLATS AND POCKETS (In Shaft 3 Levels)					
Cutting Out, Pockets & Mech. Devices	66,000.00				
8. PREPARING SITE					
Roads & Landscaping	5,000.00	NM-10-17	5,000.00	480.97	4,519.03
Move Two Houses	3,458.00	NM-10-2	3,458.00	3,458.00	-
Total	8,458.00		8,458.00	3,938.97	4,519.03
9. TEMPORARY EQUIPMENT					
Rotary Dump & Cars	)			1,038.56)	
Sinking Cage	)			1,446.05)	
Shaft Pumps	15,000.00)	NM-10-18	15,000.00	2,293.80)	5,730.83
Ventilating Fan	)			275.87)	
Chain Hoists & Miscl.	)			4,214.89)	
Truck and Tractor	18,575.00	NM-10-1	18,575.00	18,289.42	285.58
Temporary Buildings	31,130.00	NM-10-3	31,130.00	26,150.45	4,979.55
Initial Shop Equipm.	5,700.00	NM-10-4	5,700.00	5,732.73	32.73
Total	70,405.00		70,405.00	59,441.77	10,963.23
10. PERMANENT CONSTRUCTION AND EQUIPMENT					
Timber Tunnel & Tracks				1,832.45	
Power Drills					
Pump House & Sump					
Total	31,000.00	NM-10-20	31,000.00	1,832.45	29,167.55
11. PERMANENT BUILDINGS					
Headframe					
Foundations	)			12,247.12)	
Ore Trestles	)	NM-10-21	44,979.00	1,581.73)	31,150.15
Structure		NM-10-7	154,957.60	67,491.00	87,466.60
Main Building					
Main Dry Wing	)	NM-10-10		)	
Power House Wing	)	&	268,937.00	263,596.27)	5,340.73
Shop Wing	)	NM-10-19		)	
Office Wing	)			)	
Docks, Trestles, Pockets					
Permanent Trestles		NM-10-7	29,789.00	5,364.00	24,425.00
Total	489,000.00		498,662.60	350,280.12	148,382.48

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	ESTIMATED COST	SUB E&A'S AUTHORIZED NO.	AMOUNT	EXPENDITURE TO 1/1/42	AMOUNT UNEXPENDED
12. EQUIPMENT					
Headframe					
Headframe Elevator		NM-10-12	4,658.00		4,658.00
9 - 12 Ft. Sheaves	)			11,124.77)	
No. 16 Crusher	)			11,566.22)	
Miscellaneous	)			2,020.01)	
Power House	)			)	
Foundations & Erecting	)	NM-10-22	164,706.00	16,984.01)	66,152.55
Switchboards & Cables	)			44,583.42)	
Motor Generator Set	)			4,990.48)	
Skips & Cages	)			64.75)	
Counterweight	)			7,219.79)	
Cage Hoist	)	NM-10-6	143,000.00	54,000.00)	
Skip Hoist	)			89,000.00)	
Traveling Crane		NM-10-9	8,500.00	8,894.94	394.94
Hoisting Plant		NM-10-8	221,783.00	110,891.50	110,891.50
Total	542,647.00		542,647.00	361,339.89	181,307.11
Compressor Plant					
Compressor				13,217.58	
Motor & Controls				14,746.62	
Foundations				3,526.52	
Air Lines				6,123.22	
Erecting				695.27	
Cooling System				778.85	
Total	55,000.00	NM-10-23	55,000.00	39,088.06	15,911.94
Shop Equipment				1,373.35	
Office Equipment				79.82	
Change House Equipm.				1,762.12	
Total	60,000.00	NM-10-26	60,000.00	3,215.29	56,784.71
Top Tram					
3 Larry Cars					
Total	40,000.00	NM-10-24	40,000.00		40,000.00
Electric Haulage					
Locomotives					
Cars					
Loaders					
Haulage Sets					
Total	90,000.00				
Pumping Plant					
Water Column				295.48	
Discharge Pipe				329.72	
Erecting				265.11	
Total	32,000.00	NM-10-25	32,000.00	890.31	31,109.69
Total Equipment	819,647.00		729,647.00	404,533.55	325,113.45

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SUMMARY

	ESTIMATED COST	E&A'S AUTHORIZED AMOUNT	EXPENDITURE TO 1/1/42	AMOUNT UNEXPENDED
1. General Expense	97,000.00	97,000.00	46,311.81	50,688.19
2. Maintenance	9,000.00	9,000.00	3,645.61	5,354.39
3. Sinking in Sand	15,000.00	15,000.00	19,637.09	4,637.09
4. Sinking in Rock	538,000.00	538,000.00	222,701.01	315,298.99
5. Drifting to Ore Body	240,000.00			
6. Plats & Pockets	66,000.00			
8. Preparing Site	8,458.00	8,458.00	3,938.97	4,519.03
9. Temporary Equipment	70,405.00	70,405.00	59,441.77	10,963.23
10. Perm. Constr. & Equipment	31,000.00	31,000.00	1,832.45	29,167.55
11. Permanent Buildings	489,000.00	498,662.60	350,280.12	148,382.48
12. Equipment	819,647.00	729,647.00	404,533.55	325,113.45
Total	2,383,510.00	1,997,172.60	1,112,322.38	884,850.22
10% for Contingencies	238,353.00			
Grand Total	2,621,863.00	1,997,172.60	1,112,322.38	884,850.22

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Diamond drilling was resumed in July for the purpose of gaining information that will assist in planning upper level elevations while shaft sinking is underway. Drill positions were located with the idea of tracing possible ore extensions upward along the footwall and toward the general direction of the shaft, thus the new holes were north and west of those previously drilled.

Drilling began at hole No. 49 on July 18th, and at hole No. 50 on July 23rd. Hole #49 is located on the top of the diorite bluff approximately 800' north of hole #16, and about 400' west of the center of the N½ of the NE¼ of Section 2. Hole #50 is located on the meridian 650' west of #49, and is about 800' north of hole #38. Drilling was continuous in both holes the balance of the year.

Hole #49 first encountered a small shallow enrichment. Then, after passing through typical jasper formation, it entered 40' of high grade ore from 1565' to 1605' analyzing 63.36 iron and .059 phos. This was followed by transition slate to a depth of 1755', but shortly before the end of the year the hole again entered rich jasper and continued in this formation to a depth of 1778' on December 31st.

Hole #50 cut through the main intrusive sheet in which the shaft started and has had no diorite of any consequence below this intrusion, the bottom contact of which was at 690'. The hole has been in soft ore jasper with occasional runs of hard blue jasper since that time and was 1815' deep at the end of the year. This depth is nearing the horizon where ore may be encountered on the slate footwall comparable to that disclosed in holes #16 and #38, and the results in January 1942 are being awaited with interest.

The run of ore encountered in hole #49 is quite encouraging, and its extension to the west will be followed with at least one more hole. The location of any drilling west of hole #50 must of necessity await the results in that hole.

10. TAXES:

The valuation of Section 2 (excepting the north 660' of the NE of the NE and rights of way) was increased by the State Tax Commission from $227,200. to $500,000. The tentative figure recommended by the appraiser had been even higher, but an appeal to the commission was successful in arriving at the above amount. The comparision of Negaunee Mine Co. taxes paid the City of Ishpeming in 1941 and 1940 follows:-

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		1941 VALUATION	1941 TAXES	1940 VALUATION	1940 TAXES
Section 2, except N 600' of NE of NE and R's of way	Real	480,000.	16,953.50		
	Personal	20,000.	706.40		
	Total	500,000.	17,659.90	227,200.	7,832.72
	Coll. Fee		176.60		78.33
	Total		17,836.50		7,911.05
Mather Mine Pipe Line, parcel in Section 3, 47-27		322	11.37		
	Coll. Fee		.11		
	Grand Total	500,322	17,847.98		

11. ACCIDENTS AND PERSONAL INJURY:

Mather Mine accident number one occured December 12th, and this mishap was one of the keenest disappointments of the year. The accident resulted in a broken leg for Allen Hjelt, shaft boss, when he fell a distance of 14' from the bottom set of steel. The crew had just blasted and were preparing to start mucking when the boss went up to adjust the floodlight and a water drainage hose. As he knelt down on the 6" H-beam, his rubber coat slipped beneath the heel of his boot. When he arose, the pull of the coat tipped him into the shaft where he fell across the bail of the loaded tray, injuring two ribs and breaking his leg above the ankle.

The expected time loss was estimated at 150 days, and the accident classified as a trade risk. The shaft men have cooperated to the fullest extent in every safety measure that seemingly could be devised, and it is earnestly hoped the record may again be extended.

12 & 13 CONSTRUCTION AND EQUIPMENT:

The descriptions under these headings, and the costs involved, appear mainly under the "Surface" and "Cost of Opening" sections. Details are listed by the various sub-E&A numbers in tabular form.

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14. MAINTENANCE AND REPAIRS:

This work was taken care of in the small temporary Shop building north of the shaft, with the overflow and larger jobs sent to the central shops in Ishpeming. Drilling machines were inspected and cleaned between each round, spare pumps were kept in order, and the rented compressor and hoist maintenanced so that there was only one instance where a shaft crew had to be sent home because of equipment failure. This was on October 21st when two pumps failed within 1/2 hour of each other, and the shaft bottom was flooded for 5 hours before work could be resumed.

15. POWER:

There was but one delay from power failure when service was interrupted for 2 hours on May 26th by an electrical storm. Current consumption increased gradually as the shaft deepened and the permanent buildings were connected. The low billing was $107.00 in January and the high $924.30 in December. The following table lists consumption and rates:-

CONSUMPTION 1941 K.W.Hrs.	AVERAGE MAX. DEMAND	AVERAGE DEMAND FACTOR	COST OF 1941 CURRENT	AVERAGE PRICE PER K.W.HR.
442,000	165 K.W.	36%	$7,829.22	$.0160

16. WATER SUPPLY:

The city 6" water main ended at a hydrant located northwest of the permanent office. In November 1940 a 2" line was run to the temporary buildings, and during the summer the 6" line was extended to the basement of the engine house where two automatic pumps were connected to maintain a constant pressure of 40 lb. throughout the building. This was necessary because the city pressure varied from only 10 to 25 lbs.

The city water was used in the shaft sinking for drilling, wetting down and water sprays to a depth of 550'. Then, after the second pump was installed, reservoir tanks were set up to provide clean water from the shaft wall drainage. The quantity was sufficient in all but one or two instances of extremely long drilling periods, and this saved pumping extra water from the drilling machines.

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18. NATIONALITY OF EMPLOYEES:

	American Born	Foreign Born
American	20	
English	4	3
Finnish	29	2
Canadian	2	1
Swedish	8	1
Norwegian	5	
Irish	2	
Danish	1	
Italian	6	
Austrian		1
Total	77	8
	90½%	9½%

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1. GENERAL

The mine operated 254½ shifts in 1941 compared with 261 in 1940. No ore was hoisted from May 26 to June 9th due to skip hoist motor burn-out. Product for 1941 was a little larger than the tonnage hoisted in 1940.

The mine employed fewer men at the end of the year--the underground force showing a decrease of about 12 men. The average for the year shows an increase of two over 1940.

There was no change in the two shift - 5 day per week schedule although in December the men worked 24 days, working an extra day to make up the time lost on New Year's Day.

Diamond drilling was done underground during the late months of 1941 and with the exception of two narrow runs of ore, no new ore was developed.

A new stoker fed Kewanee boiler was installed in the dry. A new Jeffry "Aerodyne" ventilating fan with a rated capacity of 60,000 cubic feet per minute was purchased and stored at the top of the air shaft. Installation will be made soon.

A new 1000 g.p.m. Gould 4-stage centrifugal pump replaced one of the old Prescott pumps in the 4th level pump house.

The main dry house was remodeled and separate change rooms provided for both clean and dirty clothes.

Four new test holes were drilled on the surface and test wells #6, #7, and #8 were provided with deep well pumps.

No new caves were formed to the Southwest of the shaft, but there was a gradual settlement around the two old caves.

The new ninth level development work has not proven up new ore as anticipated. Most of the deposit to date is mixed with stringers of lean ore. The -220 sub, however, has shown up a lot of new tonnage. This sub half way between the 8th and 9th showed little promise until December. During that month crosscuts driven South across the South line of Chase Lease #9 proved the ore to have a width of nearly 200 feet. A great deal of the new tonnage is fee ore.

The ore estimate shows an increase of 1,102,708 tons over last year of which 141,000 tons is fee ore. Development work since the estimate was made has, however, increased this figure by an equal amount.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production

	Grade	Tons
Morris	Standard	260,600
"	Siliceous	82,866
Total		343,466
Stockpile Overrun*		7,299
Grand Total		350,765

*Note: Stockpile overrun made up of 7,052 tons of Standard and 247 tons of Siliceous ores.

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	Leased Lands	Fee Lands	Total Tons
Morris Standard	234,340	33,559	267,899
Morris Siliceous	76,306	6,560	82,866
Total	310,646	40,119	350,765
	88.56%	11.44%	100.00%

The tonnage from the Chase Lease and the old Excelsior Iron Company's land since 1933 follows:

	Leased Lands		Fee Lands	
Year	Tons	% of Total	Tons	% of Total
1941	310,646	88.6	40,119	11.4
1940	280,242	80.8	66,685	19.2
1939	197,365	71.1	80,377	28.9
1938	169,220	70.4	71,104	29.6
1937	261,468	61.4	164,490	38.6
1936	180,649	51.9	166,752	48.1
1935	184,447	75.2	61,013	24.8
1934	129,284	74.6	43,985	25.4
1933	103,487	82.0	22,709	18.0
Grand Total	1,816,808	71.70	717,234	28.30

It will be noted that the smallest proportion of fee ore was mined in 1941.

Summary

Product from Leased Lands 1933-1941	1,816,808 tons
" " Fee " "	717,234 "
Total	2,534,042 "

b. Shipments

Ores shipped from pocket and stockpile for 1941 were as follows:

	Pocket	Stockpile	Total
Grade	Tons	Tons	Tons
Morris Standard	150,160	120,051	270,211
Morris Siliceous	40,929	23,123	64,052
Total	191,089	143,174	334,263

Shipments in 1941 were moderate compared with other years listed in the table that follows, particularily when one considers the demand for raw material.

Year	Standard Ore	Siliceous Ore	Total Ore
1941	270,211 tons	64,052 tons	334,263 tons
1940	314,407 "	112,851 "	427,258 "
1939	332,987 "	57,256 "	390,243 "
1938	199,459 "	40,459 "	239,918 "
1937	250,467 "	88,577 "	339,044 "
1936	236,661 "	64,274 "	300,935 "
1935	181,232 "	36,624 "	217,856 "
1934	110,955 "	45,565 "	156,520 "
1933	63,255 "	13,301 "	76,556 "
Total	1,959,634 "	522,959 "	2,482,593 "

Summary

Standard Ore Shipped 1933-1941	1,959,634 tons
Siliceous " " "	522,959 "
Total	2,482,593 "

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c. Ore in Stock

Stockpile balances as of December 31, 1941, were:

Morris Standard Ore	25,768 tons
" Siliceous "	25,682 "
Total	51,450 "

Stockpile balances for previous years follow:

Stockpile balance as of Dec. 31,	1941 -	51,450	tons
" " "	1940 -	34,947	"
" " "	1939 -	115,279	"
" " "	1938 -	227,779	"
" " "	1937 -	227,374	"
" " "	1936 -	140,459	"
" " "	1935 -	93,993	"
" " "	1934 -	66,389	"
" " "	1933 -	49,641	"

e. Production by months for 1941

Month	Shifts Operated	Morris Standard	Morris Siliceous	Total Production
January	23	21242 Tons	6229 Tons	27,471 Tons
February	22	22310 "	4412 "	26,722 "
March	21	22518 "	5641 "	28,159 "
April	22	24302 "	8710 "	33,012 "
May	17½	20558 "	4994 "	25,552 "
June	17	16370 "	6315 "	22,685 "
July	22	21496 "	7287 "	28,783 "
August	22	27161 "	4382 "	31543 "
September	21	21078 "	9113 "	30191 "
October	23	23443 "	9298 "	32,741 "
November	20	18549 "	8744 "	27,293 "
December	24	21573 "	7741 "	29,314 "
Total	254½	260600 "	82866 "	343,466 "
Stockpile overrun				7,299
Grand Total				350,765 "

The following data is not entirely accurate as the tons per man and number of men employed are estimated each month.

