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8. COST OF OPERATING (Cont.)

5. Stoping (Cont.)

	1940		1939	
	Amount	Per Ton	Amount	Per Ton
Payroll Labor	140,100.75	.316	87,658.47	.297
Cliffs Shaft Labor	247.33	.000	176.39	.001
General Shops Labor	736.02	.002	2.54	.000
Shops, Labor Etc.	3,005.90	.007	2,393.81	.008
Total Labor	144,090.00	.325	90,231.21	.306
GRAND TOTAL	186,649.92	.421	117,990.08	.400
Production Tons Stoped	443,862		294,287	
Avg. Miners Rate for Stoping		7.19		7.22
Avg. Tons per Man Stoping		25.63		26.71

6. Timbering

This decrease is due to the increase in production.

7. Tramming

This decrease is due to the increase in production.

9. Pumping

This large decrease is due to the decrease in the amount of water and the increase in production.

		Inland Steel Co.			C.C.I. Co.		
		Amount	Per Cent	Avg. Gal. Per Min.	Amount	Per Cent	Avg. Gal. Per Min.
Total	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
	1936	14,887.49	61.20	208.0	9,446.76	38.80	137.0

The total amount of water pumped at the two properties increased tremendously over the past five years. The total for the two mines was 1,280.5 GPM., an increase of 33% over the previous year. The Lloyd water however, decreased from 174.2 to 125.1 or 28%. The decrease in amount of water at the Lloyd had the effect of materially decreasing the pumping costs.

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8. COST OF OPERATING (Cont.)

14. Maint. Comp. & Air Drills
This large increase was due to absorbing E&A's 851 and CC-5 into operating.

18. Hoisting
This decrease is due to the increase in production.

23. Maint. Hoisting Equipment
This increase is due to charging out one new hoisting rope and abnormally high repairs to skips and cages.

27. Mine Buildings
This large increase was due to absorbing E&A CC-9 into operating, and to abnormally large repair costs on the shaft house and top tram.

28 to 39 Inclusive
With the exception of item 36, which was an increase due to general charges from Cleveland, the decrease in the above items was due to the increase in production.

9. EXPLORATIONS AND FUTURE EXPLORATIONS

As was stated in the report for 1939, operations above the 6th Level brought up the question of sinking the 7th Level skip pit in order to provide additional working places. Early in the year it was hoped that sufficient reserves could be developed above the 6th Level to postpone, for a time at least, the necessary development work for the 7th Level. A large amount of exploration work was done by drifting, raising and diamond drilling. Toward the middle of the year it became apparent that the 7th Level would be needed as soon as development work could be completed. The following is a record of the explorations on the 6th Level during 1940. A more comprehensive discussion of the diamond drilling will be found in the report of the Geological Department.

D.D.H. #111

This hole was drilled from the end of the 680 crosscut on the 6th Level from S. 3143.5 and 1694.8 E., dip 0°, course S. 45° - 00' W., elevation of collar plus 471.0. This hole was started on January 30, 1940 and finished February 17, at a depth of 343' and disclosed a 25' seam of ore between points 95 and 120. The drilling beyond the ore seam disclosed nothing of value, being for the most part in Slate and Jasper. As was previously explained, attempts to develop this seam of ore have not proved very successful.

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9. EXPLORATIONS AND
FUTURE EXPLORATIONS (Cont.)

D.D.H. #112

Prior to the drilling of this hole, the 640 crosscut on the 6th Level was extended to the south as a means of testing the area lying beyond the main dike. Hole No. 112 was drilled from the end of this crosscut beginning at S. 3297.8 and 2342.79 E., dip 0°, course S. 2° 56' E., elevation of collar plus 477.0. This hole was started June 3, 1940 and finished September 10, at a depth of 546'. The drilling of this hole disclosed no ore, being entirely in Dike, Slate and Soft Ore Jasper. Several seams of rich formation were encountered but no ore of mineable grade.

D.D.H. #113

This hole was drilled from the end of a short test drift south of raise No. 606. Location - S. 3067.06 and 2668.90 E., dip 0°, Course S. 10° - 10' E., elevation of collar plus 480.5. This hole was started September 16, and ended November 15 at a depth of 557'. For the most part this hole was drilled through Dike and Slate with an occasional seam of Soft Ore Jasper.

D.D.H. #114

This hole was drilled downward at a rather steep angle from the 640 crosscut and tested the territory lying below the elevation of the Main Level. Location S. 3237.34 and 2339.97 E., dip-62½°, course S. 1°, 45' E., elevation plus 473.7. This hole was started December 6 and ended in slate on December 27 at a depth of 239'. Occasional seams of rich formation were encountered but no mineable ore.

The early part of the above drilling program was carried on for the express purpose of locating additional reserves for mining above the 6th Level. This attempt having failed, subsequent drilling was done for the purpose of determining general structure. It will be necessary to continue this drilling through 1941 since the reserves at this property are now very limited and no possibility can be left untried. The next several holes will be drilled to test the possibility of additional ore lying south of the Main Deposit above the 7th Level. As soon as some repair work on the 7th Level is completed it will be necessary to drill a hole or two to determine the elevation of the proposed 8th Level, which must be developed in the very near future if the present production schedule is to be maintained.

The above drilling was taken up in current production rather than under an E&A. The total cost for the 1,685' drilled was $6,968.33, or $4.136 per foot, and had the effect of increasing the yearly cost by $.015 per ton. The total cost and cost per foot was abnormally high due to the necessity of casing several of the holes which caved badly.

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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.

	1940		1939	
Lloyd & Section 6	Valuation	Taxes	Valuation	Taxes
SW¼ of NW¼ of Sec. 6, 47-27)				
N½ of SW¼ of Sec. 6, 47-27)	1,805,000	37,909.15	1,425,000	29,051.63
N½ of SE¼ of Sec. 6, 47-27)				
Personal, Ore in Stock, Supplies, Equip.	420,000	8,820.97	775,000	15,800.00
Total	2,225,000	46,730.12	2,200,000	44,851.63
Collection Fees		467.30		448.52
Total Republic Lease		47,197.42		45,300.15
C.C.I. Co. Lands Misc.				
S½ of NE¼ of Sec. 6, 47-27	320	6.72	320	6.52
SE¼ of NW¼ of Sec. 6, 47-27 Except R of W	350	7.35	350	7.13
S½ of SW¼ of Sec. 6, 47-27 " " " "	700	14.70	700	14.28
SW¼ of SE¼ of Sec. 6, 47-27 " " " "	350	7.35	350	7.13
SE¼ of SE¼ of Sec. 6, 47-27 " " " "	575	12.09	575	11.74
Total	2,295	48.21	2,295	46.80
Collection Fees		.48		.47
Total C.C.I. Co. Misc. Land		48.69		47.27
Total Lloyd	2,227,295	47,246.11	2,202,295	45,347.42
Lots in West Ishpeming			30	.61
North Lake Dwellings				
Houses on Section 6, The C.C.I. Co.	40,500	850.59	40,500	825.68
Collection Fees		8.51		8.26
Total Dwellings		859.10		833.94
Total Ishpeming Township	2,267,795	48,106.21	2,242,825	46,181.97
Rate		2.1002		2.0390

The slight increase in valuation, on which the 1940 taxes were paid, was due to an increase of a quarter of a million dollars in the valuation of the underground reserves. This increase in valuation, along with a slight increase in the tax rate from 2.039 to 2.10, had the effect of increasing the total tax payment from $46,181.97 to $48,108.21. The increase in production and shipments more than counteracted the increase in amount, as shown in the following table:

	1940	1939	1938	1937
Tax Paid per Ton Produced	.099	.143	.198	.059
Tax Paid per Ton Shipped	.093	.095	.479	.0497

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11. ACCIDENTS AND PERSONAL INJURY

There were three compensable accidents during 1940, the same number as reported for the previous year. There was a fourth accident which resulted in lost-time but was short of being compensable by several days. In addition to these there were 68 slight accidents reported, bringing the total to 72. There was a considerable increase in the total number of man-shifts worked due to the addition of the third shift and a general increase in operations. The total for the year was 62,704¾ man-days, with a frequency rate of .048 on the compensable accidents and a severity rate of 1.35 man-days lost-time per thousand man-shifts. These compare with a frequency rate of .070 in 1939 and a severity rate of 7.52 per thousand.

The above figures compare with the following averages for all of the company's underground mines: Frequency .085, severity, including fatalities, 17.0 per thousand. This excellent record resulted in the awarding of the Safety Banner Flag to the Lloyd Mine since both the frequency and severity rates were the lowest for the company's underground properties. Much credit is due the Captain and bosses for their excellent cooperation in safety work. An occasional bonus penalty was found necessary but these were relatively infrequent.

The accidents are listed in detail as follows:

Accident No. 803, Alderic Villeneuve, Company Account Miner. This man was putting up a set of timber when a piece of ore fell from the covering, striking him on his right knee. Time lost - January 31 to February 19 - 13 working days.

Accident No. 804, William Vartanen, Company Account Miner. This man was also struck on the right knee by a falling piece of ore. Time lost - November 15 to November 25 - 6 working days.

Accident No. 805, Thomas Roberts, Underground Laborer. This man slipped and fell, causing a slight injury to his back. Time lost - November 19 to November 25 - 4 working days.

Accident No. 806, William Haapala, Motorman. This man was squeezed between a stick of timber on a truck and the brakewheel on his locomotive, causing a slight pelvic injury. Time lost - from December 11 on, estimated at 60 days.

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12. NEW CONSTRUCTIONS AND PROPOSED NEW CONSTRUCTIONS

The only new construction at this property was the building of the small steel warehouse which was discussed under paragraph 6a. In addition, there was the revamping of the dry and extensive repairs to the shaft house. There were several minor construction jobs underground, which include the erecting of a concrete dam and the building of a powder house and one new lunch room.

The only new construction contemplated at the present time, with the exception of the necessary underground work in the development of the 7th Level, is the erecting of a suitable steel structure which will take the place of the old headframe at the Section 6 shaft. It is planned to build this structure to provide a roof over the shaft with the necessary openings blocked off by heavy steel mesh.

As a final step in the complete fireproofing of the shaft house it will soon be advisable to consider the possibility of erecting permanent steel trestles east and west of the shaft to take the place of the old wooden structures which now constitute a considerable fire hazard. These new trestles would also be much more durable and practical than the present wooden structures which require constant attention and repairs.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There were quite a number of pieces of new equipment added to the inventory during 1940 under a number of E&A's. The more important items are listed below:

857 - Pumping Plant - 5th Level

New pieces of equipment added under this E&A, which was authorized for $26,400, included an 800 GPM. pump which was transferred from the Stephenson Mine, electrical starting equipment which also came from the Gwinn district, a new discharge column and a power cable. Still to be purchased under this E&A are two centrifical motor pumps, one of which will be transferred from the Spies Virgil Mine and the other a new purchase.

CC-5

Ten new Ingersoll-Rand auger drills, type RA-12, were purchased under this E&A at a cost of $2,468.00. This whole item was charged back into operating in December.

CC-9

This E&A was authorized at $1300.00 for converting the change house. $1700.00 was actually spent on the project, which included the purchase of two new unit heaters. The cost of the above was taken up in operating during December.

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13. EQUIPMENT AND PROPOSED EQUIPMENT (Cont.)

CC-12 - $3450.00

This authorization covered the purchase of an Eimco-Finlay Air Loader, model 21, 30" gauge. This machine replaced an old Armstrong Loader which was scrapped the previous year and the Butler Loader which is soon to be scrapped.

CC-20 - $6818.00 - New Westinghouse Motor-Generator Set

This piece of equipment was purchased early in the year to meet the increased power demands of the present production schedule. The old converter is still kept as a spare.

CC-38 - $547.00

This covered the purchase of an Ingersoll-Rand J-3 Jackbit Grinder. A second-hand machine from the Cliffs Shaft was formerly used to determine the feasibility of grinding bits at the property instead of sending them to the Cliffs Shaft Shop. The experiment proved very successful and the new machine was purchased. The number of bits to be ground has increased considerably during the past year, due to an increase in the amount of wet drilling.

CC-39 - $2776.00

This covered the purchase of two new 15 HP. Sullivan Scraper-Hoists for use underground. These machines were needed as replacements due to the increased production schedule.

CC-44 - Shaft Sinking - $42,900.00

Under this authorization, which was made for the purpose of making the 7th Level available for mining, six Ingersoll-Rand S-49 sinking machines were acquired. Two of these machines were purchased new and the other four transferred as second-hand machines.

CC-47 - $535.00 - Amount Expended $636.00

This authorization covered the purchase of a new No. 302 Oster-Williams Pipe and Bolt Threading Machine. The difference between the amount authorized and the amount expended represented a general price increase.

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13. EQUIPMENT AND PROPOSED EQUIPMENT (Cont.)

Present plans call for acquiring the following equipment:

One underground locomotive to be transferred from the Gardener-Mackinaw Mine. This equipment has been in use on a rental basis for several years.

Eight two-ton underground dump cars to be transferred from the Gardener-Mackinaw Mine and repaired.

One new dump truck at $1,059.00 and a Trail Builder at $902.50. These expenditures have already been tentatively approved under E&A CC-53.

Several pieces of equipment were scrapped during the year. Included in these are the engine house and two hoisting ropes from the Section 6 shaft, which were scrapped after the equipment was moved to the new mine at Section 2.

One saddle-back top tram car which was wrecked beyond repair; value in use $900.00.

Three 1¼" hoisting ropes from the skips.

In addition to the above, 105 of the 117 residences in the North Lake Location were sold during the year. This will be discussed in greater detail in a subsequent portion of this report.

14. MAINTENANCE AND REPAIRS

a. Mine

Underground maintenance work remained about average with the exception of the main 4th Level haulage drift which required considerable repair. Aside from that, the only large repair project was the continuation of the fireproofing of the headframe which has been previously discussed.

Routine shaft inspections and maintenance remained about normal. The increase in the maintenance charges for the compressor, air pipes and air drills is explained by the absorbing of a large portion of E&A's Nos. 851 and CC-5 into operating. The maintenance of scrapers, mechanical loaders and electrical tram equipment remained on a par with the increased mine schedule.

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14. MAINTENANCE AND REPAIRS (Cont.)

b. Location

1. General Maintenance

The following table shows the costs of maintenance of the North Lake Location in 1940 and a comparison with former years.

	Labor	Supplies	Total
1. Prop. Policeman's Time	1967.58		1967.58
2. Cleaning	1227.58	29.83	1257.41
3. Sewers & Cess Pools	133.14	66.61	199.75
4. Water		691.25	691.25
5. Remove Snow & Ice	95.00	4.68	99.68
6. Fire Hydrants	5.00	5.40	10.40
7. Repair Fences	120.69	49.19	169.88
8. Water Mains	29.40	11.83	41.23
9. Water Tank		1.15	1.15
10. Recreation Grounds	16.61	10.52	27.13
11. Cleaning Toilets	35.96	213.77	249.73
12. Location Xmas Tree	5.00	20	5.20
Total	3635.96	1084.43	4720.39

Year - 1939	5044.89
1938	5272.04
1937	6109.82
1936	5952.21

The increase in the large items chargeable to policeman's time, cleaning and cleaning toilets were offset by substantial decreases in a number of the other items such as sewers, cess pools, water mains and water. The substantial decrease in the cost of pumping the location water is due partly to an increase in water collections and partly to the fact that the increased schedule of operations removed the necessity for having a special pumpman on the job during the week.

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

2. Rented Buildings

Early in the year, a recommendation was submitted regarding the sale of the rented buildings in the North Lake Location. Expenditures for maintenance and repairs on these buildings were held to a minimum pending the approval of the recommendation and the final sale of the buildings. This condition accounts for the fact that expenditures on the buildings were decreased by half as compared with the previous year. There were no foundation or roof repairs and expenditures in the other items were held to bare minimum except in those cases where the condition of the buildings made sheet rocking absolutely necessary.