Month	Average Daily Product	Total Tons Per Man Per Day	No. of Men Employed
January	1,195	5.26	227
February	1,215	5.59	216
March	1,341	6.16	218
April	1,341	6.79	221
March	1,460	7.12	205
June	1,334	6.48	206
July	1,308	6.12	214
August	1,434	6.66	215
September	1,438	6.65	216
October	1,423	6.77	209
November	1,365	6.48	210
Decemb er	1,221	5.68	215
Yearly Average	1,378	6.42	214

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Comparative figures for 1941 and 1940 follow:

Year	Average Daily Product	Tons Per Man Per Day	Number of Men Employed
1941	1,378	6.42	214
1940	1,199	5.66	212

f. Delays

There was one serious delay that tied up all production from May 26 to June 9th. A bolt of lightning got through the lightning arresters jumped the main switches and burned out the skip hoist motor. The motor was trucked to Milwaukee for repairs. About 12,000 tons of ore was lost by this delay and no attempt was made to work overtime to work up the loss.

3. ANALYSIS

Following are the analysis of the Morris Standard ore shipped during 1941:

Month	Tons	Iron Dried	Moisture	Iron Natural
January	2909	60.53	11.04	53.85
February	2600	59.37	10.87	52.91
March	3800	58.86	10.74	52.54
April	53912	58.68	11.05	52.19
May	39243	59.03	11.32	52.35
June	26,928	58.33	10.96	51.94
July	34305	59.28	10.97	52.78
August	28304	57.39	10.83	51.17
September	30986	58.64	10.93	52.23
October	27534	59.78	11.56	52.87
November	15555	59.70	11.86	52.62
December	4137	59.78	11.24	53.06
Total	270211	58.85	11.13	52.30

The same data for Morris Siliceous shipments follows:

Month	Tons	Iron Dried	Moisture	Iron Natural
January	743	51.83	10.23	46.52
February	1034	52.09	10.10	46.83
March	997	51.49	10.00	46.34
April	13158	51.24	10.25	45.98
May	9304	51.69	10.64	46.19
June	7588	51.84	10.63	46.33
July	8824	52.89	10.62	47.27
August	2486	47.96	9.56	45.85
September	4257	49.55	9.58	44.80
October	10725	52.19	10.32	46.80
November	4739	53.21	10.73	47.50
December	197	52.90	11.00	47.08
Total	64052	51.64	10.37	46.28

Stockpile Analysis

The analysis of the ore in stock as reported to us by the Inland Steel Company are as follows:

	Tons	Iron Dried	Phos.	Moisture
Morris Standard	25768	58.53	.088	11.00
Morris Siliceous	25682	51.17	.069	10.50
Total	51450			

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Analysis of Ore Reserves

Grade	Iron	Phos	Sil.	Mang	Alum	Lime	Mag	Sul.	Loss	Moist.
Morris Standard	52.35	.060	8.80	.45	2.29	.73	.26	.012	2.57	10.48
" H-Sulphur	52.75	.106	7.20	.39	2.28	-	-	.458	-	10.27

Note: Above all Natural Analysis

Analysis of Ore in Stockpiles

Grade	Iron	Phos	Silica	Mang	Moisture
Morris Standard	52.09	.078	7.86	.45	11.00
Morris Siliceous	45.80	.062	16.50	.35	10.50

Note: All natural analysis

Analysis of Ore Shipped

Grade	Iron	Phos	Silica	Mang	Alum	Moisture
Morris Standard	52.30	.057	8.04	.46	2.40	11.13
Morris Siliceous	46.28	.054	16.78	.35	2.87	10.37

4. ESTIMATE OF ORE RESERVES

	Ore Reserves as of Dec. 31, 1941	Ore Reserves as of Dec. 31, 1940	Difference
C. C. I. Co. Lands	526,061 tons	385,144 tons	∠ 140,917 tons
Chase Lease #9	2,038,647 "	1,366,515 "	∠ 672,132 "
" #24	463,708 "	174,049 "	∠ 289,659 "
" #25	33,273 "	33,273 "	-
" #26	26,140 "	26,140 "	-
Total	3,087,829 "	1,985,121 "	∠1,102,708 "
High-Sulphur Ore			
Chase Lease #24	55,005 "	55,005 "	-
Grand Total Ore Reserves	3,142,834 "	2,040,126 "	∠ 1,102,708 "

Detail of Ore Estimate

C. C. I. Co's Lands

Ore Above 7th Level		
No. 21 Deposit	26,538 tons	
" 81 "	3,210 "	
Total	29,748 "	
Ore between 7th & 8th Levels		
No. 21 Deposit	8,427 "	
No. 33 "	199,317 "	
No. 76 "	8,100 "	
Total	215,844 "	
Ore between 8th & 9th Levels		
No. 33 "	256,028 "	
No. 76 "	8,437 "	
Total	264,465 "	
Ore below 9th Level		
No. 33 Deposit	16,004 "	
Grand Total	526,061 "	

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Chase Lease No. 9		
Ore above 7th Level		
No. 21 Deposit	3,310	tons
" 61 "	13,729	"
" 78 "	5,250	"
Total	22,289	"
Ore between 7th & 8th Levels		
No. 33 Deposit	417,006	"
" 61 "	31,926	"
" 75 " (East)	180,337	"
" 75 " (West)	73,699	"
" 75-A "	26,557	"
" 76 "	31,965	"
" 78 "	8,672	"
Total	770,162	"
Ore between 8th & 9th Levels		
No. 33 Deposit	809,389	"
No. 75 "	187,288	"
No. 76 "	33,938	"
Total	1,030,615	"
Ore below 9th Level		
No. 33 Deposit	178,097	"
No. 75 "	37,484	"
Total	215,581	"
GRAND TOTAL	2,038,647	"
Chase Lease No. 24		
Ore above the 7th Level		
No. 75 Deposit	27,675	"
Ore between 7th & 8th Levels		
No. 33 Deposit	11,994	"
No. 75 "	128,784	"
No. 79 "	7,582	"
No. 82 "	8,654	"
Total	157,014	"
Ore between 8th & 9th Levels		
No. 33 Deposit	154,730	"
No. 79 "	15,375	"
No. 82 "	22,352	"
	192,457	"
Ore below 9th Level		
No. 33 Deposit	50,157	"
Grand Total	427,303	"
Carried forward from Dec. 31, 1938	36,405	"
Grand Total	463,708	"

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Chase Lease No. 25	
Same as in previous reports	33,273 tons
Chase Lease No. 26	
Same as in previous reports	26,140 "
GRAND TOTAL C.C.I. CO'S. LANDS & CHASE LEASES	3,087,829 "
High-Sulphur Ore	
Ore above 8th Level	
No. 79 Deposit	16,192 "
Ore below 8th Level	
No. 79 Deposit	38,813 "
Total	55,005 "
GRAND TOTAL ALL ORE RESERVES	3,142,834 "

Ore in sight Dec. 31, 1940	2,040,126 tons
Ore in sight Dec. 31, 1941	3,142,834 "
Increase	1,102,708 "
Production of Standard Ore in 1941	267,899 "
Ore developed in 1941	1,370,607 "

6. SURFACE

The area to the Southwest of the two caves has settled a maximum of 1.9 ft. Several new cracks have appeared, one of them to the North close to the old road leading to the Barnes-Hecker Mine.

Deep Wells & Pumps

At the beginning of the year surface water was being pumped from #1, #2, #3, #3A, #5, and #6 deep wells. By the end of the year #3 was discontinued and #7 and #8 added. Water from deep well #8 is being diverted into the North Lake Location water system, giving the residents a more palatable and purer water.

The following table shows the pumping rate of the various wells for the year:- G.P.M.

	Jan.	Feb.	March	April	May	June
Pump #1	371	332	388	365	368	356
" #2	99	131	123	120	117	114
" #3	722	692	136	-	418	345
" #3A	1062	958	1082	1120	1091	1042
" #4	-	-	-	-	-	492
" #5	607	589	539	510	516	212
" #6	217	269	260	225	221	22
" #7	-	36	36	38	30	-
Cave #1	-	-	-	-	±7	8
Cave #2	-	-	-	-	40	30
Total	3078	3007	2564	2378	2818	2621

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	July	Aug.	Sept.	Oct.	Nov.	Dec.
Pump #1	248	45	302	324	280	264
" #2	110	114	110	109	107	105
" #3	29	-	-	-	-	-
" #3A	1088	1115	1120	1104	1092	1076
" #5	494	495	464	450	380	348
" #6	200	191	189	178	170	162
" #7	20	19	29	40	40	-
" #8	-	-	194	537	535	527
Cave #1	5	-	5	10	10	-
" #2	16	15	21	23	20	-
Total	2210	1994	2434	2775	2634	2482

The average for the year was 2576 G.P.M.

There is a slackening off of about 600 gallons per minute between the beginning and end of the year.

The data showing how the water table has been lowered over the Morris Mine surface in the area that probably will be within the limits of the caves, follows:

Test Hole	Sea Level Elevation On Jan. 1st. 1941	On Dec. 31 1941	Feet Lowered in 1941	Depth Remaining to ledge
#501	1462.8	1457.8	5.0	59.1
503	1458.7	1438.6	20.1	140.6
504	1445.1	1436.2	8.9	85.8
505	1470.8	1463.4	7.4	98.6
506	1466.7	1454.9	11.8	49.2
508	1426.4	1413.6	12.8	61.8
509	1441.3	1422.7	18.6	119.5
510	1450.7	1444.5	6.2	90.4
511	1465.3	1452.1	13.2	136.7
512	1443.8	1436.7	7.1	115.3
513	1478.5	1466.4	12.1	142.4
514	1471.3	1461.0	10.3	109.8
515	1480.0	1471.3	8.7	114.6
516	1476.8	1472.4	4.4	21.2
517	1465.2	1451.3	13.9	96.7
518	1415.1	1397.2	17.9	73.8
519	1440.7	1405.2	35.5	93.2
520	1426.5	1391.4	35.1	9.8
521	1377.3	1377.3	-	4.0
522	1360.4	1359.5	0.9	-
523	1423.3	1423.3	-	27.1
524	1418.7	Plugged	-	-
526	1428.1	1414.3	13.8	94.7
527	1436.8	1431.5	5.3	70.9
528	1445.2	1439.4	5.8	98.7

The new test holes for 1941 are #526, #527, and #528.

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7. UNDERGROUND

The mine did not present the same serious water problem so prominent in 1938-39-40. There were no new caves and the flow of water into the mine did not fluctuate widely.

Following is a tabulation of the Weir readings by months

	Levels					
Month	4th	6th	7th	8th	9th	Total
January	79.4	71.2	377.1	408.1	128.2	1064.0
Feb.	69.7	63.0	353.9	375.6	76.5	935.7
March	67.7	59.2	351.4	345.8	86.1	910.2
April	66.7	53.3	340.7	353.1	109.0	922.8
May	73.9	52.5	333.0	314.8	116.4	890.6
June	71.1	53.1	280.8	334.6	109.8	849.4
July	76.1	51.3	283.8	315.5	110.8	837.7
August	71.0	53.0	301.0	300.0	114.0	839.0
Sept.	74.8	55.5	326.2	290.3	130.1	876.9
Oct.	82.9	48.9	331.1	266.5	136.0	865.4
Nov.	87.5	44.1	324.0	284.0	157.9	891.5
Dec.	90.9	43.6	324.0	268.0	170.8	897.3
Total & Av.	75.9	54.0	327.2	321.4	120.5	899.0

Comparison with previous years follows:

Month	1941	1940	1939	1938	1937
January	1064	1199	570	538	233
February	936	1176	590	540	255
March	910	1150	600	612	270
April	923	1117	615	641	294
May	891	1216	661	596	328
June	849	1202	683	562	393
July	838	1153	762	569	406
August	839	1234	800	563	432
Sept.	877	1171	907	557	405
October	865	1147	979	555	382
November	891	1089	1063	536	466
December	897	1041	1222	548	458
Average	899	1158	788	568	360

It will be noted that for the first time in 5 years that the gallonage pumped from underground shows a decrease.

Developing

The new ore in the mine was confined to two areas, the westerly end of #75 deposit on Chase Lease #24 and the -220 ft. sub and 9th level development in No. 33 or the old main deposit.

On Chase Lease #24 the Western limits of 75 deposit were pushed 400 ft. further West to a point nearly 600 ft. West of the East line of Chase Lease #24. This exploratory work was done on the 20 ft. sub 150 ft. above the 8th level. As a result the main 8th level haulage system was extended into this area by driving 500 ft. West from the East boundary of Lease #24.

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The -220 ft. sub level crosscuts finally found the downward extension of #33 deposit. It was not until late in November that this sub proved anything of real value. Crosscuts on the main 9th level had indicated ore further to the North and subsequent raises and drifts on the sub planned from information secured from the 9th level crosscuts showed nothing but mixed material. Crosscuts driven South on the sub soon revealed a different situation. As this report is being written, we have plenty of evidence to show the main #33 ore body to be at least 700 ft. long and over 200 ft. wide on the West end near the East line of Chase Lease #24. This means ore at least 150 Ft. wide under our own fee lands over near Chase Lease #24.

On the 9th Level to date, two ore areas have been proven up. One in the Southwest corner of Chase Lease #9 is about 300 ft. long and 150 ft. wide. The other 500 ft. farther East along the main foot is 250 ft. long and 150 ft. wide and the Easterly limit of this ore is not determined. There are good possibilities for 300 to 400 ft. more length to the East.

The 1941 development work added approximately 1,103,000 tons to the reserves, most of which is in the Main Deposit.

In addition to the ore development work just described, a rock drift, mostly siliceous ore, was driven West 475 ft. about 50 ft. South of the South 3400 coordinate line across Chase Lease #24 on the 8th Level.

On the Ninth Level the N - S crosscut nearest the shaft adjacent to the 2000 West coordinate line was extended South 145 ft. in second-class and lean ore. Another N - S crosscut over near the West line of Chase Lease #9 went through 465 ft. of ore formation before hitting ore. East-West Crosscuts totaling 500 ft. were driven in siliceous material along what appears to be the North side of the Main Deposit.

The Main East-West footwall drift in the North-West corner was pushed 180 ft. farther West in slate.

Several raises were also finished during the year. Two raises #807 and #808 went up from the West drift on the 8th level on Chase Lease #24 to develop the West end of #75 ore body.

Raises #920, #921, and #923, were put up from the 9th level crosscuts to the -220 ft. sub-level.

Stoping

Most of the product in 1941 came from sub-level slicing gangs as there were only limited opportunities for sub-level stoping.

Above 7th Level

An area about 50 ft. square was stoped from the top of the #75 deposit on the 120 and 100 ft. subs on Chase Lease #24 about 300 ft. West of the East line of that lease.

Subs between the 7th and 8th Levels

Main or #33 Deposit

Mining in this deposit in the East end under the C.C.I. Company's lands to the East of Chase Lease #9 was confined to the 50 ft. sub-level and by 10 ft. sub-level intervals down to the -10 ft. sub-level. In other words, mining was done on seven subs with most of the activity on the 10, 20, and 50 ft. sub-levels.

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On the East side of Chase Lease #9, mining was done on the +50, +40, 000, and -10 subs. On the 50 and 40 ft. elevations the sub-level slices were all in the area to the South of the Main Dike; on the 00 and -10 ft. subs mining was confined to the area North of the Main Dike.

In the Southeast corner of the Main Deposit three contracts sliced out all the ore left on the -20, -30, -40, and -50 ft. subs and started on the -60 ft. elevation.

Along the South line of Chase Lease #9 mining by the sub-level slicing system was confined to the subs between the -30 and -110 elevations. Practically all available ore has been taken from the -30 and the -40 sub levels. From the -50 to the -70 subs a pillar 300 ft. long is left between the 1800 and 2100 West coordinate lines. Below that point (the -70 sub) no ore has been mined East of the 2100 West coordinate line.

On our fee lands to the South of Chase Lease No. 9, slicing was done on the -50 ft. sub -60, -70, -80, -90, and -100 subs between 2100 and 2300 West coordinates.

No. 75 Deposit

This deposit is now quite extensive as it is outlined on the maps as extending from 1600 West to 3200 West.

The West end of #75 Deposit over on Chase Lease #24 is being mined by the sub-level stoping method and there were two working faces in 1941. One gang stoped near the East line of the lease and the other started stoping 300 ft. farther to the West. The top of the stope runs up to the 120 ft. sub, the scraping sub being located at the 000 elevation.

The East side of the same stope that runs over onto Chase Lease #9 was stoped out on various elevations from the 100 ft. sub down to the 000 sub-level.

In the central part of #75 Deposit, slicing was done on six sub-level intervals running from the +50 to the -10 elevation. This mining was confined mostly to the North central portion, from 1800 West to 2300 West.

Over in the East end of 75 Deposit in what is known as the 75A area slicing was done on the 60 and 50 ft. subs and a little started on the 40 ft. sub between 1600 and 1700 West coordinates.

Diamond Drill

Holes #4, #5, #6, #7, were finished and #8 started in 1941.

Hole #4 on the eighth level was drilled on the East side of Chase Lease #24 to determine the best location for the 8th Level crosscut under the West end of #75 Deposit. This hole drilled to a depth of 293 ft., discovered no high grade ore.

Hole #5 was a very deep hole bottomed at 1,263 ft. This hole was drilled just about due south parallel with the 1400 West coordinate line. It cut across the footwall of the soft ore formation, entering the hard ore series at 1,243 ft. The hole was stopped after cutting 20 ft. of quartzite. No ore was found.

Hole #6 drilled on the 8th level was intended to explore for ore on the Main Dike directly South of the Morris Shaft. The hole found 20 ft. of ore 1100 ft. South of the Shaft. As this report is being written, hole #8 has found at least 50 ft. of ore 350 ft. farther East and this ore is only 400 ft. from the West boundary of the Lloyd Mine. This run of ore is undoubtedly the same as that found in hole #6. That ore may have possibilities at depth fr the Lloyd Mine.

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Hole #7 was drilled on the 9th Level to outline the main or #33 Deposit on the East side of Chase Lease #24. This hole found 40 ft. of ore. From what we now know it would appear the hole was located too far to the North.

Hole #8 was started on the 8th 300 ft. Northeast of #6. This hole was in only 325 ft. by the end of the year. It found ore at 543 ft and was still in it at 600 ft. The ore is good grade, the sludge analysis varying from 58.00 Iron to 65.00 Iron.

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1. GENERAL

Tilden Mine operations reflected a general rise in performance for the year 1941. Drilling, blasting and loading operations produced higher records in the past season and although an increase in the total cost per ton produced was shown, an analysis of the cost sheet attributes this fact directly to the general wage increases granted Tilden Mine employees in 1941.

Shipping from the property started April 19, 1941 from the stockpiles and ended for the season on November 29, 1941. Production for the year totalled 302,943 tons, an increase of 97,331 tons. Loading operations were steady throughout the season, stocking of crushed ore being done between shipments. With the exception of one cargo of Low Phos. ore, all loading was done on a single shift basis, with three shovels operating. The output per shift was 2,033 tons, an increase of 13% over last season due to the fact that with a high Tilden Silica production, all three power shovels were kept at full operating capacity. It may well be noted at this point that the actual time lost by delays to equipment was less in 1941, despite a much greater production, than in 1940 and the "estimated loss of product" was reduced to 3.1% for 1941 from 4.6% in 1940.

Churn drilling was carried on throughout the year with higher performances obtained in footage per shift and also in footage per bit used. The unit costs for drilling work showed a marked decrease over 1940 records despite the higher labor costs entailed.

In blasting operations, a more extensive use of lower cost Gelamite explosives, replacing in part the higher cost Gelatin, resulted in a more balanced powder distribution in the actual blasting, and effected an economy in the cost per ton of ore broken. Six primary blasts were fired during the season, two in the East Pit with the remainder in the West Pit ore faces.

Stripping and washing operations were carried on in the East Pit advancement area by Company men and equipment. Additional drainage work was accomplished for the stocking grounds and Lower Bench-West Pit.

2. PRODUCTION SHIPMENTS & INVENTORIES

a. Production by Grades

	Tilden Silica	Low Phosphorus	Total
West Pit - - - - - - - - - -	193,544	-	193,544
East Pit - - - - - - - - - -	96,473	12,926	109,399
Total - - - - - - - - -	290,017	12,926	302,943

b. Shipments

Shipments for this property totalled 292,443 tons, leaving a balance on hand of 52,483 tons:

Tilden Silica - - - - -	279,517
Tilden Low Phos. - - -	12,926
Total - - - - - -	292,443

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2. PRODUCTION SHIPMENTS & INVENTORIES (CONT.)

c. Stockpile Inventories

Ore was stocked at the Tilden Mine in 1941 for the second year. The tonnage stocked, by grades, is given below:

	1941	1940	In Stock Dec. 31, 1941
Tilden Silica - - - - - - -	48,629	31,241	38,668
Tilden Low Phos. - - - -	3,073	10,742	13,815
Total - - - - - - - - -	51,702	41,983	52,483

The total cost of stocking 51,702 tons of ore during the 1941 season was $2,801.26 or $.054 per ton. Included in this figure is a materials and labor charge of $393.75 for the installation of a drainage culvert. Actual stocking work cost $2,557.91 or $.049 per ton. As in 1940, the stocking was done by trucks hauling the crushed ore from the pocket to the pile, and although high efficiency was maintained in the routine, the inherant disadvantages of handling tonnages in small units result in decreased tonnage stocked per shift and subsequently higher cost per unit stocked.

A total of 41,202 tons were loaded from the stockpiles at the beginning and close of the 1941 season at a cost of $708.61 or $.017 per ton. The total cost of stocking and ore and loading from the stockpiles amounted to $0.066 per ton.

d. Broken Ore Reserves

The book figures of the broken ore reserves are as follows:

East Pit - - - - - - - - - - -	34,095
West Half of West Pit - - -	15,595
Summit Pit - - - - - - - - -	7,032
Total - - - - - - - - -	56,722

e. Product by Months

Month	Days Operated	Average Tonnage Per 8 Hr. Shift	Total Tons
May	23 (1-8 Hr.)	2,062	47,426
June	22 (1-8 Hr.)	2,172	47,805
July	22 (1-8 Hr.)	2,222	48,884
August	17 (1-8 Hr.)	2,068	35,158
September	15 (1-8 Hr.)	1,887	43,418
September	4 (2-8 Hr.)		
October	23 (1-8 Hr.)	1,711	39,367
November	19 (1-8 Hr.)	2,151	40,885
Total	149 (1-8 Hr.)	2,033	302,943

The average output per 8 Hr. Shift of 2,033 tons during 1941 compares with 1,787 tons in 1940; 1,980 tons in 1939; 2,140 tons in 1938; and 1,996 tons in 1937.

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2. PRODUCTION SHIPMENTS & INVENTORIES (CONT.)

e. Product by Months (Cont.)

The proportion of total production by months to shipping and stocking is given below:

	Tonnage Shipped	Tonnage Stocked
May	31,000	16,426
June	41,761	6,044
July	46,535	2,349
August	27,286	7,872
September	36,049	7,369
October	27,725	11,642
November	40,885	-
Totals	251,241	51,702

f. Ore Statement

	1941 Tons	1940 Tons
On Hand January 1, 1941	41,983	-
Output for Year	302,943	205,612
Total	344,926	205,612
Shipments	292,443	163,629
Balance on Hand	52,483	41,983
Increase in Output	97,331	
Increase in Shipments	128,814	

1936 - 77 - 1-8 Hr. Shifts and 57 - 2-8 Hr. Shifts - Total 191 - 1-8 Hr. Shifts.
1937 - 113 - 1-8 Hr. Shifts and 20 - 2-8 Hr. Shifts - Total 153 - 1-8 Hr. Shifts.
1938 - 40 - 1-8 Hr. Shifts and 0 - 2-8 Hr. Shifts - Total 40 - 1-8 Hr. Shifts.
1939 - 78 - 1-8 Hr. Shifts and 4 - 2-8 Hr. Shifts - Total 86 - 1-8 Hr. Shifts.
1940 - 107 - 1-8 Hr. Shifts and 4 - 2-8 Hr. Shifts - Total 115 - 1-8 Hr. Shifts.
1941 - 141 - 1-8 Hr. Shifts and 4 - 2-8 Hr. Shifts - Total 149 - 1-8 Hr. Shifts.

This favorable tonnage comparison is due primarily to the fact that approximately 95% of the total output for 1941 consisted of Tilden Silica, the production of which utilizes to the full extent the productive capacity of the Tilden equipment, as contrasted with a substantial Low Phosphorus output which entails the use of one shovel only working at a single East Pit face.

g. Delays

There were no extensive individual delays during the year, and the actual percentage of estimated loss of product due to delays was reduced for the 1941 season to 3.1% from 4.6% in 1940.

The total lost time chargeable to the various pieces of equipment is listed below:

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2. PRODUCTION SHIPMENTS & INVENTORIES (CONT.)

g. Delays (Cont.)

Power Shovels

No. 29	No. 31	No. 46	Total
8	16½	24¾	49¼

The small Marion 480 Shovel, No. 46, accounted for 50% of the delays charged to the power shovels, as compared to a charged loss of 25% in 1940. As was pointed out in the Annual Report for 1940, the loading conditions existing in the Lower Bench are too heavy for efficient use of this shovel. The acquisition of the No. 52 Shovel, a Bucyrus-Erie 120-B, will alleviate this condition if delivery of parts for complete erection of the shovel can be made in time for the 1942 production season.

Other miscellaneous delays are listed below:

Crushing Plant	Lack of Electric Power	Lack of Electric Power (Storm)	Transportation Equipment	No Rail-Road Car Service	Truck
5¼	½	6¼	6¼	2¾	2

Total - - - - - 23 Hrs.

The estimated loss of product due to the above delays is as follows:

Shovels - - - - - - - - - 5,725 tons.
Miscellaneous - - - - - 3,932 "
Total - - - - 9,657 Tons.

h. Delays from Lack of Current

One half hour only was lost at the property for lack of electric power. The 6¼ hours noted above was due entirely to the precaution of shutting down the plant during severe electrical storms to avoid the possibility of the circuit breakers throwing out while the crushers are under load. Neglect of this precaution would necessitate unloading of the crushers by hand shovel.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss on Ignition
Tilden Silica	39.14	.036	42.01	.09	.72	.22	.27	.011	.32
Tilden Low Phos.	38.12	.017	43.69	.09	.46	.18	.10	.009	.20

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3. ANALYSIS (CONT.)

b. Average Analysis on Straight Cargoes

Grade	Mine Iron	Mine Phos.	Mine Sil.	Lake Erie Iron	Lake Erie Moist.
Tilden Silica - - - - - - -	39.00	.034	42.32	39.88	2.02
Tilden Low Phos. - - - - -	38.00	.015	44.25	37.85	1.62

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

1. West Pit

In the West Pit, ore reserves and stripped reserves are the same inasmuch as present conditions will not permit additional stripping in this area. A statement of the reserves is given below:

Assumption: 13 cu. Ft. equal 1 ton.
10% deduction for rock.

Total Developed Ore as of January 1st, 1941 - - - - - - - -	2,312,320 tons.
Ore Mined in 1941 -	193,554 "
Total Developed Ore as of January 1st, 1942 - - - - - - - -	2,118,766 tons.

In the West Half of the West Pit-Upper Bench, one more primary blast of approximately 70,000 tons will practically complete mining in that area from the Upper Bench. The East Half of the Upper Bench contains approximately 124,000 tons of recoverable ore.

The balance of the West Pit ore, approximately 1,925,000 tons, is expected to be mined from the Lower Bench, which is now, for the greatest part of the face, at full 60 foot depth.

2. East Pit, including Summit Pit

Assumption: 14 cu. ft. equal 1 ton
10% deduction for rock.
Tonnage above 1500' elevation (Track grade from Crushing Plant)

Total Developed Ore, January 1st, 1941 - - - - - - - - - - -	5,071,075 tons.
Ore Mined in 1941 -	109,399 "
Total Developed Ore, January 1st, 1942 - - - - - - - - - - -	4,961,676 tons.

This tonnage of available ore in the East Pit can conservatively be estimated to analyze .020% Phos. which, by selective mining and grading, can be made to yield a product of which approximately 25% would analyze .015% Phos.

As discussed in the report for 1937, operations as such, were abandoned in the Summit Pit, although it is likely that these reserves will ultimately be mined from the East Pit expansion benches.

3. Developed Ore as of January 1st, 1942

West Pit - - - - - - - - - - - - - - -	2,118,766 tons.
East Pit (including Summit Pit) -	4,961,676 "
Total Tilden Mine - - - - - - -	7,080,442 tons.

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4. ESTIMATE OF ORE RESERVES (CONT.)

c. Estimated Analysis of Reserves

1. West Pit	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Ign.	Moist.
Dried	39.25	.038	42.20	.09	.60	.28	.20	.013	.25	-
Natural	38.50	.037	41.40	.09	.59	.27	.20	.013	.25	1.90

2. East Pit	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Ign.	Moist.
Dried	37.00	.020	46.50	.120	.67	.48	.31	.014	.90	-
Natural	36.25	.020	45.90	.118	.65	.47	.30	.013	.88	2.50

The above analyses are the same as reported for 1940. There is a possibility of the Upper Bench-West Pit reserves being slightly lower because of contamination by dike. During the 1941 season, much selective loading was necessary to maintain proper analysis.

f. Estimate of Production

The following tables show the estimated production and analyses that can be produced during the coming year. The first table shows the tonnages available by mining and loading without selective loading from the East Pit. The 7,000 tons of broken ore in the Summit Pit are omitted here, inasmuch as this ore cannot be loaded out profitably now.

The figures in the second table are based on the assumption that any Low Phos. ore shipments will be produced by selective loading in the East Pit.

1. ESTIMATE OF 1942 PRODUCTION AS TO PITS

Grade	Tonnage	Iron	Phos.	Sil.	Sul.	Moist.	Iron Nat'l.
Tilden Silica West Pit	350,000	39.12	.049	42.50	.014	1.90	38.38
Tilden Silica #1 East Pit	100,000	37.50	.020	46.00	.011	2.00	36.75
Total.....	450,000	38.80	.043	43.30	.011	1.92	38.03

2. ESTIMATE OF PRODUCTION BY GRADING EAST PIT ORE

Grade	Tonnage	Iron	Phos.	Sil.	Sul.	Moist.	Iron Nat'l.
Tilden Silica (Includes West Pit and 50,000 tons of East Pit)	400,000	39.00	.036	42.00	.011	1.67	38.35
Tilden Low Phos. (Selected from East Pit Shipments)	50,000	37.00	.018	45.60	.009	1.36	36.50
Total....	450,000						

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4. ESTIMATE OF ORE RESERVES (CONT.)

f. Estimate of Production (Cont.)

From the above tables, it will be noted that the Low Phosphorus ore can be obtained only by analyzing each car and segregating those that contain the proper material. Using this method, a cargo can be obtained only by accumulating a sufficient number of cars and holding them for shipment.

The above estimated analyses for 1942 production are practically the same as reported for 1940 and 1941, for the reasons that, beyond the discussion of these analyses in the 1938 report, blast hole drilling in the East Pit has indicated few changes.

5. LABOR AND WAGES

a. Comments

1. Labor

Labor conditions were quite satisfactory during the 1941 season. An increase in stocking at the property placed employment on a very steady schedule of five 1-8 hour shifts throughout the operating season. The number of employees averaged 39, an increase of 2 over 1940.

As mentioned in the 1940 report, NRA regulations, as such, were discontinued in 1937, but have been adhered to in the sense that time-and-a-half was paid for all overtime work in excess of 40 hours in any one week or 8 hours in any one day. Beginning September 15, 1941, the standard 8 hour shift was put on a dry to dry basis.

b. Comparative Statement of Wages and Product

	1941	1940	Increase	Decrease
Product	302,943	205,612	97,331	
Number of Shifts and Hours	149 - 1-8 hr.	115 - 1-8 Hr.	34 - 1-8 hr.	
Average Number of Men Working	39	37	2	
Average Daily Wage	$6.71	$5.71	$1.00	
Tons Per Man Per Day	52.31	47.68	4.63	
Labor Cost per Ton (Labor Stmt.)	$.132	$.123	$.009	
Labor Cost per Ton (Cost Sheet)	.143	.138	.005	
Total Number of Days	5,942¼	4418	1,524¼	
Amount Paid for Labor as Per Labor Statement	$39,866.97	$25,242.13	$14,624.84	
Amount paid for Labor as Per Cost Sheet	$43,934.57	$28,409.34	$15,525.23*	

*A weighted average of wage increases granted to Tilden Mine employees, shows an increase of 13.6% in labor costs over the year 1940. If the amount, $43,934.57, paid for labor as per Cost Sheet in 1941, be reduced to the proportionate wage scales for 1940, the labor cost would have been $38,674.80 and would have shown a labor cost per ton of $0.127 for 1941 as compared to $0.138 for 1940.