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14. MAINTENANCE AND REPAIRS (Cont.)

2. Rented Buildings (Cont.)

The total expenditures compared with 1939 follow:

1940	4,323.23
1939	8,498.58
Decrease	4,175.35

The 1940 expense was divided approximately as follows:

Painting and Interior Decorating	$1,230.39
Storm Sheds (Painting)	306.69
Sheet Rock	2,786.15
Total	4,323.23

By the latter part of September the necessary preparations for the sale of the Location houses were completed and the sales were made, dated as of October 1. These sales contracts were made on a basis of a 10% down payment, with monthly payments of 1% of the total for a period of 10 years. A 10% discount was allowed for all cash purchases. In addition, each purchaser signed a lot lease with ground rental at the rate of one dollar per month. Except in a few isolated instances the occupant of the house was given the first opportunity to purchase, and in most cases this option was exercised. For several reasons it was decided to keep a few of these residences, in case it was found necessary to provide a house for a key-employee. Several other tenents were rejected as purchasers since their reputations were such that they were not deemed good risks.

Of the 117 residences owned by the Company, 105 were sold. Of these 105, 43 were double houses, 15 were single cottages and four halves of double houses were sold singly. The houses retained by the Company are three full double houses, four half houses, and two single cottages. It is possible that several of these others will be sold in the near future.

The sale of these houses will materially decrease the heavy expense annually incurred in maintenance and repairs. For the most part the purchasers have already indicated considerable interest in the upkeep and appearance of their personal premises.

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15. POWER

There were no reported production delays due to power interruptions since the occasional lack of electrical current was not extensive enough to cause any loss of product. The addition of the third shift had the effect of increasing the power consumption, while the peak demand was held down by means of the warning signal in the engine house. This had the effect of reducing materially the rate per K.W.H. from 1.677¢ in 1939 to 1.442¢ in 1940. The total consumption as recorded by the master meter is compared with the previous year as follows:

	Total K.W.H.	Cost	Rate
1940	2,516,400	36,282.72	.01442
1939	1,788,000	29,983.20	.01677

It will probably be impossible to keep the maximum demand anywhere near the 1940 figure once the new 5th Level pump is put into operation. The 250 HP. motor will have the effect of increasing the maximum demand considerably. On an operation of three shifts per day it will not be possible to operate the pump at a time when other power demands are lower.

16. WATER SUPPLY

The water supply from the 2nd Level pump was insufficient to meet the demand during several dry periods in the summer, so the auxiliary fire protection pump at the Morris Mine was run at intervals to make up the deficiency. In this way the concrete reservoir water level was maintained, and the water purified by extra chlorine dosages in the regular 2nd Level supply. The leakage at the base of the 50' diameter concrete reservoir is still excessive in spite of the attempt to concrete it in 1939.

As was stated in the report for last year the water main from the reservoir tank to the Location is now situated between two undermined areas. The surface cave extension from east to west has approached to within 400' of the pipe due to the top-slicing and stoping operations above the 5th Level. Mining was started in the 6th Level stopes in 1939 on the west side of the main, but the backs of these stopes are in hard Jasper and caving is not expected for some time. The water pipe will have to be re-routed eventually however, and the rate of extension of the present cave will determine the time limit.

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17. CONDITION OF PREMISES

The mine surface presents a better appearance each year due to the continued healthy growth of the flowers, shrubs and trees that were planted in 1937. The lawn on the slope in front of the main building, the roads and parking areas, and the modern steel buildings were all kept neat and in order, presenting a most attractive appearance, particularily during the summer months.

The North Lake Location was maintained in good condition at a cost of $4,720.39 as reported in a previous paragraph. The upkeep of the residences will now be the responsibility of the new owners, who are expected to keep them in good repair during the life of the 10 year contracts. As has been stated in a number of previous reports, there is one great need which should be taken care of as soon as possible. This is the installation of a complete sanitary sewer system and the extension and re-designing of the present surface storm sewer system which is entirely inadequate. Attempts to have this done by the County have not yet been successful.

18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Per Cent
Finnish	79	44	123	40
Italian	22	37	59	19
French	45	3	48	16
English	28	5	33	11
Swedish	22	6	28	9
Norwegian	9	-	9	3
Austrian	2	1	3	1
Jugoslavian	1	1	2	1
German	1	-	1	-
Belgian	1	-	1	-
Irish	1	-	1	-
Czechoslovak	1	-	1	-
	212	97	309	100%

The percentages as to nationalities in the above table are practically the same as the preceding two years.

MORRIS MINE

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1. GENERAL

Although the mine operated 261 days in 1940 compared with 253 days in 1937, production in 1937 exceeded last year's output by 103,000 tons. The number of men employed in 1937 varied from 205 in the winter months to 216 in the summer months. In 1940 the average number of men employed was 211.

The percentage of Silica was slightly larger in 1940 than 1937 and much larger than 1938 and 1939.

The tons per man per day showed a drop from 1939, 1938, and 1937, with consequent increased costs. The poorer operating record can partially be attributed to more water in certain mining areas but there are undoubtedly other reasons also.

The development program underground put a little more ore in sight than was mined so that the year ends with approximately 10,000 tons to the good.

A second cave occurred on the surface and after the original area went down, additional settlement went on during the year.

New pumping equipment was installed on the 9th level which brings the total capacity of the underground pumping plants up to 3800 gallons per minute.

The Dryhouse was rebuilt and a new two-story general office erected to the East of the mine office.

New test wells were drilled and four new deep well pumps started up, the last one, No. 6, on December 23rd.

Overruns were developed for the first time since 1933 in both the Silica and Standard ore piles.

A special water control project was finished on the footwall side of the 4th level and the development of the new 9th level was carried on after the new pump was ready to operate.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production

Grade	Tons
Morris Standard	247,840
" Siliceous	65,070
Total	312,910
Standard Grade S.P. Overrun	1,163
Siliceous " " "	32,854
Grand Total	346,927

The Year's product is divided between fee and leased lands as follows:

	Leased Lands	Fee Lands	Total Tons
Morris Standard	207,860	41,143	249,003
" Siliceous	72,382	25,542	97,924
Total	280,242	66,685	346,927
	80.8%	19.2%	100.00%

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The tonnage from the leased and fee portions of the Morris Mine since 1932 are as follows:

Year	Leased Lands Tons	Leased Lands % of Total	Fee Lands Tons	Fee Lands % of Total
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	1,506,162	68.98	677,115	31.02

Summary

Product from Leased Lands 1933-1940	1,506,162	tons
" " Fee " "	677,115	"
Total	2,183,277	"

The tonnage produced from the property since 1933, including the stockpile overrun developed this year, is divided between the two grades as shown. It might be noted that in 1940,for the first time since the Inland Company leased the mine, the stockpile book balances were exhausted on both grades, developing the overruns as shown previously.

Yearly Product Year	Standard Ore Tons	Standard Ore % of Total	Siliceous Ore Tons	Siliceous Ore % of Total
1940	249,003	71.8	97,924	28.2
1939	227,837	82.0	49,905	18.0
1938	198,283	82.5	42,041	17.5
1937	316,353	74.4	109,605	25.6
1936	289,422	83.4	57,979	16.6
1935	205,528	83.8	39,932	16.2
1934	125,634	72.8	47,635	27.2
1933	105,441	83.6	20,755	16.4
Total	1,717,501	78.66	465,776	21.34

Summary

Standard Ore produced 1933-1940	1,717,501	tons
Siliceous " " "	465,776	"
Total	2,183,277	"

The large overrun developed in the Siliceous stockpile increased the percentage of Silica for the year above any of the other years.

b. Shipments

Ores shipped from pocket and stockpile for 1940 were as follows:

Grade	Pocket Tons		Stockpile Tons	Total Tons
Morris Standard	148,145	for Inland	136,040	284,185
" Standard	15,896	" CCICo.	14,326	30,222
" Siliceous	38,503	" Inland	58,822	97,325
" Siliceous	8,983	" CCICo.	6,543	15,526
Total	211,527		215,731	427,258

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The shipments in 1940 were by far the largest since Inland began operating the property. This is evident from the following table:

Year	Standard Ore	Siliceous Ore	Total Ore
1940	314,407 tons	112,851 tons	427,258 tons
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	1,689,423 "	458,907 "	2,148,330 "

Summary

Standard Ore Shipped 1933-1940	1,689,423 tons
Siliceous " " "	458,907 "
Total	2,148,330 "

c. Ore in Stock

Stockpile balances as of December 31, 1940, were:

Morris Standard Ore	28,078 tons
" Siliceous "	6,869 "
Total	34,947 "

Stockpile book balances for previous years totaled:

Stockpile balance as of Dec. 31, 1940 -	34,947 tons
" " " 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 1940

Month	Shifts Operated	Morris Standard	Morris Siliceous	Total Production
January	23	23276 tons	3520 tons	26,796 Tons
February	21	16564 "	5251 "	21,815 "
March	21	19532 "	4151 "	23,683 "
April	22	23235 "	8060 "	31,295 "
May	22	21069 "	6224 "	27,293 "
June	21	21139 "	4529 "	25,668 "
July	22	22886 "	5646 "	28,532 "
August	22	18581 "	6461 "	25,042 "
September	20	17464 "	5009 "	22,473 "
October	23	23086 "	5305 "	28,391 "
November	21	19316 "	5385 "	24,701 "
December	23	21692 "	5529 "	27,221 "
Total	261	247840 "	65070 "	312,910 "

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The following table gives the daily product by months, also the approximate tons per man per day:

Month	Average Daily Product	Total Tons Per Man Per Day	No. of Men Employed
January	1,165	5.98	194
February	1,039	5,29	196
March	1,128	5.50	205
April	1,423	6.90	206
May	1,241	5.91	210
June	1,223	5.74	213
July	1,297	6.02	215
August	1,311	6.07	216
September	1,123	5.22	215
October	1,234	5.36	230
November	1,231	5.55	222
December	1,184	5.38	220
Yearly Average	1,199	5.66	193

Comparative figures for 1939 and 1940 are as follows:

Year	Average Daily Product	Tons Per Man Per Day	Number of Men Employed
1940	1,199	5.66	193
1939	1,243	6.19	200

f. Delays

There were two serious delays that interfered with production and the lost time was not made up because it would have involved paying time and half for overtime.

On May 21st at midnight a new cave was formed by the surface breaking through Southeast of the first cave. The mine continued to work, however, on Wednesday, Thursday, and Friday of that week but by Saturday the flow of water into the mine had increased to a point where it was decided not to operate the following Monday, May 27th. Product lost was 1250 tons.

On Friday, August 30th, another settlement occurred which enlarged the area of No. 2 Cave. This happened at 1:30 P.M. and all the underground men were kept out of the mine Friday night and all day Monday. Product lost was 1850 to 1900 tons.

3. ANALYSIS

Shipments

Following are the detailed analysis on shipments of Morris Standard Ore for the year:

Month	Tons	Iron Dried	Moisture	Iron Natural
January	948	59.31	10.93	52.82
February	288	61.27	11.73	54.08
March	1509	59.00	11.52	52.21
April	28709	58.87	10.87	52.47
May	36895	58.97	10.99	52.49
June	50989	58.97	11.31	52.30
July	54352	58.80	11.05	52.31
August	39784	58.55	10.55	52.38
September	41493	59.25	10.59	52.98
October	33782	58.97	11.01	52.48
November	22877	59.11	10.87	52.68
December	2780	58.96	11.05	52.44
Total	314407			

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Average analysis of Morris Standard shipments for 1940 were:

Tons	314,407
Iron Dried	58.93
Moisture	10.03
Iron Natural	52.49
Phos.	.051
Silica	8.31

Similar data as the foregoing for the Siliceous grade follows:

Month	Tons	Iron Dried	Moisture	Iron Natural
January	272	52.58	10.50	47.06
March	283	51.66	11.00	45.97
April	9060	50.76	10.08	45.64
May	11241	51.20	10.33	45.91
June	14145	51.35	10.20	46.12
July	16276	51.59	10.27	46.29
August	18147	52.90	9.97	47.62
September	14846	52.04	9.79	46.95
October	14446	50.94	9.70	46.00
November	13218	52.01	10.51	46.54
December	917	52.05	10.21	46.73
Total	112851			

Average analysis of the Morris Siliceous grade shipments in 1940 were:

Tons	112,851
Iron Dried	51.69
Moisture	10.10
Iron Natural	46.47
Phos.	.047
Silica	16.96

Stockpile Analysis

The accumulated analysis of the ores as stocked follow:

	Morris Standard			
Month	Tons	Iron Dried	Phos.	Moisture
January	115,811	58.15	.054	10.30
February	132,087	58.27	.054	10.30
March	150,110	58.42	.054	10.30
April	144,636	58.42	.054	10.30
May	128,810	58.42	.054	10.30
June	98,960	58.42	.054	10.30
July	67,494	58.42	.054	10.30
August	46,291	58.42	.054	10.30
September	22,262	58.42	.054	10.30
October	11,566	58.42	.054	10.30
November	9,168	59.37	.062	10.30
December	28,078	58.89	.063	10.30
Natural Average		52.82	.057	10.30

Natural Analysis of ore in stock was, viz:

Iron	Phos.	Silica	Mang.	Moisture
52.82	.057	7.60	.45	10.30

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Month	Morris Siliceous Tons	Iron Dried	Phos.	Moisture
January	25,044	51.61	.048	10.00
February	30,295	51.65	.048	10.00
March	34,162	51.68	.048	10.00
April	33,162	51.68	.048	10.00
May	28,145	51.68	.048	10.00
June	18,529	51.68	.048	10.00
July	7,899	51.68	.048	10.00
August	-	-	-	-
September	-	-	-	-
October	-	-	-	-
November	2,256	51.55	.052	10.00
December	6,869	49.98	.051	10.00
Natural Average		44.98	.046	10.00

Natural Analysis of ore in stock was:

Iron	Phos.	Silica	Mang.	Moisture
44.98	.046	16.55	.33	10.00

Analysis of Ore Reserves
Note: All Natural Analysis

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
" Hi-Sulpher	52.75	.106	7.20	.39	2.28	-	-	.458	-	10.27

Analysis of Ore in Stockpile
Note: All Natural Analysis

Grade	Iron	Phos	Sil.	Mang	Moist.
Morris Standard	52.82	.057	7.60	.45	10.30
" Siliceous	44.98	.046	16.55	.33	10.00

Analysis of Ore Shipments
Note: All Natural Analysis

Grade	Iron	Phos	Sil.	Mang	Alum.	Moist.
Morris Standard	52.49	.051	8.31	.41	2.29	10.93
" Siliceous	46.47	.047	16.96	.33	2.64	10.10

4. ESTIMATE OF ORE RESERVES

	Ore Reserves as of Dec. 31,1940	Ore Reserves as of Dec. 31,1939	Difference
C. C. I. Co. Lands	385,144 tons	372,999 tons	+ 12,145 tons
Chase Lease #9	1,366,515 "	1,412,302 "	- 45,787 "
" #24	174,049 "	131,818 "	+ 42,231 "
" #25	33,273 "	33,273 "	None
" #26	26,140 "	26,140 "	None
Total	1,985,121 "	1,976,532 "	+ 8,589 "
High-Sulpher Ore			
Chase Lease #9	1,994 "	2,208 "	- 214 "
" #24	55,005 "	55,079 "	- 74 "
Grand Total Ore Reserves	2,042,120 "	2,033,819 "	+ 8,301 "
1940 Prod.of Standard Ore	249,003 "		
Grand Grand Total	2,291,123 "		
1939 Estimate	2,033,819 "		
Net Gain in 1940	257,304 "		

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Detail of Ore Estimate

C. C. I. Co's Lands

Ore Above 7th Level

No. 21 Deposit	34,182	tons
" 80 "	3,210	"
Total	37,392	"

Ore Above 8th Level

No. 21 Deposit	8,427	"
" 33 or Main Deposit	216,879	"
" 76 or "C" "	8,100	"
Total	233,406	"

Ore Below 8th Level

No. 33 or Main Deposit	105,909	"
" 76 or "C" "	8,437	"
Total	114,346	"
Grand Total C. C. I. Co. Lands	385,144	"

Chase Lease #9

Ore Above 7th Level

No. 21 Deposit	3,310	"
" 61 "	13,729	"
" 75 "	19,786	"
" 78 "	5,250	"
Total	42,075	"

Ore Above 8th Level

No. 33 Deposit	494,758	"
" 61 "	31,926	"
" 75 & 77 Deposits combined	314,651	"
" 76 Deposit	31,965	"
" 78 "	8,672	"
Total	881,972	"

Ore Below 8th Level

No. 33 Deposit	348,205	"
" 75 "	60,325	"
" 76 "	33,938	"
Total	442,468	"

Total Chase Lease #9 (Standard Ore)	1,366,515	"
" " " #9 (High Sulpher)	1,994	"
GRAND TOTAL CHASE LEASE #9	1,368,509	"

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Chase Lease #24	
Ore Above 7th Level	
No. 75 Deposit	2,290 tons
Ore Above 8th Level	
No. 33 Deposit	20,640 "
" 75 "	32,680 "
" 79 "	7,582 "
Total	60,902 "
Ore Below 8th Level	
No. 33 Deposit	59,077 "
" 79 "	15,375 "
Total	74,452 "
Carried forward from 1937 estimate	36,405 "
Total	110,857 "
High Sulphur Ore	55,005 "
GRAND TOTAL CHASE LEASE #24	229,054 "
Chase Lease #25	
Ore Above 7th Level	22,937 "
" " 8th "	10,336 "
Total Chase Lease #25	33,273 "
Chase Lease #26	
Ore Above 7th Level	9,687 "
" " 8th "	16,453 "
Total Chase Lease #26	26,140 "

6. SURFACE

Deep Wells & Pumps

During 1940 there were six separate deep well pumps draining water from the surface overburden but not all of these were pumping simultaneously. Two other pumps, one in the bottom of each cave, were used to prevent as much water as possible entering the mine. Also several new test holes were drilled in the area to the Southeast of the caves.