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7. OPEN PIT OPERATIONS

a. Stripping

Stripping operations were carried on during the year in the East Pit mainly with the removal of 5,047 yards by the D-8 tractor and bull-dozer. Subsequent washing operations in the stripped area removed 1,829 cubic yards of material lying on the rough, creviced surface. On a rough surface possessing relatively no grade to assist the volume of water to carry away the burden, it was found more economical to wash the burden into windrows which were later moved by the bull-dozer. This procedure increased somewhat the unit cost of bull-dozer work but substantially reduced the washing cost.

As was explained in the 1940 report, costs of stripping work as done by Company men and equipment were so much lower than previous work done by contractors, that there was a reserve left in E. & A. 786 to handle East Pit stripping work early in the year, although, of course, the original estimated quantities have been exceeded. The balance of the stripping work in the East Pit was covered by E. & A. CC-60.

In conjunction with proposed stripping operations for the East Pit expansion program, sixteen test pits were sunk in the Northeast advancement area to determine the relative amount of overburden present. As a further guide to determine the position of stripping limits, a small amount of exploratory drilling was done during December of 1941. The costs of sinking the test pits and of the exploratory drilling were also charged to E. & A. CC-60.

7. OPEN PIT OPERATIONS (CONT.)

a. Stripping (Cont.)

As was done also in 1940, the method of handling the charges under E. & A. No. 786 varied somewhat from the method in which the expenditures were actually made. The following is the actual record of these expenditures, some of which differ from the office copy although the total amount is the same.

ORIGINAL ESTIMATE		WORK ACCOMPLISHED	EXPENDITURES 1941	PREVIOUS 1937-1940 INCL.	TOTAL TO DATE	COST PER UNIT
LOWER BENCH, WEST PIT:						
Approach to Crusher Building (1)		Completed		$ 519.03	$ 519.03	
Moving Power Line.....	$ 1,000 (2)	"		638.95	638.95	
Addition to Crusher Pocket (3)		"		214.89	214.89	
Stripping 30,000 cu. yds. at 40¢ per yard.....	12,000	42,707 Yds.		7,182.98	7,182.98	$0.168 per Yard.
220 Lineal Feet C.M.P. (24") at $5.00 per ft. in place..	1,100	Completed		1,098.90	1,098.90	$4.99 per Foot.
Clearing and Grubbing.....	500	Completed		528.43	528.43	
Washing.....	1,000	Completed		4,415.28	4,415.28 (4)	
Casting L.S. & I. tracks.....	250	Completed		1,062.12	1,062.12	
Surfacing 3,000 yds. at 50¢ per yard.....	1,500	Nothing		-	-	
Miscellaneous Material.....	400			-	-	
TOTAL.....	$17,750					
Plus 10%.....	1,775					
TOTAL LOWER BENCH.....	$19,525			$ 15,660.58	$ 15,660.58	
Waste Rock - West Pit (3)....		1,582 cu. yds.		$ 315.52	$ 315.52	$0.199 per cu. yd.
Stripping 3,000 cu. yds on West Side of West Pit at 50¢.	1,500	2,700 cu. yds.		350.59	350.59	$0.126 per cu. yd.
Stripping 2,000 cu. yds. on West Side of East Pit at 50¢	1,000	2,500 cu. yds.		909.25	909.25	$0.36 per cu. yd.
North Side of East Pit (3)...		12,014 " "	$ 381.14	1,748.74	2,129.88	$0.177 " " "
West End of West Pit (3)....		1,500 " "		371.08	371.08	$0.248 " " "
South Side of East Pit (3)...		600 " "		25.11	25.11	$0.042 " " "
East Side of East Pit (3)....		3,285 " "	340.83	728.50	1,069.33	$0.325 " " "
Prospect Drilling N½ of NE¼ of Section 27, 47-27..(3)...				3,411.25	3,411.25	
GRAND TOTAL.....	$22,025		$ 721.97	$ 23,520.62	$ 24,242.59	

(1) Not included in original estimate. Charged to "Miscellaneous Materials" in office copy of E. & A.
(2) This $1,000 item is omitted in office copy of E. & A. and included in "Miscellaneous Materials", which was originally $400.00.
(3) Not included in original estimate.
(4) Includes $867.27 washing Upper Bench.

The above operations were thoroughly discussed in the reports for 1937 to 1940, inclusives.

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7. OPEN PIT OPERATIONS (CONT.)

a. Stripping (Cont.)

E. & A. CC-60 - TILDEN MINE STRIPPING

DETAIL	AMOUNT AUTHORIZED	WORK ACCOMPLISHED	AMOUNT EXPENDED	COST PER UNIT
20,000 yds. of Stripping at 15¢ per yd.....	$ 3,000.	1,133 yds.	$ 266.74	$.24 per cu. yd.
3,000 yds. of Washing at 73¢ per yd.....	2,190.	1,829 "	921.76	.50 " " "
10% on Above for Contingencies.....(1)	519.		171.15	
Test Pits - East Pit Advancement Area.....(2)			191.52	
Exploratory Drilling East Pit Advancement Area.....(2)			663.27	
Total.....	$ 5,709.		$ 2,214.44	

Unexpended Balance - - - - - - - - $ 3,494.56

(1) The natural slope of the East Pit stripped area towards the pit necessitated washing the material away from the face to prevent contamination of the broken ore. This factor demanded as clean a bull-dozer operation as possibly could be obtained on the very rough ledge surface. Under these exacting conditions, the bull-dozer was put to a more severe use than is usually the case, which necessitated several repairs to the bull-dozing equipment.

(2) Note: Not included in original estimate.

f. Drilling, Blasting & Explosives

A large amount of primary blast hole drilling was done during 1941 at the property by two Bucyrus-Armstrong 29-T drill rigs. The total footage obtained this year equalled 9,145 ft. with 64 feet lost, giving a net obtained footage of 9,081 feet. As compared with a net footage of 2,843 feet drilled in 1940, an added footage of 6,283' was drilled this year.

All blasting faces in both pits were drilled this year and a table of drilling statistics for the year 1941 is given below:

Location	Drill No.	No. Holes	Footage 1941	Footage Lost	Net Footage 1941
Lower Bench-West Pit.....	7	21	1,381	-	1,381
Lower Bench-West Pit.....	8	8	374	35	339
East Pit.....	7	14	1,086	-	1,086
East Pit.....	8	14	1,370	-	1,370
East End-West Pit.....	7	25	1,627	29	1,598
East End-West Pit.....	8	5	350	-	350
West End-West Pit.....	7	8	815	-	815
West End-West Pit.....	8	23	2,142	-	2,142
Total.....		118	9,145	64	9,081

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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

To properly compare the drilling of 1941 with that of 1940, several factors must be considered. A cost comparison must be determined on a proportionate wage scale inasmuch as Tilden Mine labor was given an increase of 13.6% prior to the beginning of the operating season over the wage scale prevailing in 1940. The cost of supplies was greater in 1941 than in the year preceding, but no satisfactory method of determining the relative increase could be produced however, and no consideration of this factor is shown in the comparison table. The unit cost of drilling done in the two years is shown before the charges for depreciation on churn drilling equipment are placed. This is done for the reason that the depreciation charge is unevenly proportioned to the amount of drilling accomplished for the year, and is considerably less for 1941 than in 1940.

The following table gives the actual cost of drilling done in 1941, and also shows the cost per unit on a proportionate wage scale to 1940, compared with actual 1940 costs. It will be seen that the overall costs of drilling were $.27 less per foot in 1941, as compared to 1940. The unit cost before depreciation charges, were greater in 1941 than in 1940, which was due entirely to higher labor costs in 1941. The unit cost computed at a reduction factor of 13.6% (average wage increase in 1941) substantiates the footage and bit consumption records of 1941 that the overall efficiency was higher in that this proportionate cost per unit is lower than in 1940.

Drilling efficiencies were lifted this past season over former years as is shown by the following tables giving the footage obtained per 8 hour shift and the footage obtained per bit. Extremely hard material was encountered in the West Half of the West Pit where the height of bank necessitated deep holes, resulting in low footage for this section, but the total average footages were higher for 1941 nevertheless.

As was pointed out in the 1940 report, the method and procedure used at the Tilden Mine for the hardening of churn drill bits was checked against the specifications as recommended by Bucyrus-Erie. A representative of that company also personally reviewed our procedure and no suggested improvements could be made. That the Tilden methods were held to rigid standards is evidenced by the increased footage obtained per bit over the 1940 performances.

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling

COMBINED COST OF OPERATING CHURN DRILLS IN 1941
WITH PROPORTIONATE LABOR COSTS COMPARISON TO 1940.

	Total Net Footage	Labor	Supplies	Total	Actual 1941 Cost per Foot
West Pit-Lower Bench	1,720	$2,100.46	$ 815.47	$ 2,915.93	$1.69
East End of West Pit	1,948	2,329.81	1,846.60	4,176.41	2.14
West End of West Pit	2,957	5,398.27	2,790.91	8,189.18	2.77
East Pit	2,456	2,684.23	2,269.03	4,953.26	2.61
Total Cost Less Depreciation on Churn Drill Equipment	9,081	$12,512.77	$7,722.01	$20,234.78	$2.23
Depreciation					.18
1941 Total Costs.....	9,081	$12,512.77	$7,722.01	$20,234.78	$2.41

	Proportionate 1941 Labor Cost	Proportionate 1941 Total Cost	Proportionate 1941 Cost per Ft.
West Pit-Lower Bench	$ 1,849.00	$ 2664.47	$1.55
East End of West Pit	2,050.88	3897.48	2.00
West End of West Pit	4,752.00	7542.91	2.55
East Pit	2,362.87	4631.90	1.86
Total Cost Less Depreciation on Churn Drill Equipment.....	$11,014.75	$18,736.76	$2.06
Depreciation			.18
Proportionate 1941 Costs.....	$11,014.75	$18,736.76	$2.24

	1940 Net Footage	1940 Total Cost	Total Cost Per Foot
West Pit-Lower Bench	1,209	$2,565.90	$ 2.12
East End of West Pit		No Drilling in 1940	
West End of West Pit	341	704.55	2.06
East Pit	1,293	2,724.92	2.11
Total Cost Less Depreciation on Churn Drill Equipment.....	2,843	$ 5,995.37	$ 2.11
Depreciation			.57
1940 Total Cost.....	2,843	$ 5,995.37	$ 2.68

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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling

Cost of Operating 9" Churn Drills in Lower Bench, West Pit, 1941

Total Footage of Holes Drilled - - 1,720'
Total Footage of Holes Lost - - - 0
Net Available Footage - - - - - 1,720'

Operating	Labor	Supplies	Total	Cost Per Ft.
Drilling at Mine	$ 1,169.11	$ 42.10	$ 1,211.21	.704
Sharpening Bits	493.14	229.50	722.64	.424
New Rope		50.47	50.47	.029
New Bits		228.72	228.72	.133
Electric Power		72.20	72.20	.042
New Drilling Tools		64.51	64.51	.037
Pipe and Fittings		-	-	-
Building Roads	33.04	-	33.04	.019
Truck and Tractor	356.39	85.18	441.57	.256
Total Operating.....	$ 2,051.68	$ 772.68	$ 2,824.36	1.644
Maintenance				
Drill Maintenance	48.78	-	48.78	.026
Bit Dresser		42.79	42.79	.020
Total Maintenance	$ 48.78	$ 42.79	$ 91.57	.046
Total Maintenance and Operating.....	$ 2,100.46	$ 815.47	$ 2,915.93	1.690
Depreciation on Churn Drill Equipment		316.75	316.75	.181
Total Maintenance, Operating and Depreciation.....	$ 2,100.46	$1,132.22	$ 3,231.68	1.871

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling (Cont.)

Cost of Operating 9" Churn Drills in East End of West Pit - 1941

Total Footage of Holes Drilled - - - -	1,977
Total Footage of Holes Lost - - - - -	29
Net Available Footage - - - - - -	1,948

	Labor	Supplies	Total	Cost Per Foot
Operating				
Drilling at Mine	$ 1,430.60	$ 70.95	$ 1,501.55	.772
Sharpening Bits	403.86	274.65	738.51	.374
New Rope		120.59	120.59	.061
Electric Power		172.91	172.91	.087
Pipe and Fittings		-	-	-
New Bits		492.96	492.96	.253
New Tools		415.07	415.07	.213
Truck and Tractor	410.29	58.63	468.92	.243
Total Operating....	$ 2,304.75	$ 1,605.76	$ 3,910.51	2.003
Maintenance				
Drill Maintenance	25.06	207.35	232.41	.117
Bit Dresser		33.49	33.49	.020
Total Maintenance	25.06	240.84	265.90	.137
Total Maintenance and Operating.....	$ 2,329.81	1,846.60	4,176.41	2.140
Depreciation on Churn Drill Equipment.....	$	352.59	352.59	.181
Total Maintenance, Operating and Depreciation.....	$ 2,329.81	$ 2,199.19	$ 4,529.00	$ 2.321

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting and Explosives (Cont.)

1. Drilling (Cont.)

Cost of Operating 9" Churn Drills in West End of West Pit - 1941

Total Footage of Holes Drilled - - - -	2,957
Total Footage of Holes Lost - - - - -	0
Net Available Footage - - - - - - -	2,957

	Labor	Supplies	Total	Cost Per Foot
Operating				
Drilling at Mine	$3,274.63	$ 121.87	$3,396.50	$ 1.148
Sharpening Bits	1,219.40	761.43	1,980.83	.670
Electric Power		332.24	332.24	.112
New Bits		697.40	697.40	.235
New Tools		439.28	439.28	.149
Pipe and Fittings		107.87	107.87	.036
Truck and Tractor	794.36	153.83	948.19	.321
Total Operating....	$ 5,288.39	$ 2,613.92	$ 7,902.31	$ 2.671
Maintenance				
Drill Maintenance	109.88	108.45	218.33	.074
Bit Dresser Maintenance		68.54	68.54	.025
Total Maintenance	109.88	176.99	286.87	.099
Total Maintenance and Operating.....	$ 5,398.27	$ 2,790.91	$ 8,189.18	$ 2.770
Depreciation on Churn Drill Equipment.....		535.22	535.22	.181
Total Maintenance, Operating and Depreciation.....	$ 5,398.27	$ 3,326.13	$ 8,724.40	$ 2.951

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling (Cont.)

Cost of Operating 9" Churn Drills in East Pit - 1941

Total Footage of Holes Drilled - 2,456
Total Footage of Holes Lost - - 0
Net Available Footage - - - - 2,456

Operating	Labor	Supplies	Total	Cost Per Foot
Drilling at Mine	$ 1,670.20	$ 250.04	$ 1,920.24	$ .781
Sharpening Bits	481.13	252.89	734.02	.300
Pipe and Fittings		262.56	262.56	.107
New Bits		383.52	383.52	.156
Electric Power		425.81	425.81	.173
New Rope		204.98	204.98	.083
New Tools		351.93	351.93	.143
Cleaning Holes	54.16		54.16	.022
Truck and Tractor	425.74	137.30	563.04	.239
Total Operating.....	$ 2,631.23	$ 2,269.03	$ 4,900.26	2.004
Maintenance				
Drill Maintenance	53.00		53.00	.006
Total Maintenance and Operating.....	$ 2,684.23	2,269.03	$ 4,953.26	2.010
Depreciation on Churn Drill Equipment.....		443.53	443.53	.181
Total Maintenance, Operating and Depreciation.....	$ 2,684.23	2,712.56	$ 5,396.89	2.191

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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling (Cont.)

The table below shows the average footages obtained per shift in Tilden Mine churn drilling of 9" Holes:

	1941			1940		
Location	Shifts Worked	Footage Drilled	Average Footage Per 8 Hr. Shift	Shifts Worked	Footage Drilled	Average Footage Per 8 Hr. Shift
Lower Bench-West Pit	86	1,755	20.41	72	1,209	16.65
East End of West Pit	93	1,977	21.55	-	-	-
West End of West Pit	205	2,957	14.42	20	341	17.05
East Pit	117	2,456	20.99	67	1,293	19.29
Totals.....	501	9,145	18.25	159	2,843	17.87

The following table gives the footage obtained per bit (9") in 1941 compared with the 1940 performance:

	1941			1940		
Location	Bits Used	Footage Obtained.	Footage Per Bit	Bits Used	Footage Obtained.	Footage Per Bit
Lower Bench-West Pit	256	1,755	6.85	233	1,209	5.18
East End of West Pit	307	1,977	6.44	-	-	-
West End of West Pit	723	2,957	4.09	106	341	3.21
East Pit	410	2,456	5.99	216	1,293	5.98
Totals.....	1,696	9,145	5.39	555	2,843	5.12

2. Blasting

A reduction in the quantities used of the higher cost 90% Gelatin was made this year. The low cost Gelamite explosive was employed in greater quantities to provide higher powder distribution in the blasts. The extensive use of the Gelamite, although affording a heavier numerical explosives ratio, resulted in lower blasting costs, and the balanced powder distribution unquestionably was a factor in the increased tons per shift obtained in shovel loading operations.

Fragmentation obtained in the 1941 blasting operations was comparable to that of the past several years in which the 9" hole was used. It was believed, however, that a departure from the spacing and burden measurements adopted with the advent of the 9" hole would result in a higher blasting and loading efficiency. Present drilling in the East Pit is designed to afford a test section of face in which the tonnage to be obtained per foot of drill hole will be increased. The burden, however, has been reduced and the spacing between holes increased to provide a better balance of the explosives charges in an effort to reduce shear action evidently present under former blasting methods.

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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

2. Blasting (Cont.)

Six primary blasts were fired during 1941, two in the East Pit and the remainder in the West Pit. The East Pit blasts were so arranged that following the first shot, the power shovel could cast through for a tail track, thereby eliminating efficiency-wasting head-on loading. The balance of the drilled face was then blasted at an opportune time later in the season.

The Lower Bench-West Pit blast advanced the face to the north as well as continuing the westerly advancement. This was designed to produce an extra, substantial tonnage available at a close haul to the crushers.

A small blast was fired in the center dike section of the West Pit to recover approximately 6,000 tons of ore confined on three sides by dike, precluding any possibility of blasting the area with an East Half shot.

The following table outlines data pertinent to the blasts:

Location	Blast No.	Date	No. of Holes.	Footage	Pounds Powder	Estimated Tonnage	Tons of Ore Per Pound of Powder
East Pit	18A	4/15/41	28	2,653	37,100	107,450	2.90
Lower Bench-West Pit	7	6/ 7/41	20	1,180	18,500	45,250	2.45
W½ of West Pit	1-41	7/ 1/41	12	1,172	23,300	52,130	2.25
East Pit	18B	7/ 7/41	6	460	8,100	17,400	2.20
E½ of West Pit	1-41	8/22/41	13	861	14,800	31,500	2.17
Center Dike Section West Pit	2-41	10/24/41	5	332	1,200	6,120	5.10
TOTAL TILDEN MINE.....			84	6,658	103,000	259,850	2.52

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

2. Blasting (Cont.)

STATEMENT OF COST OF EXPLOSIVES USED FOR YEAR ENDING DECEMBER 31, 1941

Primary Blasting

Kind	Quantity	Price	Amount
Gelamite #2	61,650 lbs.	$11.50	$ 7,089.75
75% L.F. Gelatin	30,150 "	12.75	3,844.08
90% L.F. Gelatin	11,200 "	16.50	1,848.00
Total Powder	103,000 lbs.	12.408	12,781.83
Blasting Supplies			
Primacord Bickford Fuse, regular	3,500 ft.	38.50 M	134.75
Primacord Bickford Fuse, wire bound	7,000 "	47.50 M	332.50
#14 Special Duplex Leading Wire	750 "	15.00 M	11.25
Special A Unions	100 "	1.65 C	1.65
Total Blasting Supplies	11,350 ft.		480.15
Total All Explosives			13,261.98

Total Ore Blasted in 1941	259,850
Pounds of Powder per ton of Ore	.396
Cost per ton for Powder	.049
Cost per ton for Fuse, Caps, etc	.002
Cost per ton for all Explosives	.051
Average price per lb. for Powder	.124

Secondary Blasting

Kind	Quantity	Price	Amount
60% Gelatin	6,300 lb.	$11.50	$ 724.50
Gelamite #1	300 lb.	11.50	34.50
90% Gelatin	300 lb.	17.50	52.50
Total Powder	6,900 lb.	11.76	$ 811.50
Blasting Supplies			
Connecting Wire	11 lb.	.40	4.40
Primacord Fuse - Wire Bound	500'	47.50 M	23.75
Primacord Fuse - Regular	225 'lbs.	38.50 M	9.62
Clover Fuse	24,250'	5.05 M	122.60
#6 Blasting Caps	2,900	12.30 M	36.07
#7 Hot Wire Lighters	700		4.73
Electric Blasting Caps	100		6.15
Total Blasting Supplies			$ 207.32
Total All Explosives			$ 1,018.82

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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

2. Blasting (Cont.) (Secondary)

Product	302,943
Pounds of Powder per ton of Ore	.023
Cost per ton for Powder	.002
Cost per ton for Fuse, Caps, etc	.001
Cost per ton for All Explosives	.003
Average Price per lb. for Powder	..1176

COMBINED TOTAL BLASTING COSTS

Kind	Quantity	Price	Amount
Gelamite #1	300 lb.	$11.50	$ 34.50
Gelamite #2	61,650 "	11.50	7,089.75
60% L.F. Gelatin	6,300 "	11.50	724.50
75% L.F. Gelatin	30,150 "	12.75	3,844.08
90% L.F. Gelatin	11,500 "	16.52	1,900.50
Total Powder	109,900 lbs.	12.31	$ 13,593.33
Blasting Supplies			
Connecting Wire	11 lb.	.40	$ 4.40
Primacord Bickford Fuse (Regular)	3,725'	38.50 M	144.37
Primacord Bickford Fuse (Wire Bound)	7,500	47.50 M	356.25
Clover Fuse	24,250	5.05 M	122.60
#6 Blasting Caps	2,900	12.30 M	36.07
7" Hot Wire Lighters	700		4.73
Electric Blasting Caps	100	61.50 M	6.15
#14 Special Duplex Leading Wire	750'	15.00 M	11.25
Special A. Unions	100	16.50 M	1.65
Total Blasting Supplies			$ 687.47
TOTAL - ALL EXPLOSIVES			$ 14,280.80

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 107,450 Tons of Ore in the East Pit

Net feet of 9" Holes Drilled - 2,653'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$ 1,806.04	$ 267.95	$ 2,073.99	.781	
Sharpening Bits	504.07	291.83	795.90	.300	
New Bits		413.87	413.87	.156	
New Tools		379.38	379.38	.143	
Electric Power		458.97	458.97	.173	
New Rope		218.19	218.19	.083	
Pipe and Fittings		283.87	283.87	.107	
Cleaning Holes	54.16	4.21	58.37	.022	
Truck and Tractor	476.09	157.98	634.07	.239	
Total Operating.....	$ 2,840.36	$2,476.25	$ 5,316.61	$ 2.004	
Maintenance					
Drill Maintenance	159.00		159.00	.060	
Total Maintenance and Operating.....	$ 2,999.36	$2,476.25	$ 5,475.61	$ 2.064	.051
Depreciation on Churn Drill Equipment.....		480.19	480.19	.181	.004
Total Maintenance, Operating, and Depreciation.....	$ 2,999.36	$2,956.44	$ 5,955.80	$ 2.245	.055
Primary Blasting Costs					
Labor Loading Holes	290.40		290.40		
Explosives		4,981.25	4,981.25		
Other Supplies		13.62	13.62		
Total Blasting Costs	$ 290.40	$4,994.87	$ 5,285.27		.048
Grand Total, Operating, Maintenance, and Primary Blasting Costs	$ 3,289.76	$7,951.31	$ 11,241.07		.104

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 45,250 Tons of Ore in Lower Bench, West Pit

Net feet of 9" Holes Drilled - 1,180'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$ 801.32	$ 29.40	$ 830.72	$ .704	
Sharpening Bits	330.40	169.92	500.32	.424	
New Rope		34.22	34.22	.029	
New Bits		156.94	156.94	.133	
Electric Power		49.56	49.56	.042	
New Tools		43.66	43.66	.037	
Building Roads	216.00		216.00	.183	
Pipe and Fittings		22.42	22.42	.019	
Truck and Tractor	272.48	29.60	302.08	.256	
Total Operating....	$1,620.20	$535.72	$2,155.92	$ 1.827	
Maintenance					
Drill Maintenance	30.68		30.68	.026	
Drill Sharpener Equipt.	23.60		23.60	.020	
Total Maintenance	54.28	-	54.28	.046	
Total Maintenance and Operating.....	$1,674.48	$535.72	$2,210.20	$ 1.873	
Depreciation on Churn Drill Equipment....		213.58	213.58	.181	
Total Maintenance, Operating and Depreciation.....	$1,674.48	$749.30	$2,423.78	$ 2.054	.053
Primary Blasting Costs					
Labor Loading Holes	101.70		101.70		
Explosives		2,258.00	2,258.00		
Other Supplies		5.11	5.11		
Total Blasting Costs..	$ 101.70	$2,263.11	$2,364.81		.053
Grand Total, Operating, Maintenance, and Primary Blasting Costs	$1,776.18	$3,012.41	$4,788.59		.106

TILDEN MINE
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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 52,130 Tons of Ore in the West Half of the West Pit

Net feet of 9" Holes Drilled - 1,172'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$1,289.20	$ 56.26	$1,345.46	$1.148	
Sharpening Bits	480.52	304.72	785.24	.670	
Pipe and Fittings		42.19	42.19	.036	
Electric Power		131.26	131.26	.112	
New Bits		275.42	275.42	.235	
New Tools		174.63	174.63	.149	
Truck and Tractor	316.44	59.77	376.21	.321	
Total Operating.....	$2,086.16	$1,044.25	$3,130.41	$ 2.671	
Maintenance					
Drill Maintenance	45.00	41.73	86.73	.074	
Drill Sharpener Equipt.		29.30	29.30	.025	
Total Maintenance...	45.00	71.03	116.03	.099	
Total Maintenance and Operating.....	$2,131.16	$1,115.28	$3,146.44	$ 2.770	.051
Depreciation on Churn Drill Equipment.....		112.13	112.13	.181	.011
Total Maintenance, Operating and Depreciation.....	$2,131.16	$1,227.41	$3,258.57	$ 2.951	.062
Primary Blasting Costs					
Labor Loading Holes	182.45		182.45		
Explosives		2,834.85	2,834.85		
Other Supplies		4.09	4.09		
Total Blasting Costs..	$182.45	$2,838.94	$3,021.39		.056
Grand Total, Operating, Maintenance, and Primary Blasting Costs	$2,313.61	$4,066.35	$6,379.96		.122

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 17,400 Tons of Ore in the East Pit

Net Footage of 9" Holes - 460'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$ 310.28	$ 48.98	$ 359.26	$ .781	
Sharpening Bits	89.00	49.00	138.00	.300	
Pipe and Fittings		49.22	49.22	.107	
Rope		38.18	38.18	.083	
New Bits		71.76	71.76	.156	
New Tools		65.73	65.73	.143	
Electric Power		79.58	79.58	.173	
Cleaning Holes	10.12	-	10.12	.022	
Truck and Tractor	78.20	31.79	109.99	.239	
Total Operating.....	$ 487.60	$434.24	$ 921.84	$ 2.004	
Maintenance					
Drill Maintenance	2.76		2.76	.006	
Total Maintenance and Operating.....	$ 490.36	$434.24	$ 924.60	$ 2.010	
Depreciation on Churn Drill Equipment.....		83.26	83.26	.181	
Total Maintenance, Operating and Depreciation.....	$ 490.36	$517.50	$1,007.86	$ 2.191	
Primary Blasting Costs					
Labor Loading Holes	29.00		29.00		
Explosives		998.25	998.25		
Other Supplies		7.87	7.87		
Total Blasting Costs..	$ 29.00	$1,006.12	$1,035.12		
Grand Total, Operating Maintenance, Depreciation, and Primary Blasting Costs	$519.36	$1,523.62	$2,042.98		.112

TILDEN MINE
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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 31,500 Tons of Ore in the East Half of the West Pit

Net Footage of 9" Holes - 861'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Foot
Drilling at Mine	$ 631.98	$ 32.71	$ 664.69	$ .772	
Sharpening Bits	177.37	142.06	319.43	.374	
New Bits		217.83	217.83	.253	
New Tools		183.39	183.39	.213	
Electric Power		74.90	74.90	.087	
New Rope		52.52	52.52	.061	
Truck and Tractor	180.81	28.41	209.22	.243	
Total Operating....	$ 990.16	$731.82	$1,721.98	$ 2.003	
Maintenance					
Drill Maintenance	17.22	83.52	100.74	.117	
Drill Sharpener Equipt.	8.61	8.61	17.22	.020	
Total Maintenance..	25.83	92.13	117.96	.137	
Total Maintenance and Operating.....	$1,015.99	$823.95	$1,839.94	$ 2.140	
Depreciation on Churn Drill Equipment....		155.84	155.84	.181	
Total Maintenance, Operating and Depreciation.....	$1,015.99	$979.79	$1,995.78	$ 2.321	.0633
Primary Blasting Costs					
Labor Loading Holes	45.20		45.20		
Explosives		2,021.50	2,021.50		
Other Supplies		2.55	2.55		
Total Blasting Costs..	$ 45.20	$2,024.05	$2,069.25		.0657
Grand Total, Operating, Maintenance, and Primary Blasting Costs	$1,061.19	$3,003.84	$4,065.03		.129

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 6,120 Tons of Ore in Center Dike Section - West Pit

Net Footage of 9" Holes - 332'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$ 243.70	$ 12.66	$ 256.36	$ .772	
Sharpening Bits	74.03	50.14	124.17	.374	
New Rope		20.25	20.25	.061	
Electric Power		28.88	28.88	.087	
New Bits		83.99	83.99	.253	
New Tools		70.72	70.72	.213	
Truck and Tractor	74.03	6.65	80.68	.243	
Total Operating.....	$ 391.76	$273.29	$ 665.05	$ 2.003	
Maintenance					
Drill Maintenance	5.64	33.20	38.84	.117	
Bit Dresser	3.32	3.32	6.64	.020	
Total Maintenance...	8.96	36.52	45.48	.137	
Total Maintenance and Operating.....	$ 400.72	$309.81	$710.53		
Depreciation on Churn Drill Equipment.....		60.19	60.19		
Total Maintenance, Operating and Depreciation.....	$ 400.72	$370.00	$770.72	$ 2.321	.125
Primary Blasting Costs					
Labor Loading Holes	23.20		23.20		
Explosives		168.13	168.13		
Other Supplies		4.20	4.20		
Total Blasting Costs..	$ 23.20	$172.33	$195.53		.032
Grand Total, Operating, Maintenance, and Primary Blasting Costs	$ 423.92	$542.33	$966.25		.157

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7. OPEN PIT
OPERATIONS (CONT.)

g. Loading Operations

Loading from the stockpiles was began April 15th and from the pits on May 2nd. Tonnage loaded from the stockpiles during the year amounted to 41,202 tons. Loading from the pits was maintained on a steady program by stocking operations amounting to 51,702 tons. All operations were conducted on a single shift basis with the exception of four days in which a double shift was necessary. A total of 149 shifts were worked in producing 302,943 tons of ore.

No. 31 shovel worked in the East Pit the entire year, with Nos. 29 and 46 in the West Pit. The No. 29 shovel also loaded from the stockpile. With the development of the sinking cut advanced to its deepest face of 60' height, the loading conditions encountered by the light Marion 480, No. 46, Shovel, were more difficult than in the past. Considerable dike was broken in the West Half of the West Pit, requiring segregation as far as possible in the shovel loading in that area. To maintain grade in the ore shipments, it was necessary to load a high tonnage of the favorable Lower Bench ore, necessitating continual operation of the No. 46 Shovel, and the D-8 tractor and wagon. The use of the tractor and wagon has proved quite satisfactory to date inasmuch as the location of the broken ore in the Lower Bench offered a short haul to the crushers.