The following tabulation shows how the water level has gone down in the various test holes during the year, the total drop in water level since the program was started in 1937, and the depth of the water still remaining on top of the ledge.

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Test Hole	Drop in Water Level 1937	1938	1939	1940	Total	Depth Remaining to ledge
#501	3' 6"	6' 8"	5' 4"	12' 8"	28' 2"	64' 10"
502 *	1' 5"	5' 4"	35' 2"	0' 0"	41'11"	92' 11"
503	15' 8"	7' 7"	3' 1"	13'11"	40' 3"	159' 8"
504	16' 0"	13' 1"	4' 0"	21' 7"	54' 8"	94' 1"
505	6' 4"	7' 6"	5' 2"	6'11"	25'11"	103' 10"
506	3' 4"	5'11"	8' 0"	10' 4"	27' 7"	59' 8"
507 **	5' 0"	8' 2"	16' 8"	124' 8"	154' 6"	13' 2"
508	1' 3"	0' 0"	40'10"	17' 8"	59' 9"	74' 4"
509	27' 5"	5' 7"	5' 7"	13' 5"	52' 0"	135' 4"
510		1' 1"	6' 1"	20' 0"	27' 2"	93' 8"
511			-7' 6"	12' 9"	5' 3"	147' 4"
512			7' 8"	32' 6"	40' 2"	116' 10"
513			1' 0"	13' 6"	14' 6"	150' 6"
514			-2' 4"	10' 1"	7' 9"	114' 4"
515			-4' 6"	4' 9"	0' 3"	122' 0"
516			5' 6"	4' 7"	10' 1"	20' 10"
517			-4' 4"	7' 0"	2' 8"	108' 2"
518				19' 7"	19' 7"	84' 1"
519				28' 0"	28' 0"	124' 8"
520				7'11"	7'11"	43' 6"
521				28' 0"	28' 0"	
522				12' 7"	12' 7"	
523				4' 6"	4' 6"	27' 1"
524				31' 7"	31' 7"	72' 8"

* Test Hole #502 lost in No. 1 Cave.
** Test Hole #507 near Pump #4 is undoubtedly drained right down to ledge.

The new test holes put down in 1940 were #518 to #524 inclusive. #518 is located a short distance North of #5 deep well pump about 400 ft. West of #1 cave. #519 was put down 750 ft. Northwest of #518. The other five holes were all located South and Southeast of #2 cave.

The following data shows the pumping rate from the various wells during the year:

Month	Pump #1 G.P.M.	Pump #2 G.P.M.	Pump #3 G.P.M.	Pump#3A G.P.M.	Pump#4 G.P.M.	Pump#5 G.P.M.	Total G.P.M.
January	900	400	1600	-	190	-	3090
February	810	395	1535	-	385	-	3125
March	810	340	1500	-	295	-	2945
April	625	325	1500	-	330	-	2780
May	Down	285	960	1405	320	-	2970
June	Down	280	Down	1545	310	-	2135
July	Down	275	Down	1485	370	-	2130
August	765	265	880	1350	365	-	3625
September	740	260	910	1225	125	-	3260
October	705	215	850	1150	125	960	3945
November	640	245	820	1155	Down	875	3735
December	510	175	765	1130	Down	755	3335
Average							2862

A new pump, No. 6, was started on December 23rd at test hole #522 about 275 ft. Southeast of #4.

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In addition to the deep well pumps, centrifugal pumps in bottoms of both No. 1 and No. 2 caves have kept the water level from rising during the Spring, Summer, and Fall. Very little pumping is done with these units during the winter months because they freeze up. The pump in Cave #1 varied from 25 to 50 g.p.m. and that in #2 Cave from 50 to 125 g.p.m. depending on the depth of water in the pool at the bottom of the cave.

In the foregoing table wide variations in the average pumping rate result from the deep well pumps being shut down because of various causes. The delays of the various units are summarized, viz:

Pump #1

March	-	12 days	- bearing trouble
May	-	31 "	"
June	-	30 "	"
July	-	31 "	"
August	-	21 "	"

The pump gave so much trouble that it had to be sent to the factory for a complete overhauling.

Pump #2

May	-	4 days	- well plugged
October	-	13 "	- "
Nov.	-	12 "	- "

Pump #3

May	-	8 days	- power line down because of #2 Cave
"	-	4 "	- interfered with #3-A pump
June	-	30 "	- #3 pump drawing water from 3-A Pump
July	-	31 "	- " " " " " "

Pump #4

January	-	12 days	- Impellers worn out
May	-	14 "	- Readjusting flume
August	-	22 "	- Motor trouble and bowl cracked due to settlement in #2 Cave
Sept.	-	9 "	- Sand in well due to crack in bowl
October	-	12 "	- Transformer trouble
Nov.	-	30 "	- " "
Dec.	-	31 "	- Pump abandoned

Pump #5

Dec.	-	6 days	- Down from Dec. 6 to Dec. 11 inclusive while new bearings were installed

Pump #6 - Did not start pumping until Dec. 23rd

Cave

On Tuesday, May 21st, at midnight an area of the surface Southeast of #1 cave dropped, forming #2 cave. This hole was oval shaped 280 ft. in one diameter and 325 ft. in the other. The depth at first was about 50 ft. There was no immediate increase in the normal flow of water underground which had been about 1140 gallons per minute. On Wednesday, the 22nd of May, the weir readings increased to 1392 gallons per minute and on Friday they were 1453 gallons per minute. The next day, Saturday, the flow jumped to 1546 gallons per minute. It was then decided not to operate on Monday, the 27th, but operations were resumed on the 28th because by that time the weir readings were back to 1310 gallons per minute and it was felt that the immediate danger was passed.

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Nothing uneventful occurred until Friday, August 30th, at 1:30 P.M. when another section along the Southeast side of #2 cave dropped and this was immediately reflected by an increase of 200 g.p.m. underground on the 7th and 8th levels. The underground crew was immediately sent home, dams were closed, and no ore produced Friday night or the following Monday, which was Labor Day. On Tuesday, September 3rd, the flow underground had decreased back to 1145 g.p.m. and so operations were resumed.

Pumps operated steadily in both caves except during the winter and every effort was made to prevent the building up of a head of water that might cause a sudden surge.

Data & Capital Expenditures for Water Control for 1940

Average gallons per minute pumped from underground	1158
" " " " " surface	2862
Tons of water from underground per ton of ore	7.240
" " " surface " "	17.909
Total tons of water per ton of ore	25.149

Capital expenditure - surface project	$ 61,234.92
" " - underground pumps	30,544.03
" " - 4th level water control project	18,693.84
Total Capital Expenditure in 1940	110,472.79

7. UNDERGROUND

Water

A great deal of this report deals with test holes, deep well pumps, caves, weirs, etc. but it must be kept in mind that for two years now the proper procedure for handling the various situations as they arose has been the result of many conferences of the Inland and C. C. I. Co. officials. The C. C. I. Co. staff, however, always maintained the position that all we could offer was based on experience over many years on similar problems in other of our mines. The decisions were always left squarely on the shoulders of the Inland staff. In other words, The C. C. I. Co. staff wanted to be helpful but the Inland people had to choose from the plans that were offerred.

In order that the picture of the underground meter readings might be more complete, the following data goes back over 7 years:

	Gallons per Minute						
Month	1940	1939	1938	1937	1936	1935	1934
January	1199	570	538	233	225	130	124
February	1176	590	540	255	201	130	142
March	1150	600	612	270	202	134	120
April	1117	615	641	294	204	133	126
May	1216	661	596	328	202	181	127
June	1202	683	562	393	202	169	117
July	1153	762	569	406	206	161	123
August	1234	799	563	432	207	163	118
September	1171	907	557	405	203	172	118
October	1147	979	555	382	210	172	123
November	1089	1063	536	466	233	187	113
December	1041	1222	548	458	201	163	81
Average	1158	788	568	360	208	158	119

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The months in which Cave #2 started and further settlement occurred, namely May and August, are the months of high average water readings. The big increase in flow in May, however, followed the cave but it will be noted that the readings increased in the latter part of 1939 and the early part of 1940 which culminated in the peak on May 25th, four days after Cave #2 formed. In August, however, trouble could be anticipated because in the middle of the month, two weeks before the South side of #2 cave dropped, the flow underground suddenly increased 150 g.p.m.

History is merely repeating itself in that a cave or a material sudden enlargement of a cave is usually preceded by more water running into a mine through cracks opening up in the hanging.

A detail of the flow on the different levels is now shown, viz:

Month	4th Level	6th Level	7th Level	8th Level	9th Level	Total
January	15.2 GPM	119.4 GPM	599.6 GPM	464.8 GPM		1199.0 GPM
February	16.2 "	117.2 "	606.2 "	436.9 "		1176.5 "
March	16.6 "	114.8 "	572.6 "	443.7 "		1149.7 "
April	11.6 "	113.5 "	541.3 "	451.1 "		1117.5 "
May	63.8 "	127.1 "	549.8 "	475.0 "		1215.7 "
June	155.4 "	126.7 "	454.0 "	455.8 "		1201.9 "
July	125.6 "	125.7 "	411.3 "	490.5 "		1153.1 "
August	122.5 "	127.0 "	391.4 "	569.5 "	23.2 GPM	1233.6 "
September	142.4 "	128.5 "	426.7 "	425.9 "	47.9 "	1171.4 "
October	141.7 "	139.1 "	418.9 "	424.6 "	49.7 "	1147.0 "
November	103.9 "	106.4 "	377.5 "	453.0 "	47.9 "	1088.7 "
December	87.3 "	89.2 "	408.1 "	400.5 "	56.0 "	1041.1 "
Average						1158.0 "

4th Level Water Control Project

The idea behind the drifting, crosscutting, and raising done in the foot on the 4th level was to try and cut off as much water as possible, diverting it to the main 4th level pumps, thereby preventing the building up of a reservoir of water under pressure above the 4th and also to stop water getting into the mining areas lower down in the mine.

A new drift was started about 30 ft. back in the foot, driven due West for 800 ft., and four crosscuts turned off South to hole into the old workings. The first crosscut near the 900 West line provided a means for drilling holes in the East end of the old footwall drift and these holes drained any water trapped in the drift. The second crosscut holed in the central part of the old East footwall drift at the point where the elevation of the drift was the lowest or where the greatest accumulation of water might be expected. Over on the West side a crosscut was driven South to intersect the old hanging wall drift and short crosscuts on the East side of the end of the North-South crosscut were holed to one of the raises in the drift. We found the old hanging wall drift caved down and the entire drift had settled 6 ft. vertically and shifted 3 ft. to the South. Another small crosscut was then planned to tap the West footwall drift. This drift made it possible to get into and examine conditions under the old Northwest shrinkage stope.

When all this work was completed the flow of water on the 4th level increased from 15 g.p.m. to 155 g.p.m. By the end of the year the flow had decreased to 87 g.p.m. but undoubtedly when the Spring break up comes along in April and May 1941 the flow will increase again.

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Development Work

As mentioned previously, the development program put back into sight a little more Standard Ore than was mined. The new ore was found under our own fee lands in #21 Deposit above the 7th level and in the Main Deposit above the 8th level.

On Chase Lease No. 9 additions were made to #75 Deposit above the 7th, #61 Deposit above the 8th, and in the Main Deposit below the 8th level.

On Chase Lease #24, #75 Deposit (which is now combined with #77), doubled in area and the main deposit shows more ore below the 8th level.

On the 20 ft. sub level 150 ft. above the 8th level #75 Deposit was proven to extend 175 ft. West into Chase Lease #24 beyond the West line of Chase Lease #9. This development work also increased the size of #75 ore body on Chase Lease #9. Additional development was carried on from a new raise on the 000 sub level both on Chase Lease #9 and #24. This sub, 125 ft. above the 8th, is intended to be the main scraping sub for a proposed sub level stope above.

On the main 8th level a crosscut paralleling the East boundary of Lease #24 was driven and raises put up on the 3600 South coordinate line for the purpose of opening up the West extension of #75 Deposit.

On the 9th level the main footwall drift was extended West 1000 ft. and two crosscuts started, one South parallel with the 1400 West coordinate line, and the other near the 2000 West line. By the end of the year no Standard grade ore was cut in any of the 9th level drifts or crosscuts. The development program on this level was delayed for a while pending the installation of the new pump. The year 1941 should show up some interesting data that will materially affect the future of the property.

Stoping

Twenty gangs were employed on an average throughout the year and only one of these used the sub level stoping system of mining, all the others radially slicing. There were a few times during the year when gangs blasted down sets running ore from the back as they retreated back to their raises. In 1939 as well as in 1940 the bulk of the product came from the slicing gangs whereas in 1935, 1936, and 1937, it was customary to have four or five gangs stoping. For the last two years there has been little opportunity for opening up stopes because of water and because of the width of the ore bodies and dikes along the foot and hanging. That fact also partially explains the lowered efficiency or tons per miner per day in 1939 and 1940 compared with other years. There are, however, other reasons that definitely slowed up production.

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#21 Deposit

Mining in this deposit was confined to the central part of the deposit under our fee lands to the East of Chase Lease #9 above the 7th level. The top slices started on the 160 ft. sub and contract #1 gradually dropped down in successive stages to the 150 ft. sub, 140 ft. sub, and the 130 ft. sub level.

Contract #27 also sliced fee ore to the Southwest of #1 East of Lease #9 on the 130 ft., 120 ft., and 110 ft. sub levels.

#61 Deposit

This deposit, located on the North footwall 500 ft. West of the East line of Chase Lease #9, had only one gang - #6 - mining in it, #7 having been moved elsewhere. Contract #6, a radial slicing contract, finished the 100 ft. sub level, the 90 ft. sub, and then dropped down to the 7th level sill floor. This area was wet most of the year.

#75 Deposit

Six contracts - #4, #9, #10, #15, #20, and #25 - sliced ore from the 110 ft. elevation down to the -20 ft. sub in various portions of #75 Deposit, on Chase Lease #9, and in order to prevent one gang undermining the other #10 took the South Central portion and the others were spaced East to West along the North foot with #20 up in the Northeast corner. Going West #4 had the next block, then #25, then #9, with #15 over on the West end. Contract #20 mined at the highest elevation and #10 was lowest down under the hanging. The former took out a small pillar left on the 110 ft. sub level and then dropped down to the 100 ft. sub, the 90 ft. sub, the 7th level, finishing the year one sub below the 7th level. Contract #4 in the next block West sliced on two subs, the 70 ft. and 60 ft. subs, spending most of the year slicing out an area 175 ft. East and West and also 175 ft. North and South along the East side of their assigned territory. Contract #25 in the next area West of #4 finished slicing on the 60 ft. sub level and then in turn mined all their territory on the 50 and 40 ft. subs and started half the 30 ft. sub level. Continuing West Contract #9 worked on the 70, 60, 50, and 40 ft. subs, slicing on each one in regular order. The most Westerly gang - #15 - confined their mining to the 50, 40, and 30 ft. sub levels.

It will be noted that #75 Deposit is being mined in a series of steps with the South and West areas lowest and the highest gangs on the East end.

#77 Deposit

This ore area is really the Southwest offshoot of #75 Deposit and the two are only separated by a thin dike on the 20 ft. sub level. The top workings are the top of #14 stope on the 100 ft. sub level. This stope is mined at various elevations down to the 20 ft. elevation, the ore being scraped on the 000 ft. sub. This, by the way, was the only stope in the Morris Mine in 1940. All of #14's activities was confined to Lease #9. Contract #24 to the West of #14 as mentioned before under the caption "Developing" is getting ready to open up an extension of #14's stope.

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Main or #33 Deposit

All the contracts in the Main Deposit worked between the 7th and 8th levels.

Beginning at the top in the Northeast corner on the 70 ft. sub Contract #7 sliced both on our fee lands and on Chase Lease #9. This contract enlarged the formerly known ore area in the Southeast offshoot of the Main Deposit by slicing on the 60 ft. sub an area equal in size to #13. The latter took a little ore on both the 60 and 50 ft. subs in the extreme Northeast corner but were mining most of the year on the 40 and 30 ft. subs. #7 did not get below the 50 ft. elevation. Both of these gangs were bothered with water.

To the Northwest of #13, who do not mine beyond the limits of our fee property, #2 sliced on the 40 and 30 ft. subs, always stopping their slices on the boundary.

Contract #3 over the boundary on Chase Lease #9 sliced between foot and hanging on the 30, 20, 10, and started the 000 sub.

Continuing West and stepping down to lower elevations, #23 took out the next block on the -20, -30, and -40 ft. elevations.

To the West of #23 were gangs #5 and #8. #5 sliced the ore between 1600 and 1800 West on the -20 ft. sub and started the -30 ft. sub. Contract #8 to the South of Lease #9 on our fee lands again sliced a triangular shaped area on the -10, -20, and -30 ft. subs and also went North over the line onto Lease #9 to take another block of ore on the -30, -40, and -50 ft. subs. This was one of the most productive contracts in the mine.

Northwest of #8, gang #26 sliced between the hanging and the South line of Lease #9 on the -40, -50, -60, -70, and -80 ft. subs and then crossed over South onto our fee lands to slice under their old sub level stope on the -60, -70, and -80 ft. sub levels.

Down in the Southwest corner of the Main Deposit there were three more slicing gangs - #1, #21, and #24. The first named was moved from #21 Deposit above the 7th when these workings became too wet and they sliced in the Northwest limb of the deposit on the -90 and -100 ft. subs. Contract #21 in the extreme Southwest corner and #24 in the Northwest corner took out the pillars that were left on the -90 ft. sub level and the -100 ft. sub. Contract #21 also crossed over onto Chase Lease #24 and cleaned up the ore under the hanging on the -120 and -110 ft. subs, which means that this area is mined down to within 10 ft. of the back of the 8th level.

New Pump

A new 1000 g.p.m. horizontal Prescott Triplex pump was put into operation on the 9th level and the new discharge line connected, which means that the new pump can lift water to surface without relaying it with the 4th level pumps. With this pump in service the mine has two 1000 g.p.m. pumps on the 4th, one 800 g.p.m. capacity unit on the 8th, and the new 1000 g.p.m. unit on the 9th, and all four of these pumps lift the water direct to the surface.

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Diamond Drill

Early in the year a diamond drill was used to drill a short hole from the breast of the old 4th level crosscut into the East end of the old footwall crosscut. When the hole broke through no water was found dammed up and it was then decided to start the 4th level water control project which has already been described.

TILDEN MINE
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1. GENERAL

Loading operations at the Tilden Mine were started on May 3rd this year which comparatively equalled the early start of 1939. Operations were intermittent throughout the season as governed by shipments, and were for the most part on a single shift basis with one shovel in the East Pit, one in the West Pit Upper Bench and the third in the West Pit Lower Bench. Production was 205,612 tons as compared with 170,276 tons in 1939, an increase of 35,336 tons. Production and shipments were completed on November 16, and the winter schedule of repairs to plant and equipment commenced.

The following tonnages were produced in the various pits: West Pit 127,023, East Pit 78,589, Total - 205,612. Approximately 19,000 tons were shipped as Tilden Low Phosphorus Ore and the remainder as Tilden Silica.

Churn drilling was carried on throughout the season as conditions required. Production drilling was done exclusively with the 9" machines, the 6" machines being used only for exploratory drilling.

Stripping was done in the East Pit area only during the season, by Company men and equipment. Stocking grounds adjacent on the south to the crusher, were cleared and graded, also by Company men and equipment.

Four primary blasts were fired during the season, one in the East Half of the West Pit, and the other three in advancing the Lower Bench of the West Pit. The shovel working in the Lower Bench sinking cut was serviced by the D-8 Caterpillar tractor and the Athey crawler-wagon.

2. PRODUCTION SHIPMENTS & INVENTORIES

a. Production by Grades

	Tilden Silica	Tilden Silica #1.	Low Phosphorus	Total
West Pit	127,023			127,023
East Pit	59,154	328	19,107	78,589
Summit Pit	-	-	-	-
Total	186,177	328	19,107	205,612

The production shown for Tilden Silica #1 of 328 tons was the ore produced during the loading of Low Phosphorus cargoes. The cars which analyzed too high in Phosphorus were held as Tilden Silica #1, mixed with and shipped as Tilden Silica.

b. Shipments

Shipments from this property totaled 163,629 tons, leaving a balance on hand of 41,983 tons.

Tilden Silica.....	154,936 tons.
Tilden Low Phos.....	8,365 "
Tilden Silica #1.....	328 "
Tons.....	163,629 tons.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (CONT.)

c. Stockpile Inventories

Ore was stocked at the Tilden Mine this year following the completion of the clearing and grading of the stocking grounds. The tonnages stocked by grades are given below.

Tilden Silica.....	31,241 tons
Tilden Low Phos.....	10,742 "
Total.....	41,983 tons.

The book figures of broken ore reserves are as follows:

East Pit.....	19,014 tons
Lower Bench-West Pit...	72 "
W½ of West Pit.....	27,698 "
E½ of West Pit.....	16,727 "
Summit Pit.....	7,032 "
Total.....	70,543 tons.

The book figures of broken ore reserves are very close to actual, inasmuch as previously accumulated over-run was cleaned up in 1938-39.

e. Product by Months

Month	Days Operated	Average Tonnage Per 8 Hr. Shift	Total Tons.
May	18 (1-8 Hr.)	2,042	37,669
June	11 (1-8 Hr.)	2,303	25,332
July	7 (1-8 Hr.)	1,593	11,151
August	21 (1-8 Hr.)	2,087	43,845
September	18 (1-8 Hr.)	1,315	23,683
October	18 (1-8 Hr.) 4 (2-8 Hr.)	1,449	37,697
November	14 (1-8 Hr.)	1,874	26,235
Total	115 (1-8 Hr.)	1,787	205,612

The average output per 8 Hr. shift of 1,787 tons during 1940 compares with 1,980 tons in 1939; 2,140 tons in 1938, and 1,996 tons in 1937. The cause for this decrease may be pointed out as the fact that of 115 shifts worked, 37 shifts or 32% were spent in stocking ore. The ore was transported by trucks from the loading pocket to the piles and although high efficiency was maintained in the routine, the disadvantages inherent to handling small tonnages were great enough to cause the resultant decrease in tonnage per shift. Moreover, of the 37 shifts of stocking, 15 shifts or 51% of stocking time, was used in handling Low Phos. ore, during which time one shovel only in the East Pit could be operated. The average output, if the shifts and tonnages charged to stocking be disregarded, actually reached the figure of 2056 tons per 8 Hr. Shift.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (CONT.)

f. Ore Statement

	1940 Tons	1939 Tons
On hand January 1, 1940 - - - - - - - -	-	-
Output for year - - - - - - - - - - - -	205,612	170,276
Shipments - - - - - - - - - - - - - - -	163,629	170,276
Balance on Hand - - - - - - - - - - - -	41,983	-
Increase in Output - - - - - - - - - -	35,336	
Decrease in Shipments - - - - - - - - -	6,647	

1936 - 77 - 1-8hr. 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.

g. Delays

There were no extensive individual delays as such during the year, but continuous mechanical breakdowns of the No. 46 Shovel accounted for approximately 2,785 tons or 25% of the total tonnage loss by delays.

The total lost time chargeable to the different pieces of equipment are listed below:

Power Shovels

No. 29	No. 31	No. 46	Total
10¼	15¼	31½	57

This total of 57 hours lost compares with 18½ hours in 1939, 50½ in 1938, and 114½ in 1937.

Other miscellaneous delays are listed below:

Crushing Plant	Lack of Electric Power	Transportation Equipment.	No Railroad Car Service	Total
7	1½ (storm)	14½	2	25 Hours.

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

Shovels - - - - - -	5,672 tons
Miscellaneous - - -	3,872 "
Total - - - - -	9,544 tons.

h. Delays from Lack of Current

No delays caused by mechanical failure have been encountered since the installation of the sub-station and transformers at the property. The 1½ hours listed under the heading of power delays was due entirely to the precaution of shutting down the plant at the peak of severe electrical storms to avoid the possibility of the circuit breaker throwing out while the gyratory crushers are under load.

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3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss on Ignition
Tilden Silica	39.02	.035	41.93	.10	.72	.28	.27,	.010	.35
Tilden Silica #1	)37.05	.044	45.09(	.08	.44	.20	.16	.009	.33
Tilden Low Phos.	)36.91	.017	45.59(						

b. Average Analysis on Straight Cargoes

	Mine			Lake Erie	
Grade	Iron	Phos.	Sil.	Iron	Moist.
Tilden Silica	39.09	.036	41.84	39.49	1.81
Tilden Low Phos.	36.87	.013	45.79	37.90	1.37

c. High Sulphur Ore

The high sulphur ore found in the West portion of the East end of the West Pit was successfully added to and mixed with the West Pit product throughout the loading season without materially increasing the average sulphur content. To maintain production and successfully grade shipments, it is necessary, however, to use all shovels.

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore

1. West Pit

The estimate of reserves in the West Pit as reported in 1939 is here maintained. In the West Pit ore reserves and stripped reserves are the same, inasmuch as conditions will not permit additional stripping in this area, and no stripping, drilling, nor other information was produced in 1940 to warrant a change in the estimate of reserves.

Assumption: 13 cu. ft. equal 1 ton.

Grade: Tilden Silica

West Portion of West Pit, Upper Bench	203,365 tons.
Less 10% for Rock	20,335 "
Balance	183,030 tons
Broken Ore Reserves	27,700 "
Total W½ of West Pit, Upper Bench	210,730 tons
E½ of West Pit, Upper Bench	146,590 "
Total Upper Bench	357,320 tons
Total Lower Bench (60' deep)	1,955,000 "
Total Developed Ore, January 1st, 1941, West Pit	2,312,320 tons.

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, 1940	5,149,665 tons
Ore Mined in 1940	78,590 "
Total Developed Ore, January 1st, 1941, East Pit	5,071,075 tons.

Of this total of 5,071,075 tons, approximately 2/5 is expected to grade above .015% Phos. and 3/5 below .015% Phos. Those figures based on 1930 diamond drill exploration, have not been proved by the small tonnage mined at the base of the hill. The tonnage explored covers so large an area that it will be years before much of it is actually developed by mining. Until such time as results prove otherwise, the available ore at the East Pit can conservatively be estimated as analyzing .020% in Phos. which, by selective mining and grading, can be made to yield a product of which approximately 25% would run .015 Phos. or lower.

As discussed in the report for 1937, operations at Summit Pit have been abandoned as such, although it is probable that these reserves will ultimately be mined from the present floor of the East Pit.

3. Developed Ore as of January 1st, 1941:

West Pit	2,312,320 tons
East Pit (including Summit)	5,071,075 "
Total Tilden Mine	7,383,395 tons.

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4. ESTIMATE OF ORE RESERVES (CONT.)

b. Prospective Ore

In addition to the developed ore, there is probably a considerable tonnage to the North and East of the area developed by drilling at the East and Summit Pits. The reserves in the West Pit are definitely limited by dikes, over-burden and lean material. Under present conditions, there is no further prospective ore in this portion of the property. Prospect drilling in an area 1500 feet to the West of the present West Pit boundary has not shown any sufficient tonnages of merchantable ore to be immediately available. The ultimate expansion of operations will probably be an advancement of the East Pit to the North and East to eventually include Summit Pit. The recovery of the ore in the Lower Bench of the West Pit is underway with considerable advancement of the thorough-cut with the present floor of the West Pit as the top of the face and a plane 10' below the elevation of the L. S. & I. tracks as the floor. The height of this face is approximately 60'.

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 1937 to 1939, inclusive. As was mentioned in the 1939 report, there is a possibility that the West Pit reserves will be slightly lower than the above due to contamination by dike. By selective loading in the West Pit during the 1940 operating season, the iron analyses was held up to 39.02.

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 1941 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
	450,000	38.80	.043	43.30	.011	1.92	38.03

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4. ESTIMATE OF ORE RESERVES (Cont.)

f. Estimate of Production (Cont.)

2. ESTIMATE OF PRODUCTION BY GRADING EAST PIT ORE

Grade	Tonnage	Iron	Phos.	Sil.	Sul.	Moist.	Iron Natl.
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						

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 1941 production are practically the same as reported for 1939 and 1940, for the reasons that, beyond the discussion of this analysis in the 1938 report, blast hole drilling in the East Pit indicated a few minor changes.

5. LABOR AND WAGES

a. Comments

1. Labor

Labor conditions on the whole were satisfactory during 1940. Employment was maintained on a much more even schedule than in former years because of the stocking work. The number of employees averaged 37, an increase of 7 men per shift, which was the result of an increased drilling program, and greater production entailing more track work

As mentioned in the 1939 report, NRA regulations, as such, were discontinued in July 1937, but have been adhered to since, in 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.