With a much greater tonnage expected from the Lower Bench, the present loading and haulage facilities will be entirely inadequate. Much is to be expected by the use of the new No. 52 Bucyrus-Erie 120-B shovel in conjunction with the two Euclid haulage units. Whether or not the complete erection of the No. 52 shovel can be made in sufficient time to aid materially in the 1942 season, the new truck haulage units will work to a decided advantage in Tilden operations.

The 1941 season schedule of shovel movements is noted below:

No. 29 Shovel		No. 46 Shovel	
Period Worked	Locality (West Pit)	Period Worked	Locality (West Pit)
Apr. 15 - May 1	Stockpile	May 2 - Nov. 21	Lower Bench.
May 2 - Nov. 26	Upper Bench	Nov. 22 - Nov. 29	Stockpile
		Nov. 30 - Dec. 5	Drainage Ditch - Lower Bench.

No. 31 Shovel - East Pit entire season.

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8. COST OF OPERATING

a. Comparative Mining Costs

	1941	1940	Increase	Decrease
Production	302,943	205,612	97,331	
Average Daily Output	2,033	1,787	246	
Tons per man per day	52.31	47.68	4.63	
Number of days operating	149	115	34	
Number of shifts and hours	141 - 1-8 hr. 4 - 2-8 hr.	107 - 1-8 hr. 4 - 2-8 hr.	134	
Cost				
Stocking and Loading Ore	.011	.017		.006
Pit Operating Accounts	.333	.309	.024	
Pit General Accounts	.042	.068		.026
Cost at Mine	.386	.394		.008
Idle & Winter Expense	.124	.090	.034	
Total Cost at Mine	.510	.484	.026	
Depreciation				
Plant and Equipment	.059	.063		.004
Taxes	.025	.027		.002
Stripping	.015	.013	.002	
Grand Total Cost at Mine	.609	.587	.022	
Expense Beyond Mine				
Freight - Rail	.650	.650		
Lake Freight	.860	.860		
Cargo Insurance and Analysis	.011	.011		
Shrinkage	.012	.012		
TOTAL COST LOWER LAKES	2.142	2.120	.022	

b. Detailed Cost Comparison

1. Days and Shifts

The property operated a total of 149 shifts as compared with 115 in 1940, an increase of 34 shifts.

2. Production

In 1941, a tonnage of 302,943 tons was produced, an increase of 97,331 over the 1940 production. The average daily product shows a gain of 246 tons per shift, being 2,033 tons as against 1,787 tons in 1940.

The "tons per man per day" were increased 4.63 tons or 9% over the 1940 season.

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7. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

3. Cost of Production

A cost comparison on actual stocking work done at the Tilden Mine for the two years 1941 and 1940, are given below:

	1941	1940
Tons Stocked - - - - - - - - - - - -	51,702	45,176
Cost of Stocking Work - - - - - - -	$2557.91	$1468.65
Cost per ton of ore stocked - - -	.049	.032

Loading from the stockpiles this year was the first operation of this kind of any extent done at the Tilden Mine. For purposes of record, the costs of this work are given below:

	1941	1940
Tons Loaded - - - - - - - - - - - -	41,202	3,193
Cost of Loading Work - - - - - - -	$708.61	$72.80
Cost per ton of ore loaded - - -	.017	.023

TILDEN MINE
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8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs

	1941	1940	Increase	Decrease
Shifts and Hours	141 - 1-8 hr. 4 - 2-8 hr.	107 - 1-8 hr. 4 - 2-8 hr.	134	
Production Tons	302,943	205,612	97,331	
Average Product per 8 Hr. Shift	2,033	1,787	246	
Number of Shifts Worked	149	115	34	

PIT OPERATIONS	1941		1940		Increase		Decrease	
Direct Ore	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1. Drilling and Blasting	$39,791.19	.130	$24,920.05	.122	$14,871.14	.008		
2. Power Shovels Operating	10,845.49	.036	7,184.36	.035	3,661.13	.001		
3. Power Shovels Maintenance	4,289.25	.014	2,706.53	.013	1,582.72	.001		
4. Locomotives & Cars Operating	10,163.85	.034	6,644.15	.032	3,519.70	.002		
5. Locomotives & Cars Maintenance	890.10	.003	505.72	.002	384.38	.001		
6. Track Expense	3,239.77	.011	1,956.05	.010	1,283.72	.001		
6A. D-8 Tractor Operating	4,584.15	.015	2,103.20	.010	2,480.95	.005		
6B. D-8 Tractor Maintenance	764.20	.003	688.21	.003	75.99	-		
TOTAL DIRECT ORE	$74,568.00	.246	$46,708.27	.227	$27,859.73	.019		
General Pit Expense								
8. Water Supply	$ 150.27	.000	$ 8.59	.000	$ 141.68	.000		
9. Buildings	344.57	.001	-	-	344.57	.001		
10. Crushing and Screening	17,473.33	.058	10,047.42	.049	7,425.91	.009		
11. General Open Pit Expense	6,567.57	.022	4,248.47	.021	2,319.10	.001		
12. Open Pit Supts	1,438.80	.005	1,248.48	.006	190.32			.001
14. Waste Pile Expense	293.18	.001	751.36	.004			$ 458.18	.003
14A. TestPitting	94.16	.000	274.07	.001			179.91	.001
15. Exploration Drilling	-	-	217.69	.001			217.69	.001
TOTAL GENERAL EXPENSE	26,361.88	.087	16,796.08	.082	9,565.80	.005		
TOTAL PIT OPERATION	$100,929.88	.333	63,504.35	.309	37,425.53	.024		
Stocking Tilden Crushed Ore	2,801.26	.009	3,546.68	.017			745.42	.008
GRAND TOTAL	$103,731.14	.342	$67,051.03	.326	36,680.11	.016		

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8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs (Cont.)

GENERAL MINE EXPENSE	1941 Amount	1941 Per Ton	1940 Amount	1940 Per Ton	Increase Amount	Increase Per Ton	Decrease Amount	Decrease Per Ton
16. Mining Engineering.....	$ 749.45	.002	$ 940.64	.005			$ 191.19	.003
16A. Geological.....	19.05	.000			$ 19.05	.000		
17. Mechanical and Electrical Engineering.	210.43	.001	106.09	.001	104.34	.000		
18. Analysis & Grading.....	3,558.26	.013	2,145.37	.010	1,412.89	.003		
19. Safety Department.....	99.00	.000	95.00	.000	4.00	.000		
20. Local & Gen. Welfare...	272.00	.001	267.88	.001	4.12	.000		
21. Special Expense.....	434.68	.001	5,000.88	.024			4,566.20	.023
22. Ishpeming Office.....	922.00	.003	847.00	.004	75.00			.001
23. Mine Office.....	2,209.19	.008	1,945.14	.009	264.05			.001
24. Insurance.....	161.46	.001	160.98	.001	.48			
25. Personal Injury.....	398.64	.001	932.09	.004			533.45	.003
26. Social Security Taxes..	1,928.30	.006	1,183.25	.006	745.05			
27. Employees Vacation Pay.	1,595.64	.005	596.89	.003	998.75	.002		
TOTAL GENERAL MINE EXPENSE..	$12,558.10	.042	14,221.21	.068			1,663.11	.026
IDLE & WINTER EXPENSE.....	37,612.40	.124	18,332.49	.090	19,279.91	.034		
COST OF PRODUCTION.....	153,901.64	.508	99,604.73	.484	54,296.91	.024		
28. Deprn. Plant & Equipt..	17,672.62	.059	12,933.06	.063	4,739.56			.004
29. Amortization Stripping.	4,669.60	.015	2,671.79	.013	1,997.81	.002		
30. Taxes.....	7,779.73	.025	5,468.52	.027	2,311.21			.002
COST AT MINE.....	30,121.95	.099	21,073.37	.103	9,047.58			.004
Loading Stocked Ore.....	708.61	.002	72.80	.000	635.81	.002		
Inventory Adjustment.....	10.46	.000	11.75	.000			1.29	
TOTAL COST AT MINE.....	$184,742.66	.609	120,762.65	.587	63,980.01	.022		

Direct Ore Operations

In the above cost statement, it will be seen that the increase in total cost per ton of ore produced of $.016 over that of 1940, is derived mainly from the "Direct Ore Operations". In the Direct Ore Operations, the labor factor is large and it is obvious that a higher labor cost as was present in 1941 will be reflected in the operation costs in a measure proportionate to the extent of labor employed.

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8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs (Cont.)

Crushing and Screening

The crushing costs were higher this year because of extensive repairs and overhauling given units during the week of August 10th - 16th, the regular vacation wee, during which the Mine did not operate. Concaves in the West 10" crusher were also replaced at that time.

Idle and Winter Expense

The increase of .034 per ton was due to extensive repairs being necessary early in the year on the No. 46 and No. 31 shovels. Complete overhauling was demanded of the No. 46 shovel following the working season in the Lower Bench and the badly loosend front end of the No. 31 Shovel necessitated many repairs.

For purposes of record the idle expense for the current year is listed below:

	Labor	Supplies	Total
January	$ 3,266.89	$ 2,739.13	$ 6,006.02
February	2,454.61	7,971.25	10,425.86
March	2,250.05	3,380.90	5,630.95
April	2,841.81	4,111.84	6,953.65
December	4,174.91	4,421.01	8,595.92
Total	$14,988.27	$22,624.13	37,612.40

9. EXPLORATIONS AND FUTURE EXPLORATIONS

Prospect drilling carried on during the fall of 1940 in the NE¼ of Section 27, 47-27 in an area roughly 1,500 feet West of the West Pit boundary line, was completed in January of 1941. The 1940 Annual Report gives full coverage to a discussion of the possible ore tonnage available in that area. For purposes of record, data pertinent to the drilling completed in January, 1941, is given in the following table:

Hole No.	Location		Elev. Collar	Elev. Ledge	Depth	Elev. Bottom	Analyses		
	Southing	Westing					Iron	Phos.	Sul.
14	21577	17000	1478	1469	60	1418	37.83	.065	.009
16	21440	17400	1507	1481	80	1427	29.52	.058	.012
17	21572	17400	1485	1430	71	1414	33.03	.033	.009
18	21600	16400	1485	1467	72	1413	36.65	.049	.009
19	21616	16207	1496	1479	74	1422	35.37	.042	.010
20	21683	16000	1500	1485	105	1395	12.49	.121	-

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10. TAXES

Tilden Township Tilden Mine	1941 Valuation	 Taxes	1940 Valuation	 Taxes
N½ of Section 26, 47-27.....	$310,000	$6,045.16	$265,000	$4,347.91
Personal Supplies and Equipment.....	85,000	1,657.54	65,000	1,066.47
Total.....	$395,000	$7,702.70	$330,000	$5,414.38
Collection Fees.....		77.03		54.14
Total Tilden Mine.....	$395,000	$7,779.73	$330,000	$5,468.52

11. PERSONAL INJURY

There were no lost time accidents at the Tilden Mine during 1941.

12. NEW CONSTRUCTION
AND PROPOSED
NEW CONSTRUCTION

On March 7th, 1941, the building housing the drill sharpening equipment was entirely destroyed by fire. A new building purchased from the Truscon Steel Company was erected by Company men and equipment on the same site.

The cost of the new building as covered by E. & A. CC-75 is given below:

	Amount Authorized	Amount Expended	Amount Unexpended
Quotation of Truscon Co.....	$ 2,195.00	$ 2,096.79	$ 98.21
Erection by Company men.....	200.00	383.48	183.48
Concrete Foundations.....	200.00	314.37	114.37
Glass, Painting, etc.....	205.00	85.43 (1)	119.57
Total.....	$ 2,800.00	$ 2,880.07	80.07

(1) Building to be painted when weather conditions are suitable. The above expenditure is for glass work.

To house heavy supplies at the property, a storage building was erected in August, 1941, near the mouth of the West Pit by Company men. The cost of the construction amounted to $344.57.

13. EQUIPMENT
AND PROPOSED
NEW EQUIPMENT

a. Shovels and Crushers

Thorough overhauling prior to the opening of the season enabled the three power shovels to operated throughout the year with few minor repairs. Following the close of operations for the year, the winter program of repairs was started, the items of which are set forth at the close of the report under repairs for December, 1941.

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13. EQUIPMENT AND PROPOSED NEW EQUIPMENT (CONT.)

c. Haulage Equipment (Cont.)

The yearly depreciation of $2,592.20 which had, in the past, been charged out in five equal installments of $518.53 from May to September, inclusive, was increased to a total of $3,670.49 to compensate for the longer operating season of 1941.

It may be mentioned here that the stripping work done by the D-8 tractor and bull-dozer must be accomplished at times other than the operating season when the tractor is needed for transporting ore from the Lower Bench. The stripping is, of necessity, done under the unfavorable conditions of winter weather.

A new Cletrac tractor, used principally in servicing the drill rigs with bits and other supplies and in general haulage use throughout the pits, was purchased this year to replace the old one then in use. The cost of acquisition as covered by E. & A. CC-59 is given below:

	Amount Authorized	Amount Expended	Amount Unexpended
1 Model BG Gas Cletrac Tractor	$2,485.00		
Less Allowance for old Tractor	610.00		
Total	$1,875.00	$1,875.00	
Book Value on old Cletrac Tractor		207.95	
Total	$1,875.00	$2,082.95	$207.95

d. Proposed New Equipment

A comprehensive discussion is given in the 1940 Annual Report under this heading concerning the conditions prevalent in both the Lower Bench-West Pit and the East Pit. Since measures have been taken to correct these unfavorable conditions, no good purpose is served by a repetition of the discussion at this time. However, a description of the proposed and acquired additional equipment follows:

1. Shovel No. 52 - Bucyrus-Erie Model 120-B

It is expected that this shovel will economically and efficiently meet the most severe conditions of loading present at the Tilden Mine. The benefit of this equipment, however, will not be felt until midsummer, inasmuch as delivery of the front end is not expected before July of 1942. The shovel with the above mentioned exception was delivered on January 6th, 1942 and was immediately erected.

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13. EQUIPMENT AND PROPOSED NEW EQUIPMENT (CONT.)

a. Shovels and Crushers (Cont.)

The crushing plant operated satisfactorily during the year. Replacements of wearing parts constituted the chief maintenance work. A new main frame was installed on the East 10" Crusher in April before the beginning of operations.

b. Drills and Equipment

The 29-T drill rigs produced 9,145 feet of drilled 9" primary blast holes during the year, a substantial part of the total being in the exceedingly hard material of the West Half of the West Pit, with no delays other than the expected natural wear of moving parts.

c. Haulage Equipment

The D-8 tractor and Athey wagon provided the haulage equipment for ore removed from the Lower Bench. With a closer haul, the daily output was raised to 635 tons per shift over an output of 575 tons per shift in 1940. A change in the depreciation charges made this year allocating a heavier proportion to the 1941 production increased the unit cost to $.07 per ton in 1941 over $.05 per ton in 1940.

A description of the work done by the D-8 tractor is shown by the following table:

	Days	Labor	Supplies	Depreciation	Maintenance	Total
Hauling Ore from Lower Bench.....	102	$1,005.14	$ 548.89	$3,030.12		$4,584.15*
Stripping.....	59½	414.40	192.47	252.31	$ 78.71	937.89
Hauling Rock.....	2	13.20	12.40	55.30		80.90
General Open Pit Expense (Roads, etc.).	8	54.40	37.43	230.04		321.87
Sec. 27 Drilling.....	4	24.00	14.08		11.71	49.79
Stocking Ore, Grading, etc.....	4¼	28.90	15.89	102.72		147.51
Total Operating.....	180	$1,540.04	$ 821.16	$ 3,670.49	$ 90.42	$ 6,122.11
Tractor Maintenance....	50	686.78	702.04			1,388.82
Total Operating and Maintenance.....	230	$2,226.82	$1,523.20	$3,670.49	$ 90.42	$7,510.93

*64,771 tons for year 1941; 635 tons per day at $.07 per ton. Increased cost per ton due to increased wages and larger proportion of depreciation charged to hauling ore from Lower Bench.