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5. LABOR AND WAGES (CONT.)

b. Comparative Statement of Wages and Product

	1940	1939	Increase	Decrease
Product	205,612	170,276	35,336	
Number of Shifts and Hours	107 - 1-8 hr.	78 - 1-8 hr.	29 - 1-8 Hr.	
Average number of men working	37	30	7	
Average daily wage	$5.71	$5.54	$.17	
Tons per man per day	47.68	55.05		7.37
Labor cost per ton (Labor Stmt.)	$.123	$.104	$.019	
Labor cost per ton (Cost Sheet)	.138	.121	.017	
Total number of days	4,418	3,186.75	1,231.25	
Amount paid for labor as per Labor Statement	$25,242.13	$17,651.14	$7,590.99	
Amount paid for labor as per Cost Sheet	28,409.34	20,600.65	7,809.99	

7. OPEN PIT OPERATIONS

a. Stripping

Several stripping operations were carried on during the year, the costs of which were charged to E. & A. No. 786, although not included in the original estimate. As explained in the 1939 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 the E. & A. to handle this year's stripping work, although of course the original estimated quantities have been exceeded.

The first stripping job of the year was the use of a scraper with a 50 H.P. scraper hoist in an attempt to remove the overburden left on the North side of the East Pit following the stripping done in the spring of 1939. However, it was found that this method of removing the overburden was not altogether practical because the overburden was lying in pot holes three to four feet deep, and to remove these accumulations would necessitate too frequent moving of the scraper hoist. The method was discontinued and the work completed with the monitor and bull-dozer working in conjunction with one another.

Work at the East side and continuation of the North side of the East Pit comprised the balance of the stripping for the year.

A total of 2,300 cu. yds. was removed from the North side, of which 900 cu. yds. were washed at a cost of 70¢ per yard and 1,400 yds. stripped by the D-8 tractor and bull-dozer at a cost per yard of 26¢. The labor costs account for the difference in the methods, the cost of supplies being comparatively equal.

An overburden of 2,085 cu. yds. was removed from the east side by the D-8 tractor and bull-dozer at a cost of 35¢ per yard. The average length of haul on this particular operation was 380 feet.

7. OPEN PIT
OPERATIONS (CONT.)

a. Stripping (Cont.)

As was done also in 1939, 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	EXPENDITURE 1940	PREVIOUS 1937-38-39.	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 yd.....	12,000	42,707 Yds.		7,182.98	7,182.98	$0.168 per yd.
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	"		528.43	528.43	
Washing.....	1,000	Nearly Completed		4,415.28	4,415.28 (4)	
Casting L.S.& I. tracks.....	250	Completed		1,062.12	1,062.12	
Surfacing 3,000 cu. yds. at 50¢ per yd.....	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)...		1582 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	2700 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	2500 cu. yds.		909.25	909.25	0.36 per cu. yd.
North Side of East Pit (3)..		9300 cu. yds.	$ 1,048.75	699.99	1,748.74	0.188 " " "
West End of West Pit.....(3)		1500 cu. yds.		371.08	371.08	0.248 " " "
South side of East Pit (3)		600 cu. yds.		25.11	25.11	0.042 " " "
East side of East Pit (3)		2085 cu. yds.	728.50		728.50	0.349 " " "
Prospect Drilling N½ of NE¼ of Section 27, 47-27... (3)			3,411.25		3,411.25	
GRAND TOTAL.....	$ 22,025		$ 5,188.50	$18,332.12	$23,520.62	

(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.

Most of the above operations were thoroughly discussed in the reports for 1937, 1938 and 1939. Following are remarks concerning the expenditures during the current year, 1940:

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7. OPEN PIT
OPERATIONS (CONT.)

a. Stripping (Cont.)

North Side of East Pit: As explained earlier, much material left in pot-holes in this locality after the first stripping by the bull-dozer, had to be washed away to prevent contamination of subsequent blasts. With two men required to handle the monitor, the labor costs for this phase of stripping materially increases the total unit cost of removal of the over-burden.

East Side of East Pit: The stripping of 2,085 yards from this section was accomplished without undue expense, although the unit cost runs 35¢ per yard. A factor that increased this cost slightly was the double handling of considerable yardage left by operations in a former year.

Prospect Drilling Section 27, 47-27: A complete account of this work will be found in Section 9 of this report under "Explorations".

b. Development

No development of new ore at the pits proper were made during the year since the ore stripped had already been outlined by test drilling, and the ore in the Lower Bench-West Pit has been carried as developed ore.

f. Drilling, Blasting & Explosives

All primary blast hole drilling was done by the Armstrong 29-T rigs using 9" bits. The footage drilled this year totalled 2,885' with one hole of 42' lost in the Lower Bench of the West Pit, leaving a net footage of 2,843'. As compared with the drilling accomplished in 1939 of 1,674 ft., an added footage of 1,169 ft. was obtained this year.

Drilling this year was done in the West Half of the West Pit, Lower Bench of the West Pit, and East Pit. The following short table gives a comparison of the total operating and maintenance costs, exclusive of cost of depreciation of drilling equipment, between 1940 and 1939 for drilling 9" holes in the same localities.

	1940		1939	
Location	Footage	Cost per Foot	Footage	Cost per Foot
Lower Bench-West Pit	1,209	$2.12	278	$2.32
West Half of West Pit	341	2.06	184	2.06
East Pit	1,293	2.11	169	2.42
Totals	2,843	$2.11	631	$2.27

During 1939, however, 924 additional feet of 9" holes were drilled in the East Half of the West Pit at $1.61 per foot total operating and maintenance costs. This large footage brought the 1939 drilling costs down to $1.88 per foot. During 1940, there was no occasion to drill in the East Half of the West Pit.

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7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling (Cont.)

The item "Depreciation of Drilling Equipment" which was first added to the record of drilling costs in 1938 amounted to $0.567 in 1940, as compared with $1.056 in 1939 and $0.45 in 1938. The differences in these amounts charged to the three years are inversely proportional to the footage drilled.

Cost of Operating 9" Churn Drills in Lower Bench, West Pit, 1940

Total Footage of Holes Drilled - -	1,251
Total Footage of Holes Lost - - -	42
Net Available Footage - - - - -	1,209

	Labor	Supplies	Total	Cost Per Foot
Operating				
Drilling at Mine	$ 983.84	$ 38.38	$ 1,022.22	$0.845
Sharpening Bits	299.48	186.18	485.66	.402
New Bits		486.95	486.95	.402
Electric Power		82.73	82.73	.068
Pipe and Fittings		80.00	80.00	.066
Truck and Tractor	208.46	168.55	377.01	.312
Total Operating.....	$1,491.78	$1,042.79	$2,534.57	$2.095
Maintenance				
Drill Maintenance	23.25	8.08	31.33	.026
Total Maintenance.....	$ 23.25	$ 8.08	$ 31.33	$0.026
Total Maintenance and Operating.....	$1,515.03	$1,050.87	$2,565.90	$2.121
Depreciation on Churn Drill Equipment.....		$ 672.69	$ 672.69	$ .557
Total Maintenance, Operating and Depreciation.....	$1,515.03	$1,723.56	$3,238.59	$2.678

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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 - 1940

Total Footage of Holes Drilled - - 1,293
Total Footage of Holes Lost - - - 0
Net Available Footage - - - - 1,293

	Labor	Supplies	Total	Cost Per Foot
Operating				
Drilling at Mine	$ 936.52	$ 224.83	$ 1,161.35	$0.901
Sharpening Bits	311.06	230.97	542.03	.412
Pipe and Fittings		25.61	25.61	.019
New Bits		362.23	362.23	.280
Electric Power		178.90	178.90	.138
New Tools		111.38	111.38	.086
Truck and Tractor	204.32	93.66	297.98	.236
Total Operating.....	$ 1,451.90	$ 1,227.58	$ 2,679.48	$2.072
Maintenance				
Drill Maintenance	39.63	5.81	45.44	.035
Total Maintenance...	39.63	5.81	45.44	.035
Total Maintenance and Operating.....	$ 1,491.53	$ 1,233.39	$ 2,724.92	$2.107
Depreciation on Churn Drill Equipment.....		718.88	718.88	.567
Total Maintenance, Operating and Depreciation.....	$ 1,491.53	$ 1,952.27	$ 3,443.80	$2.664

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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 - 1940

Total Footage of Holes Drilled - - -	341'
Total Footage of Holes Lost - - - -	0
Net Available Footage - - - - -	341'

	Labor	Supplies	Total	Cost Per Foot
Operating				
Drilling at Mine	$ 356.20	$ 40.00	$ 396.20	$1.161
Sharpening Bits	83.02	53.36	136.38	.399
Electric Power		42.45	42.45	.124
Pipe and Fittings		6.36	6.36	.018
Truck and Tractor	93.98	24.08	118.06	.349
Total Operating.....	$ 533.20	$ 166.25	$ 699.45	$ 2.051
Maintenance				
Drill Maintenance.....	5.10		5.10	.012
Total Maintenance.....	5.10		5.10	.012
Total Maintenance and Operating.....	$ 538.30	$ 166.25	$ 704.55	2.063
Depreciation on Churn Drill Equipment.....		189.73	189.73	.567
Total Maintenance, Operating and Depreciation.....	$ 538.30	$ 355.98	$ 894.28	2.620

Combined Cost of Operating Churn Drills - 1940

	Total Net Footage	Total Cost.	Cost Per Foot
West Pit, Lower Bench, 9" Holes	1,209'	$ 2,565.90	$2.121
West End of West Pit, 9" Holes	341'	704.55	2.063
East Pit, 9" Holes	1,293'	2,724.92	2.107
Total.....	2,843'	$ 5,995.37	$ 2.110
Depreciation of Churn Drill Equipment.		1,581.30	.567
Total.....	2,843'	$ 7,576.67	$ 2.667

TILDEN MINE
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YEAR - 1940

7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

1. Drilling (Cont.)

The performance of the 29-T drill rigs as reflected by the higher average footage drilled per shift, was even more satisfactory this year than during 1939. The figures supporting this comparison were obtained from drilling data in the same areas this year as last. The table below shows this briefly:

	1940			1939		
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.....	72	1,209	16.65	19	278	14.63
West End of West Pit.....	20	341	17.05	11½	184	16.00
East Pit.....	67	1,293	19.29	13	169	13.00
Total.....	159	2,843	17.87	43½	631	14.50

Correspondingly, the footage obtained per bit was higher this year than that of 1939. As was mentioned in the 1939 report, the relatively low footage per bit in the West Half of the West Pit is due primarily to the hardness of the material encountered in drilling. It may be noted at this point that on two occasions this past season the method and procedure used at the Tilden Mine for the hardening of churn drill bits was checked against the specifications of the practice as recommended by Bucyrus-Erie. On the second occasion, a representative of that company reviewed the procedure personally and on neither occasion could a deviation from the recommended practice be observed.

The table below gives the footage obtained per bit (9") on drilling in comparable areas this year and last.

	1940			1939		
Location	Bits Used	Footage Obtained.	Footage per Bit	Bits Used	Footage Obtained	Footage Per Bit
Lower Bench, West Pit.....	233	1,209	5.18	29	278	9.58
West End of West Pit.....	106	341	3.21	50	184	3.68
East Pit.....	216	1,293	5.98	51	169	3.31
Total.....	555	2,843	5.12	130	631	4.85

TILDEN MINE
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YEAR - 1940

7. OPEN PIT OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

2. Blasting

Four primary blasts were fired this year, all in the West Pit. The large blast fired in 1939 in the East Pit produced sufficient tonnage to cover production for this area in 1940. The four blasts this year produced an estimated tonnage of 79,200 tons. As was mentioned in the discussion of drilling, the tonnage was obtained by the use of 9" holes entirely. The blasting practice followed quite closely that of recent years.

Three of the blasts were fired in advancing the face of the Lower Bench, and of necessity these blasts were small, totalling 43,000 tons. The fourth blast, the largest, produced 36,000 tons in the East Half of the West Pit. The following is a table of blast results:

Blast No.	Date	No. of Holes.	Footage	Pounds Powder	Estimated Tonnage.	Tons of Ore per Pound of Powder
1 (Lower Bench)	5/8/40	(9") 6	318	4,650	14,000	3.0
2 (Lower Bench)	6/12/40	(9") 6	361	5,350	16,000	3.0
3 (E½ of West Pit)	7/20/40	(9") 15	904	13,450	36,000	2.7
4 (Lower Bench)	10/28/40	(9") 6	397	5,950	13,200	2.2
Total West Pit.....		33	1,980	29,400	79,200	2.7
TOTAL TILDEN MINE.....		33	1,980	29,400	79,200	2.7

On the whole, good fragmentation was obtained and the usual amount of secondary blasting was necessary in dressing the bank and during the loading operations. At the close of the loading in the East Pit, considerable work was necessary in taking out shallow hard toe left from the previous blast. All of the secondary drilling was done with detachable jack-bits and water, utilizing both jack-hammer and tripod drifter drills.

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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, 1940

Primary Blasting.

Kind	Quantity	Price	Amount
Gelamite #2	12,250 Lbs.	$ 11.50	$ 1,408.75
75% L.F. Gelatin	8,750 "	13.35	1,159.38
90% L.F. Gelatin	8,400 "	17.50	1,470.00
Total Powder	29,400 Lbs.	$ 13.73	$ 4,038.13
Blasting Supplies			
Primacord Bickford Fuse, regular	3,500 ft.	$ 43.20	$ 151.22
Primacord Bickford Fuse, wire bound	1,000 "	55.60	55.60
Total Blasting Supplies	4,500 ft.		$ 206.82
Total All Explosives			4,244.95

Total Ore Blasted in 1940	79,200 tons.
Pounds of Powder per ton of Ore	.372
Cost per ton for Powder	$ .051
Cost per ton for Fuse, Caps, etc	.003
Cost per ton for all explosives	.054
Average price per lb. for Powder	.137

Secondary Blasting

Kind	Quantity	Price	Amount
60% Gelatin	5,800	$ 12.00	$ 696.00
90% Gelatin	100	17.50	17.50
Total Powder	5,900	$ 12.09	$ 713.50
Blasting Supplies			
Connecting Wire	10 Lb.	.40 Lb.	4.00
Primacord Fuse	1000 ft.	47.40 M.	47.40
Clover Fuse	18000 ft.	5.04 M	90.72
#6 Blasting Caps	1000	12.20 M	12.20
Total Blasting Supplies			$ 154.32
Total Powder			713.50
Total Secondary Blasting Cost			$ 867.82

Product	205,612 tons
Pounds of Powder per ton of Ore	.028
Cost per ton for powder	$ .003
Cost per ton for fuse, caps, etc	.001
Cost per ton for all explosives	.004
Average Price per lb. for Powder	.121

TILDEN MINE
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YEAR - 1940

7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

2. Blasting (Cont.)

COMBINED TOTAL BLASTING COSTS

Kind	Quantity	Price	Amount
Gelamite #2	12,250 Lbs.	$11.50	$ 1,408.75
60% L.F. Gelatin	5,800 "	12.00	696.00
75% L.F. Gelatin	8,750 "	13.25	1,159.38
90% L.F. Gelatin	8,500 "	17.50	1,487.50
Total Powder	35,300 Lbs.	$13.45	$ 4,751.63
Blasting Supplies			
Connecting Wire	10 Lbs.	$ .40 Lb.	$ 4.00
Primacord Bickford fuse, regular.	4,500 ft.	42.80 M	198.62
Primacord Bickford fuse, wire bound	1,000 ft.	55.60 M	55.60
Clover Fuse	18,000 ft.	5.04 M	90.72
No. 6 Blasting Caps	1,000	12.20 M	12.20
Total Blasting Supplies			$ 361.14
TOTAL ALL EXPLOSIVES			$ 5,112.77

TILDEN MINE
ANNUAL REPORT
YEAR - 1940

7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 43,200 tons of Ore in Lower Bench - West Pit

Net feet of 9" Holes Drilled - 1,076'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine.....	$ 835.97	$ 73.25	$ 909.22	$ 0.845	
Sharpening Bits.....	269.74	162.81	432.55	.402	
New Bits.....		432.56	432.56	.402	
Electric Power.....		73.17	73.17	.068	
Pipe and Fittings.....		70.02	70.02	.066	
Truck and Tractor.....	182.92	152.89	335.81	.312	
Total Operating.....	1,288.63	964.70	2,253.33	2.095	
Maintenance					
Drill Maintenance.....	24.45	3.52	27.97	.026	
Drill Sharpener Equipment..	-	-	-	-	
Total Maintenance.....	$ 24.45	3.52	27.97	.026	
Total Maintenance and Operating.....	1,313.08	968.22	2,281.30	2.12	.053
Depreciation on Churn Drill Equipment.....		599.69	599.69	.566	.014
Total Maintenance, Operating and Depreciation.....	$ 1,313.08	1,567.91	2,880.99	2.688	.067
Primary Blasting Costs					
Labor Loading Holes.....	92.92		92.92		
Explosives.....		2,245.10	2,245.10		
Other Supplies.....		4.80	4.80		
Total Blasting Costs.....	$ 92.92	2,249.90	2,342,82		.054
Grand Total, Operating, Maintenance, and Primary Blasting Costs.....	$ 1,406.00	3,817.81	5,223.81		.121

TILDEN MINE
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7. OPEN PIT
OPERATIONS (CONT.)

f. Drilling, Blasting & Explosives (Cont.)

3. Statement of Cost of Drilling and Blasting 36,000 tons of Ore in the East Half of the West Pit

Net Feet of 9" Holes Drilled - 924'

Drilling Cost Operating	Labor	Supplies	Total	Cost Per Foot	Cost Per Ton
Drilling at Mine	$ 658.20	$ 98.35	$ 756.55	$0.819	
Sharpening Bits	164.02	62.59	226.61	.246	
Pipe and Fittings		58.66	58.66	.064	
Rope		113.18	113.18	.120	
Electric Power		108.52	108.52	.118	
Truck and Tractor	159.56	45.54	205.10	.222	
Total Operating	$ 981.78	$ 486.84	$1,468.62	$1.589	
Maintenance					
Drill Maintenance	$ 5.52	11.63	17.15	.018	
Total Maintenance	$ 5.52	11.63	17.15	.018	
Total Maintenance and Operating	$ 987.30	$ 498.47	$1,485.77	1.607	$0.041
Depreciation on Churn Drill Equipment		975.74	975.74	1.056	.027
Grand Total, Operating, Maintenance & Depreciation	$ 987.30	$1,474.21	$2,461.51	2.663	.068
Primary Blasting Costs					
Loading Holes	$				
Explosives		1,819.25	$1,819.25		
Other Supplies	109.20	25.77	134.97		
Total Blasting Costs	$ 109.20	1,845.02	$1,954.22		.054
Grand Total, Operating, Maintenance, Depreciation and Blasting Costs	$1,096.50	$ 3,319.23	$4,415.73		.122

It will be seen from the foregoing tables of blasting costs in the Lower Bench and East Half of West Pit that the total costs per ton are the same. As noted previously under "Drilling", the cost of drilling 924 feet in the East Half of the West Pit area was considerably less than the Lower Bench and consequently the Operating and Maintenance costs per ton are $.053 and $.041 for the Lower Bench and East Half respectively. Further, as was also mentioned previously, the Depreciation on Drill Equipment was $.49 per foot less in 1940 than in 1939 when the East Half drilling was done, and this fact equalizes the operating costs inasmuch as blasting practice costs for both areas were the same.

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7. OPEN PIT
OPERATIONS (CONT.)

g. Loading Operations

Loading was begun on May 3rd this year in an early start to produce a greater tonnage for the 1940 season. The loading program was held to a more even schedule than formerly through the medium of stocking both Tilden Silica and Low Phosphorus ore in the grounds completed this year. All operations were conducted on a single shift basis with the exception of four days during which a double shift was necessary. A total of 115 shifts were worked in producing 205,612 tons of ore.

As mentioned in Paragraph 2e, the average daily output per 8 hour shift was less than last year because of the fact that 37 shifts were used in stocking ore. The 78 shifts actually worked in producing shipments gave an output of 2,056 tons per shift.

No. 31 Shovel worked in the East Pit throughout the year, with Nos. 29 and 46 in the West Pit. However, changing conditions in the West Pit Lower Bench forced many extra moves in the handling of Nos. 29 and 46. During 1939, the Lower Bench was being opened on an inclined sinking cut method with a gradually (10% grade) deepening face. Throughout that season the No. 46 Shovel was able to handle the blasts, and with the use of the D-8 Tractor and Athey crawler-wagon to transport the ore up the incline to the crushers, production was maintained.

The advancement of the Lower Bench during 1940 progressed beyond the gradually deepening incline and entered the levelling off stage of the thorough-cut with an average height of face of 60 feet. With a burden of 30 feet and height of 60 feet, the blasts in this area produced a bank too heavy for the light No. 46 Shovel to handle. The last blast for the year in this area was loaded at a heavier powder factor than customary to expedite the work of the No. 46 Shovel, but despite the greater fragmentation obtained, the height of cut encountered in loading proved still too high and consequently too heavy for efficient loading by this shovel.

To meet shipments with the difficult condition of the Lower Bench present, the #29 Shovel was moved from the Upper Bench West Pit to finish the last cut of a Lower Bench blast. The No. 46 Shovel was able to begin loading again on the following Lower Bench blast on the light edge of the cut and finished out the season on that work.

The 1940 season schedule of shovel movements noted below indicates the problem of maintaining shipments with the bulk of the West Pit tonnage to come out of the Lower Bench in future operations.

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7. OPEN PIT
OPERATIONS (CONT.)

g. Loading Operations (Cont.)

No. 29 Shovel		No. 46 Shovel	
Period Worked	Locality (West Pit)	Period Worked	Locality (West Pit)
May 3 - Aug. 29	Upper Bench	May 3 - May 5	Upper Bench E½
Aug.29 - Oct. 22	Lower Bench	May 6 - July27	Lower Bench
Oct.23 - Oct. 24	Stockpile	July 28- Aug. 6	Upper Bench E½
Oct.26 - Nov. 16	Upper Bench	Aug. 7 - Aug.11	Lower Bench
		Aug. 12- Aug. 15	Upper Bench
		Aug. 17- Aug. 29	Lower Bench
No. 31 - East Pit - All season.		Aug. 30- Oct. 27	Upper Bench W½
		Oct. 31- Nov. 16	Lower Bench

As pointed out under "Reserves", considerable quantities of dike and other lean material are encountered in the West Half of the West Pit. To keep up the grade of ore, this rock must be segregated and loaded out to the waste pile. The following is a record of the rock removed, the cost of which was charged to the Waste Pile account.

	Labor	Supplies	Total
Tractor Operating.....	$ 37.12	$ 27.74	$ 64.86
Power Shovels Operating.....	219.80	112.00	331.80
Locomotives Operating.....	105.52	44.92	150.44
Surface Labor - Tracks.....	20.00	-	20.00
Repairing Dump Cars.....	-	30.89	30.89
Depreciation on Tractor Equipment...	-	153.37	153.37
Total.....	$382.44	$ 368.92	$ 751.36

Yards moved by Wooden Rock Cars.....	4,152
Yards moved by Athey Crawler-Wagon.....	636
Total cubic yards moved.....	4,788
Cost per cubic yard moved.....	$0.157

The cost of moving 4,788 cu. yds. of rock at $.157 per yard compares with the 1939 figures of moving 6,624 yards at $.12; and 1938 of moving 1,582 cu. yards at $.18 per yard. Of the 4,788 cu. yds. of rock removed this year, the bulk or 4,152 yards was hauled out with locomotives and cars and the remainder with the D-8 tractor and wagon. During loading operations, any significant amount of rock is cast to the side, and the actual loading of the rock is accomplished at a time not interfering with production. The loading entails considerable moving on the part of the shovels and transportation units which factor increases the removal cost per yard.

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8. COST OF OPERATING

a. Comparative Mining Costs

	1940	1939	Increase	Decrease
Production	205,612	170,276	35,336	
Average Daily Output	1,787	1,980		193
Tons per man per day	47.68	55.03		7.35
Number of days operating	115	86	29	
Number of shifts and Hours	107 - 1-8 hr. 4 - 2-8 hr.	78 - 1-8 hr. 4 - 2-8 hr.	29	
Cost				
Stocking Ore	.017		.017	
Pit Operating Accounts	.309	.315		.006
Pit General Accounts	.068	.052	.016	
Cost at Mine	.394	.367	.027	
Idle & Winter Expense	.090	.077	.013	
Total Cost at Mine	.484	.444	.040	
Depreciation				
Plant and Equipment	.063	.047	.016	
Taxes	.027	.046		.019
Stripping	.013	.027		.014
Grand Total Cost at Mine	.587	.564	.023	
Expense Beyond Mine				
Freight - Rail	.650	.650		
Lake Freight	.860	.880		.020
Cargo Insurance and Analysis	.011	.010	.001	
Shrinkage	.012	.012		
TOTAL COST LOWER LAKES	2.120	2.116	.004	

b. Detailed Cost Comparison

1. Days and Shifts

This property operated a total of 115 shifts as compared with 86 in 1939, an increase of 29 shifts.

2. Production

In 1940 the property produced 205,612 tons, an increase of 35,336 over 1939 when 170,276 tons were produced. The average daily product for 1940 shows a decrease of 193 tons per 8 hr. shift, being 1,787 tons as compared with 1,980 tons in 1939. As explained in Paragraph 2e, this decrease was due to the number of shifts spent in stocking ore.

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7. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

3. Cost of Production

In 1940 the cost in cars at the mine before depreciation and taxes was .484 as compared with .444 in 1939. This increase of $.04 per ton may be explained by the fact that for the first year in the operation of this property, ore was stocked at a cost of $.017 per ton, using the entire product of 205,612 tons as a cost basis. Also to General Pit Account, under the caption "Special Expense E. & A. 856", there was a charge of $3,241.24; and further to "Pensions and Allowances adjustment" a charge of $1,400.10. This last caption cost per ton for the year 1940 is $.024 against .002 last year, an increase of .022 per ton. Extensive repairs were required for Nos. 29 and 46 Shovels, and the 42" gyratory crusher and 10" West gyratory crusher.

A detailed explanation of the cost of stocking Tilden ore mentioned above is as follows:

Cost of Construction of Stocking Grounds.....	$ 2,078.03
Cost of Stocking 45,176 tons of Ore.....	1,468.65
Total Cost in 1940.....	$ 3,546.68
Cost per ton of ore stocked (205,612 basis).....	$ .017
Cost per ton of actual ore stocked 45,176 tons against actual cost of stocking ($1,468.65)..	.032

TILDEN MINE
ANNUAL REPORT
YEAR - 1940

8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs

	1940	1939	Increase	Decrease
Shifts and Hours.....	107 - 1-8 hr. 4 - 2-8 hr.	78 - 1-8 hr. 4 - 2-8 hr.	29	
Production Tons.....	205,612	170,276	35,336	
Average Product per 8 hr. Shift	1,787	1,980		193
Number of Shifts Worked.....	115	86	29	

PIT OPERATIONS	1940		1939		Increase		Decrease	
Direct Ore	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1. Drilling & Blasting.....	$24,920.05	.122	$21,465.27	.127	$3,454.78			.005
2. Power Shovels Operating.....	7,184.36	.035	5,461.11	.032	1,723.25	.003		
3. Power Shovels Maintenance.....	2,706.53	.013	3,991.16	.023			$1,284.63	.010
4. Locomotives & Cars Operating.....	6,644.15	.032	4,840.92	.028	1,804.13	.004		
5. Locomotives & Cars Maintenance.....	505.72	.002	188.09	.001	317.63	.001		
6. Track Expense.....	1,956.05	.010	1,559.48	.009	396.57	.001		
6A. D-8 Tractor Operating.....	2,103.20	.010	2,126.69	.013			23.49	.003
6B. D-8 Tractor Maintenance.....	688.21	.003	70.65	.000	617.56	.003		
TOTAL DIRECT ORE...	$46,708.27	.227	$39,702.47	.233	$7,005.80			.006
General Pit Expense								
8. Water Supply.....	$ 8.59	.000	$ 4.78	.000	$ 3.81			
10. Crushing and Screening.....	10,047.42	.049	9,150.97	.053	896.45			.004
11. General Open Pit Expense.....	4,248.47	.021	3,376.96	.020	871.51	.001		
12. Open Pit Supts.....	1,248.48	.006	779.37	.005	469.11	.001		
14. Waste Pile Expense.	751.36	.004	433.94	.003	317.42	.001		
14A. Testpitting.....	274.07	.001			274.07	.001		
15. Exploration Drilling.....	217.69	.001	189.11	.001	28.58			
TOTAL GENERAL EXPENSE..	$16,796.08	.082	13,935.13	.082	2,860.95			
TOTAL PIT OPERATION....	$ 63,504.35	.309	$53,637.60	.315	9,866.75			.006
Stocking Tilden Crushed Ore.....	$ 3,546.68	.017			3,546.68	.017		
GRAND TOTAL.....	$67,051.03	.326	$53,637.60	.315	13,413.43	.011		

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8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs (Cont.)

GENERAL MINE EXPENSE	1940 Amount	1940 Per Ton	1939 Amount	1939 Per Ton	Increase Amount	Increase Per Ton	Decrease Amount	Decrease Per Ton
16. Mining Engineering...	$ 940.64	.005	$ 1,073.60	.006			$ 132.96	.001
17. Mechanical and Electrical Engrg.....	106.09	.001	156.48	.001			50.39	
18. Analysis & Grading...	2,145.37	.010	1,665.10	.010	$ 480.27			
19. Safety Department....	95.00	.000	106.74	.001			11.74	.001
20. Local & Gen. Welfare.	267.88	.001	296.00	.002			28.12	.001
21. Special Expense.....	5,000.88	.024	389.70	.002	4,611.18	.022		
22. Ishpeming Office.....	847.00	.004	803.00	.005	44.00			.001
23. Mine Office.....	1,945.14	.009	2,000.53	.011			55.39	.002
24. Insurance.....	160.98	.001	265.96	.002			104.98	.001
25. Personal Injury.....	932.09	.004	735.50	.004	196.59			
26. Social Security Taxes	1,183.25	.006	892.36	.005	290.89	.001		
27. Employees Vacation Pay	596.89	.003	536.35	.003	60.54			
TOTAL GENERAL MINE EXPENSE	14,221.21	.068	8,921.32	.052	$5,299.89	.016		
IDLE & WINTER EXPENSE.....	18,332.49	.090	13,128.17	.077	$5,204.32	.013		
COST OF PRODUCTION....	$99,604.73	.474	$75,687.09	.444	$23,917.64	.030		
28. Deprn. Plant & Equipt.	12,933.06	.063	$ 7,913.76	.047	5,019.30	.016		
* 29. Amortization Stripping	2,671.79	.013	4,642.69	.027			$1,970.90	.014
30. Taxes.....	5,468.52	.027	7,789.98	.046			2,321.46	.019
COST AT MINE.....	$21,073.37	.103	$20,346.43	.120	726.94			.017
Loading Stocked Ore.....	72.80	.000			72.80			
Inventory Adjustment.....	11.75	.000	8.56	.000	3.19			
TOTAL COST AT MINE.....	$ 120,762.65	.587	$ 96,042.08	.564	$24,720.57	.023		

No explanation is made for changes in the above cost items unless the increase or decrease is large enough to be significant.

1. Drilling and Blasting

Last year this amount was high on account of drilling and blasting the original sinking cut in the Lower Bench and also that more secondary drilling was required.

3. Power Shovels - Maintenance

The increase of .01 per ton is due to more repairs required for 46 and 29 Shovels, changing dipper handle, and No. 31 Shovel repairing boom.

* To this classification there has been added a charge of $110.71 according to advice from the Cleveland office on February 10, 1941. No changes have been made on this cost sheet however.

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8. COST OF OPERATING (CONT.)

b. Detailed Cost Comparison (Cont.)