Maintenance work included the installation of one set of tracks and building up of two other sets of tracks.

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13. EQUIPMENT AND PROPOSED NEW EQUIPMENT (CONT.)

d. Proposed New Equipment (Cont.)

The estimate and authorization covering the expenditure for this piece of equipment is given below:

E. & A. CC-83 - TILDEN MINE
Bucyrus-Erie Model No. 120-B - Mining Shovel

Amount Authorized

1 Bucyrus-Erie Model 120-B Shovel	$ 78,425.00
Estimated Freight	1,000.00
1,000 ft. of Cable, Delivered	1,140.57
Erecting Shovel	1,000.00
Total	$ 81,565.57

2. Euclid Trac-Truks

To properly service the No. 52 Shovel in operation, two Euclid 15-ton rear-dump trucks have been requisitioned. The utilization of truck haulage may be expected to develop to a much broader scale in future operations of the Tilden Mine. Proposed stripping of the northeast advancement area of the East Pit and the development of a second bench in that area will require this type of haulage. The scope of truck haulage operations as proposed for 1942 may not exceed, however, the Lower Bench servicing.

The expenditure authorized for the trucks is as follows:

E. & A. CC-88 - TILDEN MINE
Euclid Trucks

Amount Authorized

2 - 15-ton Euclid Trucks at $11,390.00 each	$22,780.00
2 - Spare tires for each truck, 1 front, and one rear	
2 - 1200 x 24 - 14 ply - at $116.95	233.90
2 - 1400 x 24 - 14 ply - at $212.63	425.26
Freight to Ishpeming	400.00
Total	$23,639.16

14. MAINTENANCE AND REPAIRS

The maintenance and repair work during the operating season have already been discussed under Paragraph 13, labeled Equipment. The cost of winter and idle expense has been listed under Open Pit Costs.

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15. POWER

Electric power was entirely satisfactory during the year and occasioned little delay, except as was set forth under "Delays", the power was shut off during severe electrical storms to avoid the possibility of the circuit breaker throwing out while the crushers were under load.

16. WATER SUPPLY

The water supply was satisfactory and ample for all property needs throughout the year, including the washing which was done after stripping with the bulldozer on the North side of the East Pit.

All secondary drilling with both jack-hamers and tripod drifter drills was done wet, water pressure being obtained by placing the supply tanks on the high faces of both pits. Water for primary churn drilling was also obtained from these sources.

18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total
English	20	5	25
Swedish	5		5
Finnish	6	5	11
Irish	3		3
French-Canadian	1		1
Total	35	10	45

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For purposes of record, the following remarks are included on the repair work done during the month of December, 1941:

No. 31 Electric Shovel

Installed new wear plates and new front and two new side frames on dipper. Installed two new boom ends and rivetted boom and shipper shaft plates and repaired A frame and babbitted bearings on boom hoisting machinery.

Conveyor

Removed conveyor belts for winter and removed small pulley on belt tightener. Repaired coupling on speed reducer and dismantled motor for cleaning.

42" Crusher

Lowered eccentric and removed drive shaft for inspection.

East 10" Crusher

Turned concaves and babbitted eccentric and dismantled motor for cleaning and removed drive shaft.

West 10" Crusher

Babbitted eccentric and installed new gear on same. Dismantled motor for cleaning and removed drive shaft.

D-8 Tractor and Equipment

Installed two new track rollers and four roller guards on tractor. Changed cutting edge and corner ends on road-builder.

Locomotives

Electric-welded No. 1, 2 and 4 boilers and repaired No. 2 smoke box.

New Construction

Completed erection of new drill shop.

JSW:DWC

ATHENS MINE
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1. GENERAL:

The Athens Mine operated five days per week three shifts per day from January 1st to January 25th. From January 25th to June 1st the operating schedule was five days per week, three shifts and one shift on Saturday. Starting June 1st and continuing for the balance of the year two shifts were worked on Saturdays. Only a few miners worked at first on the Saturday afternoon shift but after the shutdown in July on account of the fire in the mine, more miners were allowed to work in order to increase production and also to make up a portion of the time lost on account of the fire. The men working on the afternoon shift on Saturdays were gradually increased until sufficient ore was being produced to keep the skip operating at capacity. When working conditions in the mine were favorable there was ore available for hoisting on the third shift on Saturdays. Only the skip tenders, however, worked in the mine and the top landers and hoisting engineers on surface on the midnight shift Saturday night when ore was available.

Production in 1941 of 648,750 tons was the largest in the history of the mine and exceeded by 133,025 tons the next largest hoist of 515,725 tons in 1940. Shipments in 1941 were 8,558 tons less than in 1940 but with this one exception were much larger than in any prior year.

A fire was discovered in the mine on June 20th in the timber mat above a drift on the -600' sub level approximately 2,000 ft. below surface. The fire was located in the crushed timber at the elevation of the 6th level. It was noticed that a drift being driven on the -600' sub level was very warm, in fact the ore broken by blasting was actually hot when touched. No smoke was visible but for several weeks prior to the discovery of the fire a slight creosote smell was noticeable on the -600' sub level and also in the airways on the 6th level. The fire was discovered when a one inch air pipe was pushed up into the timber mat above the drift and glowing charcoal coals came down. Tight brattices were installed to seal off the drift in the expectation of smothering the fire but this plan was unsuccessful as smoke was observed on July 2nd coming through the brattices. It was impossible to make an airtight seal due to openings in the crushed timber mat above the drifts on the -600' sub level. The mine was closed down immediately and helmet crews organized to fight the fire. Every precaution was taken to safeguard the fire fighters and it is gratifying to report that during the fifteen days required to extinguish the fire no one was overcome by gas or smoke. Two Bureau of Mines officials stationed at Duluth, Minnesota, were asked to bring their fire fighting equipment to Negaunee and advise as to the best methods to follow in fighting the fire. They rendered valuable aid in the work, particularly in safeguarding the fire fighting crews. Three crews of ten men each, all trained in the use of helmets, were organized and the fire fought twenty-four hours per day until it was finally extinguished. The fire fighters deserve great praise for working day after day in the smoke and heat. The fire had been burning for at least five months before it was discovered as this part of the 6th level was mined and blasted down in February 1941. Due to lack of oxygen the fire smoldered, forming a bed of charcoal several feet in thickness in a small area. It is assumed that the fire started from a hot wire lighter or burning powder when the 6th level was blasted down.

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1. GENERAL: (Cont'd)

The development of the 4th level for mining ore was started late in 1940 and completed in 1941. Two cross-cuts were driven and a number of raises put up. One cross-cut was located in the East half of block 4 and one 200 ft. further East in block 5. The raises that were completed in 1941, with two exceptions, found the ore to extend above the limits that had heretofore been used in estimating the ore reserves above the 4th level. The new estimate of ore reserves at the end of the year was materially increased as a result. The extension of the ore bodies as risers in the hanging in small areas make it necessary to break the hanging by drilling and blasting to form filling over the mined area.

The mine is now developed for a production equal to the capacity of the skip hoist but in order to reach this capacity ore is being mined above the 4th, 6th, 7th, and 9th levels. The Athens ore body is not large enough to mine on the block system (roughly 300 ft. wide strips) and furnish a product of 700,000 tons per year except by mining in four or five blocks at one time. Even now a new cross-cut is being driven on the 7th level and on its completion development of the 8th level will be undertaken. In connection with development of new areas for mining the fact that the minimum royalties paid in advance on the estimated tonnage on the Corbit Lease now equal the full royalty due on this ore makes it necessary to consider the development and mining of this ore as soon as possible.

The expense for timbering in 1941 exceeded the cost for stoping approximately 17%, as compared with 4% in 1940 and 15% in 1939. In 1941 the actual cost per ton for stulls, lagging, and poles, was almost 10% lower than in 1940. The increase in timbering cost in 1941 of $ .072 per ton was due to the 10¢ per hour increase in wages and more shifts on repair work. Maintenance of haulage drifts on the 6th level was a factor again in 1941 as it has been for the past four years.

The safety record in 1941 was excellant as the severity rate was only one-fifth that of the previous year. The severity rate was lower due to no fatal accidents in 1941 and only one accident causing lost time of over four months in duration. The total number of compensable accidents in 1941 was eighteen as compared with eleven in 1940 but most of the 1941 accidents caused loss of time of less than one month. There was also an increase in number of employees in 1941.

In March a new break or crack in the surface occurred South and East of the original cave to surface. The new crack extended Eastward for a distance of over 1,000 ft. and was located approximately 250 ft. South of the ore areas mined in blocks 2, 3, and 4. A test pit sunk 26 ft. to ledge showed an actual break in the rock ledge. Settlement continued during the Summer and reached a depth of 4 ft. to 5 ft. for a distance of several hundred feet South of blocks 2 and 3. Further East in the area South of block 4 it varied from 1 ft. to 2 ft. in depth. It was feared that this new break would cause an appreciable increase in the mine water but thus far there has been only a slight increase.

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1. GENERAL: (Cont'd)

Due to extension of the pull of the cave to surface to the East of the original cave it became necessary to move the Athens timber treating plant to a new location. The only mine in the Negaunee District with an available site was the Maas Mine and the plant was dismantled and moved there in the Early Summer. Late in the year arrangements were underway to transfer the plant to The Cleveland-Cliffs Iron Company and it is expected that the transfer will be approved early in 1942. The Athens Mine will, in the future, buy treated timber from the Maas Mine.

The new break in surface South of the mine involved the mine water discharge ditch and it was necessary to make plans for disposal of the water elsewhere. The old discharge ditch carried the water to the City sewerage ditch which discharges into a branch of the Escanaba River. The only feasible relocation involved conveyance of the water to the East and North into the Negaunee Mine water discharge ditch which connects with the Carp River. To accomplish this diversion it was necessary to lay a 10" pipe line for a distance of over 1,500 ft. from the mine and carry the water beyond this point in an open ditch for approximately 1,500 ft. A small revolving shovel was used to make several cuts from 5 ft. to 10 ft. in depth, also to excavate the ditch. While this work was underway the mine water was pumped up to the connec ting drift to the Negaunee Mine 1,000 ft. below surface which carried it to the Negaunee shaft on the 11th level. It was pumped to surface by the Negaunee pumping plant for a period of two months. This work was authorized under E. & A. No. AM-5 - Surface Discharge Line.

The most extensive improvement at the Athens Mine in 1941 was the remodeling of the dry house. This work involved remodeling the old dry building to provide a clean and dirty clothes room with a large shower room between, construction of an addition to the dry house for the surface men, remodeling of the shift bosses' rooms, and an addition to the lamp room. The work was all completed except for interior painting at the end of the year which work will be done early in 1942. Provision for keeping down the dust count well below the permissable limit was provided by the installation of two 7,000 ft. per mimute low pressure exhaust fans.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1941	1940	Increase	Decrease
Athens Ore	478,330	344,524	133,806	
Mitchell Lease Ore	170,420	171,201		781
Total Ore	648,750	515,725	133,025	
Rock	20,630	11,782	8,848	
Total Hoist	669,380	527,507	141,873	

Production increased approximately 26% in 1941 and was the largest in the history of the mine.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont'd)

b. Shipments:

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total 1940
Athens Ore	286,507	191,038	477,545	365,159
Mitchell Lease Ore	102,929	78,977	181,906	302,850
Total - 1941	389,436	270,015	659,451	668,009
Total - 1940	276,630	391,379	668,009	
Increase	112,806			
Decrease		121,364	8,558	

Shipments decreased 1.28% in 1941 and were 10,701 tons more than the product for the year.

c. Stockpile Inventories:

Grade of Ore	Dec. 31, 1941	Dec. 31, 1940	Increase	Decrease
Athens Ore	39,433	33,551	5,882	
Mitchell Lease Ore	11,724	18,145		6,421
Total	51,157	51,696		539

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:

	1941		1940	
	Tons	%	Tons	%
4th Level	59,660	9.2		
6th Level	148,105	22.8	194,948	37.8
7th Level	291,867	45.0	235,282	45.6
8th Level			668	.1
9th Level	149,118	23.0	84,827	16.5
Total	648,750	100.0	515,725	100.0

Production from the 4th level started in 1941 after this level had been idle more than twelve years. In 1941 the ore hoisted from the 7th and 9th levels increased and from the 6th level decreased.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont'd)

e. Production by Months:

The production by months was as follows:

Month	Athens	Mitchell	Total	Rock
January	35,096	12,413	47,509	1,540
February	35,647	12,823	48,470	680
March	38,266	12,158	50,424	1,465
April	46,314	15,493	61,807	1,215
May	45,153	11,690	56,843	1,750
June	41,929	12,070	53,999	795
July	22,301	6,649	28,770	1,350
August	41,489	14,807	56,296	3,635
September	35,885	14,442	50,327	2,900
October	41,568	16,312	57,880	2,045
November	33,532	17,752	51,284	1,320
December	41,512	12,437	53,949	1,935
Total 1941	458,692	158,866	617,558	20,630
Current Year's Stockpile Overrun	19,638	11,554	31,192	
Total 1941	478,330	170,420	648,750	20,630
Total 1940	344,524	171,201	515,725	11,782
Increase	133,806		133,025	8,848
Decrease		781		

f. Ore Statement:

	Athens	Mitchell	Total	Total 1940
On Hand Jan. 1, 1941	33,551	18,145	51,696	203,765
Product for Year	458,692	158,866	617,558	514,654
Prior Year's Stockpile Overrun	5,097	5,065	10,162	215
Current Year's Stockpile Overrun	19,638	11,554	31,192	1,071
Total	516,978	193,630	710,608	719,705
Shipments	477,545	181,906	659,451	668,009
Balance on Hand	39,433	11,724	51,157	51,696
Increase in Output			102,904	
Decrease in Ore on Hand			539	

g. Delays:

April 21st - 2 Hours Delay - Loss of Product 185 Tons
The skip stuck in the skip dump and two hours were required to free it.

April 22nd - 2 Hours Delay - Loss of Product 185 Tons
Two hours were required to make repairs to the skip dump to prevent the skip from sticking in the dump and to free the skip.

April 23rd - 1½ Hour Delay - Loss of Product 140 Tons
Further repairs to the skip dump were necessary due to the skip sticking in the dump.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont'd)

g. Delays: (Cont'd)

May 24th - 2 Hours Delay - Loss of Product 160 Tons

Due to the skip rope being too long, the skip struck the dirt in the skip pit pocket causing damage to the timber on the side of the skip pit pocket. Two hours were required for repairs.

May 29th - 1 Hour Delay - Loss of Product 100 Tons

A regular inspection of the hoisting equipment disclosed that the skip shoes were so badly worn that they had to be replaced before hoisting could be resumed. It required one hour to remove the old shoes and install new ones.

June 10th - 2½ Hours Delay - Loss of Product 225 Tons

A routine mid-week inspection of the skip roads disclosed several badly worn skip runners. Two and one-half hours were required to replace the worn runners with new ones.

July 2nd to 17th - 11 Operating Days or 30 Shifts - Loss of Product 23,050 Tons

During the day shift on June 20th fire was discovered in No. 8 contract which had been advancing a drift Northwest towards the fault dike from No. 721 raise at the elevation of the -600' sub level approximately 2,000 ft. below surface. Examination showed a fire to be smoldering in the timber mat 10 ft. above the back of the drift. Work was immediately abandoned here and brattices built to cut off the air from this area in an effort to smother the fire. Numerous tests made in the surrounding drifts failed to indicate the presence of carbon monoxide gas and work was continued in the adjacent mining contracts. However, smoke was observed coming through the brattices on July 2nd. The afternoon shift crew was sent home and helmet crews organized to combat the fire. The extent of the fire could not be determined for some time due to the intense heat and smoke. Eventually however, the fire was brought under control and finally extinguished on July 16th, and work resumed in the mine on the following day.

July 18th - 17 Hours Delay - Loss of Product 1,500 Tons

This delay in hoisting was due to the skip pit being filled with ore and water as a result of water overflowing into the shaft on the 7th level from the large quantities used in fighting the mine fire.

July 25th - 2½ Hours Delay - Loss of Product - 180 Tons

This delay was due to trouble that developed in loading ore from the skip pit pocket at the bottom of the shaft.

August 15th - 4¾ Hours Delay - Loss of Product 350 Tons

The regular daily inspection of the South skip rope disclosed that it should be removed and a new rope put on. It required 4¾ hours to remove the old rope and install the new one.