4. Open Pit Costs (Cont.)

10. Crushing and Screening

Last year this cost was higher on account of replacing the broken frame in the West 10" crusher.

21. Special Expense

This amount includes $3,241.24 spent on E. & A. 856 and $1400.10 for Pensions and Allowances.

Idle and Winter Expense

The increase of $.016 per ton is due to overhauling No. 46, 31 and 29 Shovels. For purposes of record the idle expense for the current year is listed below:

	Labor	Supplies	Total
January	$ 1,935.24	$ 2,882.69	$ 4,817.93
February	834.79	796.25	1,631.04
March	735.93	484.31	1,220.24
April	976.67	319.20	1,295.87
November	1,282.23	2,109.42	3,391.65
December	2,741.43	3,234.33	5,975.76
Total	$ 8,506.29	$ 9,826.20	$ 18,332.49

30. Taxes

This cost per ton is less in 1940 because of the increase in production.

Loading Stocked Ore

A cost of $72.80 was entailed in loading out 3,193 tons of ore from the stockpile. Charged against a production of 205,612 tons, the cost per ton of $.0003 is negligible but the actual cost of loading the 3,193 tons amounts to $.023 per ton.

9. EXPLORATIONS AND FUTURE EXPLORATIONS

Considerable prospect drilling was done in the North Half of the NE¼ of Section 27, 47-27 in an area roughly 1400 ft. by 600 ft., lying approximately 1500 feet West of the West Pit boundary. The drilling was done by two rigs a Cyclone and an Armstrong 29-T, using 6" bits. Because of the difficulties encountered in casing some of the holes, considerable doubt was thrown on the accuracy of the sampling. In several holes water was struck above or

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9. EXPLORATIONS AND FUTURE EXPLORATIONS (CONT.)

near the ledge contact, and with loose casing it was surmised that much sand from the overburden was washed into the hole by the action of the stem and brought up with the sludge as a sample of the hole. Inspection of the dried sludge samples through a petrographic binocular showed much sand contamination, particularly in Holes #4 and #12. The several holes giving this sampling difficulty were shallow holes, and the driving of additional casing was useless for the obvious reason that drilling would then be beyond the required sampling depths.

An estimate of the ore as revealed by Holes 1, 5, 12, 13 and 14 gives an approximate tonnage of 900,000, averaging close to West Pit grade of ore. The overburden on this body of ore is approximately 100,000 cu. yards. For the estimate of the tonnage of ore, a lower elevation of 1,430, which is the elevation of the Lower Bench West Pit is taken as the practicable bottom for extraction under the present set-up of Tilden Mine equipment.

The tables below give data pertinent to the prospect drilling in this area:

Hole No.	Southing	Westing	Elev. Collar	Ledge	Elev. Ledge	Depth	Elev. Bottom	Analyses Iron	Phos.	Sul.
1	21299	16639	1545	3	1542	117	1428	41.41	.036	.010
2	21126	17059	1597	19	1578	130	1467	34.92	.073	.009
3	21105	16466	1556	21	1535	59	1497	12.39	-	-
4	21200	16403	1537	28	1509	78	1459	8.31	-	-
5	21402	16999	1531	22	1509	101	1430	38.82	.032	.010
6	21400	16400	1522	25	1497	45	1477	26.30	.033	.010
7	21134	16639	1555	27	1528	80	1475	26.74	.049	.015
8	21249	17001	1564	14	1550	87	1477	35.50	.054	.009
9	21246	17421	1589	15	1574	144	1445	37.63	.061	.010
10	21307	17200	1555	10	1545	105	1450	29.90	.053	.009
11	21324	17400	1552	10	1542	93	1469	36.14	.070	.009
12	21588	16600	1478	16	1462	51	1427	23.98	-	-
13	21400	16800	1532	6	1526	127	1405	41.21	,034	.010
14	21577	17000	1478	9	1469	60	1418	37.83	.065	.009
15	21400	17200	1525	12	1513	102	1423	18.76	-	-
16	21440	17400	1507	26	1481	80	1427	29.52	.058	.012

Holes Nos. 14 and 16 were only partially drilled at the close of the year, but the complete depth and analyses are given here for the purpose of information although the total footage of these holes is not entered in the cost sheet.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS (CONT.)

The cost of the exploration work in Section 27 is given in the following table:

Labor.....	$2,384.29
Supplies....	562.12
Total.....	$2,946.41

Total Feet Drilled.....	1,326
Cost per Foot.....	$2.221
Shifts Worked.....	129
Feet per Shift.....	10.27
Number of Bits Used.....	343
Feet per Bit.....	3.86

Of the 129 shifts worked, 14 were spent in moving drills, which resulted in a somewhat higher cost per foot for this operation and in addition to the above costs, the following charges were incurred which were necessary on account of drilling over a large area:

	Labor	Supplies	Total
Power Lines for Drills....	$ 30.00	$ 137.87	$ 167.87
Drill Roads.....	143.78	98.67	242.45
Excavating with D-8 Tractor.....	12.00	42.52	54.52
Total Incidental Costs...	$ 185.78	$ 279.06	$ 464.84
Operating Churn Drills....	2,384.29	562.12	2,946.41
Total Drilling Cost....	$ 2,570.07	$ 841.18	$3,411.25

Two test churn drill holes were put down in the area adjacent to the East boundary of the West Pit. The first hole showed ore at 28' and the second at the elevation of the floor of the Upper Bench, but the overburden on this latter area is excessive.

Mention is made at this time of investigations carried out at the Mines Experiment Station of the University of Minnesota under the direction of Mr. E. W. Davis, to determine the economic feasibility of making a high grade concentrate of Tilden Mine siliceous ore. The results demonstrate that a high grade concentrate and sinter can be produced with a concentration ratio of four to one but the process is not an economic possibility at present. Mr. E. L. Derby, Jr., Geologist, in his report for the year 1940, gives full coverage to this investigation. The cost of this work is given under E. & A. 856.

	Amount Authorized	Expended
Expense of Laboratory Test.....	$3,500.00	$3,000.00
Freight and Miscellaneous.....	500.00	241.24
Totals.....	$4,000.00	$3,241.24

This was charged off to Special Expense in the December Cost Sheet.

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10. TAXES

Tilden Township Tilden Mine	1940 Valuation	 Taxes	1939 Valuation	 Taxes
N½ of Section 26, 47-27.....	$265,000	$4,347.91	$290,000	$6,128.02
Personal Supplies & Equipment....	65,000	1,066.47	75,000	1,584.83
Total.....	$330,000	$5,414.38	$365,000	$7,712.85
Collection Fees.....		54.14		77.13
Total Tilden Mine.....	$330,000	$5,468.52	$365,000	$7,789.98

11. PERSONAL INJURY

There were no lost time accidents at the Tilden Mine during 1940.

12. NEW CONSTRUCTION
AND PROPOSED
NEW CONSTRUCTION

The new construction during 1940 consisted of the clearing and grading of the stocking grounds adjacent on the south to the crusher pocket. This work was done by Company men and equipment under E. & A. CC-36 at the following expense:

	Amount Authorized	Amount Expended
Clearing.....	$ 700.00	$ 691.80
Grading.....	850.00	766.87
Alterations.....	510.00	619.36
Totals.....	$2,060.00	$ 2,078.03
10% for Contingencies.....	206.00	
Grand Total.....	$2,266.00	$ 2,078.03

This was charged out to Stocking Tilden Crushed Ore in December Cost Sheet.

The construction of the stocking grounds and the stocking of Tilden Silica and Low Phos. ore provided this past season, and is intended to provide in future operations, a more steady program of employment. Tilden operations have heretofore been irregular in intensity, being governed entirely by shipments. Further, the possession of quantities of ore stocked will relieve undue pressure on the small amount of equipment in contingencies.

13. EQUIPMENT
AND PROPOSED
NEW EQUIPMENT

a. Shovels and Crushers

The three electric shovels operated throughout the season with no major breakdowns. However, numerous mechanical repairs were necessary, the more important of which consisted of installing a spare dipper handle on No. 29; repairing the caterpillars and installing a new shipper shaft

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13. EQUIPMENT AND PROPOSED NEW EQUIPMENT (CONT.)

a. Shovels and Crushers (Cont.)

on No. 46 Shovel; and repairing the boom on No. 31. Following the close of the operating season, the winter program of overhauling and repairing the shovels was started. These items are set forth at the close of the report under repairs for December, 1940.

The crushing plant operated satisfactorily. New upper and lower mantles were installed in the West 10" crusher before the start of operations, and later a new set of concaves were put in. The other jobs of consequence done on the crushing plant, were the installation of a new curved rib-liner and new lower concaves on the 42" crusher.

b. Drills and Equipment

The 29-T rigs drilling 2,843 feet during the year, turned in a satisfactory performance. Only one mechanical repair of consequence was necessary, that being the re-lining of a friction disk clutch on the No. 6 rig in October.

c. Haulage Equipment

Having been overhauled in the General Shops before the operating season, the Cletrac tractor performed many and varied jobs with but few interruptions.

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

	Days	Labor	Supplies	Depreciation	Total
Hauling Ore from Lower Bench	78	$ 488.58	$ 307.01	$ 1,307.61	$2,103.20*
Hauling Rock	6	37.12	27.74	153.37	218.23
Track Expense	1½	9.00	5.40	46.05	60.45
L. S. & I. R.R. Co.	21½	129.00	156.63	327.13	612.76
Section 27 Drill Roads	7½	45.00	98.67	-	143.67
Sec. 27 Excavation	2	12.00	42.52	-	54.42
Exploration	1	6.66	5.19	20.16	32.01
General Open Pit Expense (Roads	3½	21.00	60.36	-	81.36
Stripping - East Side of East Pit	22	134.64	391.85	120.96	647.45
Stripping - North Side of East Pit	6½	39.00	112.87	140.66	292.53
Stockpile Grounds (E.& A. CC-36)	16	99.37	85.16	376.18	560.71
Grading " "	5½	34.32	73.18	100.48	207.98
Total Operating	171	$1,055.69	1,366.58	2,592.60	5,014.87
Tractor Maintenance	44	226.92	940.54		1,167.46
Total Operating and Maintenance	215	$1,282.61	$2,307.12	$2,592.60	$6,182.33

* - 44,870 tons at $.0468 per ton.

Maintenance includes two sets of track, the cost of which was $754.00; generator repairs and new radiator shell.

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13. EQUIPMENT AND PROPOSED NEW EQUIPMENT (CONT.)

c. Haulage Equipment (Cont.)

The yearly depreciation of $2,592.20 was charged out in five equal installments of $518.52 from May to September, inclusive.

It may be mentioned here that the bulk of 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, of necessity then is done under the unfavorable conditions of winter weather.

d. Proposed New Equipment

The difficulties encountered by the small Marion No. 480, 2 yard capacity shovel (No. 46) as discussed under paragraph 7g, give evidence to the fact that the efficiency of loading operations for 1941 will be seriously impaired, unless an additional shovel can be obtained to replace No. 46. It has been suggested by the Mechanical Department that a satisfactory type of shovel to fit the needs of the Tilden Mine is the Bucyrus-Erie No. 85-B.

Haulage from the Lower Bench-West Pit is now accomplished by the D-8 Tractor and Athey Crawler-Wagon. The purchase of this unit was made expressly for serving on the short haul on the inclined sinking cut. The present blasting face is 650 feet from the crushers and the shovel operating in that area this past season wasted considerable time waiting for the return of the haulage unit. It was planned at the time of purchase of the original unit to add to the haulage equipment as the Lower Bench progressed and it is evident that the operations on that bench have reached a stage where additional haulage service is necessary.

Moreover, the East Pit maximum height of face at present is 120 feet, which will steadily reach higher proportions as the bench advances towards the north and east. Considering the extremely blocky characteristics of the East Pit ore, the present height of face is not conducive to efficient operations. A shorter face would afford a more satisfactory cycle of operations. To cut the present face and begin a second bench would then necessitate haulage equipment to service the new bench.

It is believed that the installation of motor haulage, in the form of two heavy duty trucks of 17 or 18 ton capacity will be necessary to supplement our present system of transportation.

A further need at the property, of lesser magnitude than the above, but nevertheless of importance, is the installation of a new chunk hoist at the crusher. The hoist is used to turn over large chunks wedged up in the primary crusher. The present hoist, purchased in 1928 for the Maas Mine and subsequently transferred to the Tilden property, has not been giving satisfactory service. A delay at the crusher forces a delay on all the producing equipment in operation at the time, a condition which demands the elimination of faulty equipment at the crusher.

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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.

15. POWER

Electric power was entirely satisfactory during the year and has occasioned no 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 bull-dozer 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 nigh 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.....	10	5	15
Swedish.....	6	-	6
Finnish.....	9	4	13
Irish.....	4	-	4
Italian.....	1	-	1
French-Canadian.....	1	-	1
Total.....	31	9	40

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For purposes of record, the following remarks are included on the repair work during the month of December, 1940:

No. 31 Electric Shovel

Installed new bushing in swing gear and new key in slip clutch on boom. Repaired running boards on shovel and boom. Rivetted boom base and welded all breaks on boom. Installed two new rack pinions on boom. Repaired dipper with new wearing plates, bushings, pins and teeth and one new tooth base. Hard surfaced all wearing parts on dipper and bail with electric welder.

D-8 Tractor

Installed four new roller guards on tractor and two new corner ends on road-builder.

Cletrac Tractor

Installed new set of grousers.

Crushers

East 10" - Installed new upper and lower mantle, new set of concaves, and the spare rebabbitted eccentric.

West 10" - Inspected and replaced eccentric and removed motor for cleaning.

42" Crusher - Installed new bearings in drive shaft.

Pocket: - Repaired all pocket chutes.

Conveyor

Removed belts for winter and babbitted bearings on small pulley on belt tightener.

Locomotives

Installed new draw-head timber on rear end of No. 1 Locomotive and removed smoke stacksfrom Nos. 1, 2 and 4 locomotives.

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1. GENERAL:

The Athens Mine operated on a five day per week schedule throughout the year. This schedule went into effect in September 1939 and shortly afterwards a few men were hired and hoisting started on the third shift. In September 1940 it was decided to increase production and mining was started on the third shift. The third shift crew was increased again in November and December in an effort to bring production up to the capacity of the hoist. This had not been attained up to the end of the year due to crushing of raises and unfavorable mining conditions in the producing areas. The 4th level is being reopened for mining and as soon as production here is underway it is expected that sufficient ore will be available to keep the hoist at capacity on the schedule of three shifts per day, five days per week.

The product of 515,725 tons was the largest in the history of the mine and exceeded by 72,627 tons the next largest hoist of 443,098 tons in 1937. Shipments of 668,009 tons were larger by 37% than in any previous year. The two prior largest shipments were in 1929 and 1937 when 485,940 tons and 476,038 tons respectively were shipped.

The expense for timbering in 1940 exceeded the cost for stoping approximately 4% while in 1939 it exceeded the stoping cost by about 15%. There was less retimbering of the 6th level main drifts where the pressure had been excessive for the past three years but more repairs were required to raises which, in many areas, show no diminution of heavy pressure.