August 19th - 1¾ Hours Delay - Loss of Product 150 Tons

A new rope was installed on the South skip on August 15th and after four days of service it had stretched so much that a piece had to be cut off. The work of cutting the rope to the required length caused a delay of 1¾ hours.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont'd)

g. Delays: (Cont'd)

November 4th - 6½ Hours Delay - Loss of Product 550 Tons
A short circuit developed in the skip hoist control and 6½ hours were required to locate it and make the necessary repairs.

A summarized comparison of the delays for the years 1941 and 1940 shows that in 1941 there was a total loss of 26,775 tons of product in 283¼ hours or the approximate equivalent of twelve days hoisting while in 1940 only 4,745 tons of product were lost in 48 hours, or the approximate equivalent of 2½ days hoisting. In 1941 the delay due to the mine fire accounts for 240 hours of the total of 283¼ hours. Discounting the loss from the fire would leave 43½ hours delay as compared with 48 hours in 1940.

h. Delays From Lack of Current:

March 26th - 2½ Hours Delay - Loss of Product 300 Tons
This delay was due to the burning out of a sub station transformer.

May 26th - 1 Hour Delay - Loss of Product 80 Tons
A severe electric storm interrupted the electric power service thereby causing an hours delay in operation.

The total loss of product due to delays from lack of current in 1941 amounted to 380 tons. In 1940 there were no interruptions in the electric power service and consequently no delays due to lack of current.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1941				1940			
Grade	Tons	Iron	Phos.	Silica	Tons	Iron	Phos.	Silica
Athens	478,330	60.17	.124	6.97	344,524	61.14	.124	6.29
Mitchell	170,420	60.09	.122	7.17	171,201	61.00	.122	6.24

The grade of output was lower in 1941 due to the heavy production on the three shift schedule which makes it difficult to maintain the grade as the daily advance in the slices is far ahead of the analyses.

b. Average Analysis on Straight Cargoes:

		Mine		Lake Erie	
Grade	Iron	Phos.	Silica	Iron	Moisture
Athens		None			None
Mitchell		None			None

c. High Sulphur Ore:

No high sulphur ore was encountered in mining during 1941.

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4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12.75 cubic feet equals one ton
10% deducted for rock
10% deducted for lossin mining
% of Bessemer - none

	Athens Lots 1, 7, 10, 12	Mitchell Lots 8, 9, 11	Corbit Lot 13	Total Tons
4th Level and above	364,674	377,920	521,352	1,263,946
4th to 6th Level	620,797	877,583	11,626	1,510,006
6th to 7th Level	667,036	200,034		867,070
7th to 8th Level	526,683	9,588		536,271
8th to 9th Level	405,678			405,678
9th to 10th Level	423,922			423,922
Below 10th Level	60,784			60,784
Total Gross Tons	3,069,574	1,465,125	532,978	5,067,677
Less 10% Loss in Mining	306,957	146,513	53,298	506,768
	2,762,617	1,318,612	479,680	4,560,909
Less 10% Loss for Rock	276,262	131,861	47,968	456,091
	2,486,355	1,186,751	431,712	4,104,818
Less December Production	41,512	12,437		53,949
Net Tons - 1941	2,444,843	1,174,314	431,712	4,050,869
Net Tons - 1940	2,637,681	1,149,027	431,712	4,218,420
Decrease	192,838			167,551
Increase		25,287		

In spite of the large product in 1941, the ore reserves only decreased 167,551 tons. Subtracting the decrease of 167,551 tons from the output of 648,750 tons shows that 481,199 tons were developed in 1941. The newly developed ore was divided 285,492 on the Athens Lots and 195,707 on the Mitchell Lease Lots. Part of the increase was on and above the 4th level where development work has been underway most of the year. The ore areas have been proven to extend beyond and above the areas used in previous estimates. There was also an increase on the 6th and 7th levels due to extension of ore areas beyond the limits used in previous estimates.

b. Prospective Ore:

All ore in the mine is developed.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis:

Tons	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
4,050,869	52.55	.113	6.09	.374	2.75	.62	.73	.010	1.40	13.00

Ore in Stock: Average Dried Analysis:

Athens Ore

Tons	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
38,433	60.29	.124	7.35	.50	2.64	.66	.70	.010	1.55	13.08

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4. ESTIMATE OF ORE RESERVES: (Cont'd)

c. Estimated Analysis: (Cont'd)

Ore in Stock: Average Dried Analysis:

Mitchell Lease Ore

Tons	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
11,724	59.98	.119	7.41	.47	2.64	.66	.70	.010	1.55	13.08

5. LABOR AND WAGES:

a. Comments:

The average number of employees in 1941 was 399, an increase of 42 over the number employed in 1940. The number shown on the December Labor Statement was 408 while in December 1940 it was 383. During the year 69 men were hired, 10 were transferred to other mines, 7 were discharged, 15 quit of their own accord, 6 died, 3 retired on a small pension and 3 were drafted into the army. The net increase for the year was 25 men. Wages were advanced ten cents per hour in April. The average earnings per month by each employee increased from $124.67 to $195.73 or $71.06 per month. The men are contented and there has been very few complaints made during the year. The remodeling of the dry house was the underlying cause of most of the complaints such as lack of hot water for the showers. The complaints were speedily remedied in all cases.

b. Comparative Statement of Wages and Product:

	1941	1940	Increase	Decrease
PRODUCT	648,750	515,725	133,025	
No. Shifts and Hours	1-8 25	1-8 6	1-8 19	
	2-8 23	2-8 254		2-8 231
	3-8 248		3-8 248	
AVERAGE NO. MEN WORKING:				
Surface	68	64	4	
Underground	331	293	38	
Total	399	357	42	
AVERAGES WAGES PER DAY:				
Surface	6.40	5.51	.89	
Underground	7.34	6.26	1.08	
Total	7.17	6.12	1.05	
AVERAGE WAGES PER MONTH:	(Based on Mine Payroll Including Captain & Clerks)			
Surface	180.47	118.89	61.58	
Underground	198.84	127.00	71.84	
Total	195.71	125.55	70.16	

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5. LABOR AND WAGES: (Cont'd)

b. Comparative Statement of Wages and Product: (Cont'd)

	1941	1940	Increase	Decrease
PRODUCT PER MAN PER DAY:				
Surface	33.84	31.13	2.71	
Underground	7.23	7.23		
Total	5.96	5.87	.09	
LABOR COST PER TON:				
Surface	.189	.177	.012	
Underground	1.015	.866	.149	
Total	1.204	1.043	.161	
AVERAGE PRODUCT MINING:				
Stoping	22.46	19.85	2.61	
Development in Ore	12.06	13.15		1.09
Total	21.97	19.78	2.19	
AVERAGE WAGES CONTRACT LABOR	8.28	6.96	1.32	
TOTAL NUMBER OF DAYS:				
Surface	19,169	16,574	2,595	
Underground	89,691	71,322	18,369	
Total	108,860	87,896	20,964	
AMOUNT FOR LABOR:				
Surface	122,719.02	91,310.08	31,408.94	
Underground	658,167.80	446,561.86	211,605.94	
Total	780,886.82	537,871.94	243,014.88	
AVERAGE WAGES PER MONTH AS PER LABOR STATEMENT - LESS CAPTAIN AND CLERKS:				
Surface	181.19	116.86	64.33	
Underground	198.55	126.50	72.05	
Total	195.73	124.67	71.06	

Proportion of Surface to Underground Men:

1941 - 1 to 5.156

5-3-8-hr. shifts January 1st to January 25th, 1941.
5-3-8-hr. shifts and 1-1-8-hr. shift January 25th to June 1st, 1941.
5-3-8-hr. shifts and 1-2-8-hr. shift June 1st to December 31st, 1941.

1940 - 1 to 4.578

2 8-hr. shifts five days and afternoons January 1st to December 31st.

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5. LABOR AND WAGES: (Cont'd)

c. Operating Schedules - 1941:

Month	Days Mine Worked Per Week	Days Per Month	Days Men Worked Per Week	Avg. Shifts Worked Per Month by Each Man
January	5	23	5	23
February	6	24	5 & 6	22
March	6	26	5 & 6	24
April	6	26	5 & 6	24
May	6	27	5 & 6	24
June	6	27	5 & 6	24
July	6	15	5 & 6	14
August	6	26	5 & 6	25
September	6	25	5 & 6	24
October	6	27	5 & 6	26
November	6	24	5 & 6	23
December	6	26	5 & 6	24
Average for year mine operated		24.66		
Average for year worked by each man				23.09

6. SURFACE:

a-1. Buildings:

During the past several years a number of leaks developed in the dry house roof. Examination showed that the old roofing was no longer serviceable. A new roof was constructed over the old one by nailing shiplap to strips thereby creating an air space between the old and new roofs. The work was started in July but due to the difficulty of obtaining new roofing the job was not completed until in October.

To facilitate the loading and unloading of supplies the doorway into the carpenter shop building was widened and new double doors constructed. In October the blacksmith shop doorway was also enlarged and new double doors installed. The mine truck and also the trucks from the General Shops can now be driven into the shop building.

Minor repairs were made to the dry house windows and to the roof of the timber tunnel in November.

E. & A. No. AM-1 - Remodeling Change House, was authorized in March 1940 and the E. & A. closed in December 1941. The work has been completed except the painting of the interior. The building was entirely remodeled and an addition added for the surface men.

The mine office was redecorated late in the year after the plaster had been repaired. In two rooms the plaster was in such bad condition that the old walls were covered with plaster board. All the work was completed in December except painting the walls and varnishing the woodwork in two rooms.

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6. SURFACE: (Cont'd)

a-2. Docks, Trestles and Pockets:

There were no additions made to the wood stockpile trestles during 1941. Two broken legs were replaced on the wood ore stocking trestle at the end of the Southeast steel trestle. The ore stocked from this trestle in 1941 was all loaded by shovel without wrecking the trestle. The Diesel tractor with bulldozer attachment moved the ore directly under the trestle away from the legs to a point where it could be reached by the shovel. In 1940 there were thirteen wood trestle bents added to the Southeast steel trestle for stocking Athens ore and nine bents erected for stocking rock South of the old rock pile.

The skip dump was repaired several times during the year. Worn out plates were replaced and a new butterfly gate was installed. Worn plates in the chutes below were also replaced.

b. Stockpiles:

Shipments from stockpile were completed late in November. Only a small rill of Athens ore remained in stock. The tractor with bulldozer attachment cleaned up the scattered ore from the stocking grounds more thoroughly than had been possible in prior years. It is no longer necessary to dismantle wood stocking trestles when loading all the stocked ore as the tractor moves the ore from around the legs to a point where the shovel can reach it. This has effected an appreciable saving in the cost of stocking ore.

c. Timber Treating Plant:

The timber treating plant was moved to the Maas Mine early in the Summer. The tractor with bulldozer attachment excavated the pits for the hot and cold water tanks. Timber frames were installed to hold the steel tanks and these frames acted as forms for the concrete which was installed to make the job permanent. A tank car was rented from the Dow Chemical Company and the solution in the tanks at the Athens pumped into the tank car. The steel liner in the hot water tank was so badly corroded by the Zinc Chloride solution that a new lining was welded together at the Maas Mine. The steel liner in the cold water tank was still serviceable and it was loaded on a flat car and taken to the Maas Mine. The mast on the derrick was found to be badly rotted and a new one was made from a 48 ft. fir timber that had been used when moving houses to the second addition. The derrick was erected prior to moving the other equipment so as to have it available for handling material. It was mounted on a concrete base and the two small hoists used, one to hoist timber and one to swing the derrick, were also set up on concrete bases. A contract for peeling the timber to be treated this year was given the timber jobbers at a considerable saving over the cost for peeling at the mine. Several hundred pieces of 9 ft. timber were piled and seasoned and late in the Summer were treated. The men erecting and operating the plant came from the Athens Mine surface crew.

It was originally planned to lease the ground used by the timber treating plant from the Maas Mine at a nominal rental per year. However, at the end of the year consideration was being given to transfer of the plant and all equipment to the Maas Mine at a fair valuation.

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6. SURFACE: (Cont'd)

c. Timber Treating Plant: (Cont'd)

	Cost Per Ft. 1941	Cost Per Ft. 1940	Cost Per Ft. 1939
Peeling	.0200	.0484	.0485
Treating	.0558	.0375	.0360
Decking	.0098	.0048	.0216*
Chromated Zinc Chloride	.0400	.0643**	.0298
Heat, Water, Etc.	.0125	.0138	.0138
Total	.1381	.1688	.1497
Maintenance Cost	-	.0232	.0116
Grand Total	.1381	.1920	.1613

(*) Charge for decking high due to moving treated timber away from caved area.

(**) Charge for Chromated Zinc Chloride high due to cleaning tanks and adding Zinc Chloride to bring solution up to the required strength.

Year	No. of Pcs. Hardwood Stull Timber Treated	No. of Ft. Treated
1941	405	3,743
1940	221	1,989
Increase	184	1,754

	1941	1940	Inc.	Dec.
No. Pcs. Used at Athens	160	209		49
No. Pcs. Used at Maas	-	-		
No. Pcs. Shipped to Negaunee & Gardner-Mackinaw	-	-		
Total Pcs. Used & Shipped	160	209		49

	Treated Timber On Hand 12/31/41	Peeled Untreated Timber On Hand 12/31/41
9 ft. Pcs.	344	111
8 ft. Pcs.	7	-
Total	351	111
On Hand 12/31/40	160	-
Increase	191	111

d. Water Purchased for Heating, Cooling, Etc.:

The cost of water purchased from the City of Negaunee the last three years is as follows:

	1941		1940		1939	
	Gallons	Amount	Gallons	Amount	Gallons	Amount
1st Quarter	2,364,000	179.44	3,116,000	228.99	1,351,000	105.80
2nd Quarter	2,450,000	182.23	1,246,000	98.07	874,000	71.42
3rd Quarter	2,477,000	184.50	2,376,000	177.08	2,093,000	157.28
4th Quarter	2,621,000	197.78	2,414,000	179.44	3,461,000	252.92
Total	9,912,000	743.95	9,152,000	683.58	7,779,000	587.42
Product - Tons	648,750		515,725		404,877	
Cost Per Ton	.001147		.001325		.001451	

There was an increase in the amount of City water used at the mine due to more operating shifts in 1941. The cost per ton was however, lower due to larger product. The enlargement of the cooling pond near the engine house in 1939 has materially reduced the consumption of water used for cooling the compressors.

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6. SURFACE: (Cont'd)

e. Grounds:

The parking area for the automobiles used by Company employees located North of the mine grounds is under lease from The Negaunee Mine Company at the nominal rental of $1.00 per year. The parking grounds were leveled with cinders during the Summer. A high wire netting fence reinforced with barbed wire is maintained on three sides of the lot and with several electric lights is expected to prevent theft of tires and gasoline.

The grounds around the mine buildings were maintained in good condition during the Summer growing season. Due to rainfall very little watering of the lawns and shrubbery was necessary.

The extension of the pull of the cave to surface further to the East has reduced the size of the timber yard. In the Fall when the stock of timber got very low due to excessive rainfall making maintenance of trucking roads impossible, the accumulation of bark in the timber yard, averaging over two feet in thickness, was removed by the tractor bulldozer and scraped into the caved area.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1941.

b. Development:

The main development program in 1941 was confined to the 4th level. This work was started late in 1940 and rushed to completion early in 1941. Two cross-cuts were extended across the ore body and a number of raises put up to the hanging jasper. The jasper was encountered quite near the level in the center of the trough but extended much higher in the North footwall area. The ore near the South footwall also extended a considerable distance above the level, but part of this area was mined a number of years ago. The hanging jasper in the Athens Mine is quite irregular and the ore is often found extending upward some distance into the jasper in small areas. These risers are discovered as development of an area progresses and they often delay mining until raises are extended and occasionally call for new raises more advantageously located. In fact sometimes a transfer drift and raise is the cheapest and quickest method of developing and mining these small areas.

Late in 1941 the East cross-cut on the 4th level was being extended 160 ft. further South to provide for two new raises.

In 1941 there was a total of 875 ft. of rock and ore drifting on the 4th level and eight raises completed.

A connection was made in ore by drifting and raising from one of the main airway raises from the 6th to 4th level to provide for diversion of part of the air to the West cross-cut on the 4th level to improve ventilation.