The safety record in 1940, until December, was good considering the increase in working time. Until this time there had been only one severe injury. On December 12th a miner sustained a basal fracture of the skull which caused his death on January 4th. The fatal accident was not due to carelessness or to violation of the safety rules but was a trade risk.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1940	1939	Increase
Athens Ore	344,524	243,256	101,268
Mitchell Lease Ore	171,201	161,621	9,580
Total Ore	515,725	404,877	110,848
Rock	11,782	11,348	434
Total Hoist	527,507	416,225	111,282

Production increased 110,848 tons and was the largest hoist in the life of the mine. It exceeded by 72,627 tons the previous largest made in 1937.

b. Shipments:

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Tons 1939
Athens Ore	187,069	178,090	365,159	330,788
Mitchell Lease Ore	89,561	213,289	302,850	126,551
Total	276,630	391,379	668,009	
Total Last Year	204,006	253,333	457,339	457,339
Increase	72,624	138,046	210,670	

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

b. Shipments: (Cont'd)

Shipments increased 46% in 1940 and were 152,284 tons more than the product for the year. They exceeded by 182,069 the largest previous shipment which was in 1929.

c. Stockpile Inventories:

Grade of Ore	Dec. 31, 1940	Dec. 31, 1939	Decrease
Athens Ore	33,551	53,971	20,420
Mitchell Lease Ore	18,145	149,794	131,649
Total	51,696	203,765	152,069

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:

	1940		1939	
	Tons	%	Tons	%
6th Level	194,948	37.8	185,037	45.7
7th Level	235,282	45.6	203,023	50.1
8th Level	668	.1	1,536	.4
9th Level	84,827	16.5	15,281	3.8
Total	515,725	100.0	404,877	100.0

The main increase in production occurred on 9th Level which increased 456% in 1940.

e. Production by Months:

The production by months was as follows:

Month	Athens	Mitchell	Total	Rock
January	28,335	15,560	43,895	1,544
February	25,975	15,845	41,820	1,056
March	27,164	15,096	42,260	1,188
April	25,015	16,636	41,651	1,829
May	29,655	16,666	46,331	1,660
June	29,112	14,267	43,379	1,085
July	29,778	13,943	43,721	1,340
August	29,320	10,918	40,238	300
September	29,982	9,508	39,490	415
October	31,293	15,577	46,870	305
November	29,850	14,070	43,920	490
December	27,974	13,115	41,089	570
Total	343,453	171,201	514,654	11,782
Current year stock-pile overrun	1,071		1,071	
Total 1939	243,256	161,621	404,877	11,348
Increase	100,197	9,580	109,777	434

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

f. Ore Statements

	Athens	Mitchell	Total	Total 1939
On hand Jan. 1, 1940	53,971	149,794	203,765	256,227
Product for Year	343,453	171,201	514,654	404,877
Prior years stock-pile overrun	215		215	
Current Year stock-pile overrun	1,071		1,071	
Total	398,710	320,995	719,705	661,104
Shipments	365,159	302,850	668,009	457,339
Balance on Hand	33,561	18,145	51,706	203,765
Increase in Output	101,268	9,580	109,777	
Decrease in Ore on Hand	20,410	131,649	152,059	

g. Delays:

On January 22 there was a 1¾ hr. delay on the midnight shift due to the valves on the I-R compressor sticking. There was no loss of product.

On April 26 the dirt hung up in the skip pit pocket at shaft and suddenly let go, running into the shaft breaking several runners and the chute at the bottom of the shaft. There was a two hour delay on the day shift and an 8 hour idle period on the afternoon shift while repairs were being made. A total of 850 tons product was lost during this 10 hour delay.

On May 20 and 21 the mine was idle both on the day and afternoon shifts, a total of 16 hours each day, due to the steel sets in the skip road being broken. No hoisting was done on either the day or afternoon shifts of each of these days but hoisting was resumed on the midnight shift on the second day. The resultant loss of product was 2000 tons on the 20th and 1500 tons on the 21st. The regular hoisting schedule was resumed again on the 22nd.

Broken piston rings on the I-R compressor caused a 1½ hour delay on Sept . 11th with a loss of product of 150 tons.

A new key, put on the skip hoist drum on Sunday, Oct. 20th, worked loose on Monday the 21st, causing a 3 hour delay and a loss in product of 245 tons.

On December 12th a broken door on one of the top tram cars caused a half hour delay. There was no loss of product as another top tram car was used for stocking while the car was repaired.

Summarizing the above shows a total loss of 4745 tons of product in 48 hours or the approximate equivalent of 2½ days hoisting.

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

h. Delays From Lack of Current:

There were no interruptions in the electric power service during 1940 and consequently no delays to hoisting due to lack of current.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1940				1939			
Grade	Tons	Iron	Phos.	Silica	Tons	Iron	Phos.	Silica
Athens	344,524	61.14	.124	6.29	243,256	61.08	.132	6.39
Mitchell	171,201	61.00	.122	6.24	161,621	61.20	.129	6.12

b. Average Analysis on Straight Cargoes:

	Mine			Lake Erie	
Grade	Iron	Phos	Silica	Iron	Moisture
Athens	All	Mixed		None	
Mitchell	"	"		"	

c. High Sulphur Ore:

No high sulphur ore was encountered in mining during 1940.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

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

	Athens Lots 1,7,10, 12	Mitchell Lots 8,9, & 11	Corbit Lot 13	Total Tons
4th Level and above	319,805	320,502	521,352	1,161,659
4th Level to 6th Level	626,702	909,041	11,626	1,547,369
6th Level to 7th Level	802,624	195,612		998,236
7th Level to 8th Level	586,641	9,588		596,229
8th Level to 9th Level	470,454			470,454
9th Level to 10th Level	423,922			423,922
Below 10th Level	60,784			60,784
Total Gross Tons	3,290,932	1,434,743	532,978	5,258,653
Less 10% Loss in Mining	329,093	143,474	53,298	525,865
	2,961,839	1,291,269	479,680	4,732,788
Less 10% Loss For Rock	296,184	129,127	47,968	473,279
	2,665,655	1,162,142	431,712	4,259,509
Less Dec.Production	27,974	13,115	0	41,089
Net Tons 1940	2,637,681	1,149,027	431,712	4,218,420
Net Tons 1939	2,864,316	1,254,974	431,712	4,551,002
Decrease	226,635	105,947		332,582

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

a. Developed Ore: (Cont'd)

For the second year the estimated ore on each level is reported in gross tons and 10% for loss in mining and 10% for rock is deducted from the total gross tons instead of being deducted from the gross tons on each level. The total estimated ore is 332,582 tons less than in the previous year. Deducting the decrease from the actual product shows that 183,143 tons were developed in 1940. The increase occurred in the ore area between the 6th and 7th levels due to the ore South of the dike extending further to the South and West than had been assumed in making previous estimates. This is also true of the ore area North of the fault dike between the 6th and 7th level where an irregularity in the North limit of the ore increased the size of the ore body on the -615' sub level, 25' below the 6th level.

b. Prospective Ore:

All ore in the mine is developed.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis:

Tons	Iron	Phos	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
4,218,420	53.11	.114	5.50	.392	2.75	.62	.73	.010	1.40	13.00

Ore in Stock:	Average Natural Analysis:									
Athens	33,559	53.02	.104	5.60	.44	2.30	.57	.61	.008	1.35	12.93
Mitchell	18,145	52.41	.104	5.98	.41	2.30	.57	.61	.009	1.35	13.02

5. LABOR AND WAGES:

a. Comments:

The average number of employees in 1940 was 357 as compared with 326 in 1939, an increase of 31. The number shown on the Labor Statement at end of year was 383 while in 1939 it was 339. During the year 55 men were hired, five employees left of their own accord, three were discharged, one died and four surface men from the steam shovel pit crew were temporarily laid off for the Winter. The men given the temporary lay off were physically unfit for underground work or else were unwilling to work in the mine. The local supply of unemployed skilled miners was exhausted in 1937 since which time men have had to be trained in the mine. It takes several years for a man to become a skilled miner capable of taking the lead in the contract. The men are well satisfied with the working schedule of 5 days per week as their earnings insure them a good living. Very few complaints were made to the Representatives of the Marquette Range Industrial Union during the year and all complaints were immediately adjusted without being referred to the Manager. The men are contented and glad to have a job in a Cleveland-Cliffs Iron Company Mine.

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5. LABOR AND WAGES: (Cont'd)

b. Comparative Statement of Wages and Product:

	1940	1939	Increase	Decrease
PRODUCT	515,725	404,877	110,848	
No. Shifts and Hours	1-8, 6	1-8, 5	1	
	2-8, 254	2-8, 240	14	
AVERAGE NO. OF MEN WORKING:				
Surface	64	59	5	
Underground	293	267	26	
Total	357	326	31	
AVERAGE WAGES PER DAY:				
Surface	5.51	5.51		
Underground	6.26	6.34		.08
Total	6.12	6.18		.06
AVERAGE WAGES PER MONTH:	Based on Mine Payroll Including Capt. & Clerks			
Surface	118.89	104.84	14.65	
Underground	127.00	110.93	16.07	
Total	125.55	109.72	15.83	
PRODUCT PER MAN PER DAY:				
Surface	31.13	30.20	.93	
Underground	7.23	7.22	.01	
Total	5.87	5.83	.04	
LABOR COST PER TON:				
Surface	.177	.182		.005
Underground	.866	.878		.012
Total	1.043	1.060		.017
AVERAGE PRODUCT MINING:				
Stoping	19.85	21.25		1.40
Developmen t in Ore	13.15	12.55	.60	
Total	19.78	21.03		1.25
AVERAGE WAGES CONTRACT LABOR:	6.96	7.21		.25
TOTAL NUMBER OF DAYS:				
Surface	16,574	13,405	3,169	
Underground	71,322	56,079	15,243	
Total	87,896	69,484	18,412	
AMOUNT FOR LABOR:				
Surface	91,310.08	73,799.05	17,511.03	
Underground	446,561.86	355,405.99	91,155.87	
Total	537,871.94	429,205.04	108,666.90	
AVERAGE WAGES PER MONTH AS PER LABOR STATEMENT LESS CAPTAIN AND CLERKS:				
Surface	116.86	101.24	15.62	
Underground	126.50	110.38	16.12	
Total	124.67	108.79	15.88	

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5. LABOR AND WAGES: (Cont'd)

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

Proportion of Surface to Underground Men:

1940 - 1 to 4.578

5, 2-8 hr. Shifts, 5 day and afternoon 1-1-40 - 12-31-40

1939 - 1 to 4.525

2-8-hr. shifts 5 day and afternoon shifts 1/1 to 6/12.
2-8-hr. shifts 4 day and afternoon shifts 6/12 to 9/11/.
2-8-hr. shifts 5 day and afternoon shifts 9/11 t o 12/31.

Crews worked on a staggered schedule and men received one shift less than the number of days the mine operated up to Sept. 11th.

c. Operating Schedules - 1940:

Month	Days Mine Worked Per Week	Days per Month	Days Men Worked Per Week	Avg. Shifts Worked Per Month By Each Man
January	5	22	5	22
February	5	21	5	21
Marc h	5	22	5	22
April	5	21	5	21
May	5	21	5	21
June	5	21	5	21
July	5	22	5	22
August	5	23	5	23
September	5	20	5	20
October	5	23	5	23
November	5	21	5	21
December	5	23	5	22

Average for Year Mine Operated 21.67

Average for Year Worked by Each Man 21.58

6. SURFACE:

a-1. Buildings:

In 1939 a section of the timber tunnel about 200 ft. in length extending from the concrete section near the shaft to the West towards the timber yard was repaired and painted. Repairs consisted of replacing the rotted members of the frame as well as sections of the sheet iron covering which had become badly rusted and deteriorated. Repairs to the remaining section of the tunnel were continued and completed in 1940.

About 75 ft. of sewer pipe was installed to drain the water away from the timber tunnel. In the Spring and after heavy rains during the Summ er, water proved to be quite troublesome as the grade of the tunnel floor carried the water to the shaft.

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6. SURFACE: (Cont'd)

a-1. Buildings: (Cont'd)

In 1940 the major repairs to mine buildings consisted of replacing the Engine house window casings and frames which had become rotted so badly that the rain and wind entered freely. At the end of the year only the large circular windows in the gables remained to be replaced.

The dry house sewers were flushed and the catch basins cleaned in September.

Remodeling of the dry house to provide all the men with lockers for street clothes in one end of the dry and hangers for underground clothes in the other was started in September and is covered by E & A No. AM-1. A part of this work was let on contract and consisted of the construction of a surface dry addition to the south wing, interior partition work for the new shower room, lamp room and combined fuse and check room. At the end of the year the unfinished work let on contract consisted of laying a new floor with drains in the shower room and the construction of a glazed tile wall lining in this room. The plumbing and rearrangement of the west end for a locker room and east end for underground clothes hangers will be done by company labor. A summary of the expenditures under E & A No. AM-1 is included under the title of new construction.

a-2. Docks, Trestles and Pockets:

Thirteen additional bents were added to the Southeast steel stocking trestle to provide more room for the stocking of Athens ore during the 1940-41 stocking season.

During the past few years the rock hoisted at the Athens Mine has been stocked by a side dumping car running on tracks laid directly on the rock pile. This method proved quite expensive as it required extensive blocking and much attention for a period of two months or more every Spring due to the thawing and settling of the pile. In October 1940 nine bents were erected to the South of the old pile which will provide sufficient stocking capacity for rock hoisted during the next year or more.

In 1938 and 1939 the idler sheaves for the skip ropes were replaced with rubber lined sheaves designed by Mr. O.D. McClure, Chief Mechanical Engineer (now retired). These were a great improvement over the old cast iron sheaves but were still somewhat objectionable due to their excessive weight (200 lbs. each). In 1940 these 200-lb. sheaves were replaced with light weight rubber lined roller bearing sheaves. Several types of roller bearing sheaves are being tried out to determine which is best suited to this installation.

The skip dump was repaired in May and July the work consisting mainly of replacing the worn out plates with new ones. New plates were also installed on the butterfly gate.

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6. SURFACE: (Cont'd)

b. Stockpiles:

Shipments from the stockpiles were concluded late in November and due to the large shipments during the year only a small amount of Mitchell and Athens ore was left on hand. At the end of the shipping season a small rill of Mitchell ore remained under the center wood trestle and the balance under the Northeast steel trestle where the wet ore was dumped during the shipping season. A small rill of Athens ore remained under the Southeast steel trestle plus some wet ore stocked during the year. In spite of the increased production schedule sufficient stocking capacity is available for both grades until the 1941 shipping season begins.

c. Timber Treating Plant:

During the past year there has been an appreciable extension of the cave to surface further to the East which has involved the timber treating plant and made it necessary to provide for removal of this plant to a new location. There is no available location at the Athens Mine and it was finally decided to move the plant to the Maas Mine where it will be erected in the Spring of 1941 and operated by Athens Mine employees. A nominal ground rental will be paid the Cleveland-Cliffs Iron Company for the ground occupied by the plant. During the year 1940 only a small amount of timber was treated and a considerable increase in output of the plant will be necessary in 1941. At the end of the year the derrick that handles the timber to and from the treatment tanks had been dismantled, with the exception of the mast, and part of the equipment had been trucked to the new site at the Maas Mine.

The following table gives comparative operating costs of the treating plant for three years:

	1940 Cost Per Ft.	1939 Cost Per Ft.	1938 Cost Per Ft.
Peeling	.0484	.0485	.0447
Treating	.0375	.0360	.0448
Decking	.0048	.0216*	.0047
Chromated Zinc Chloride	.0643**	.0298	.0140
Heat, Water, Etc.	.0138	.0138	.0133
Total	.1688	.1497	.1215
Maintenance Cost	.0232	.0116	.0088
Grand Total	.1920	.1613	.1303

*Charge for decking high due to moving timber away from caved area
**Charge for Chromated Zinc Chloride high due to cleaning tanks and making up new solution.

Year	No. of Pcs. Hardwood Stull Tbr. Treated	No. of Ft. Treated
1940	221	1989
1939	625	5641
Decrease	404	3652

	1940	1939	Inc.	Decr.
No. of Pcs. Used at Athens	209	656		447
No. of Pcs Shipped to Maas & Negaunee Mines & Gard.-Mack. - None	0	307		307
Total Pcs. Used and Shipped	209	963		754

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6. SURFACE: (Cont'd)

c. Timber Treating Plant: (Cont'd)

	Treated Tbr. On Hand 12/31/40	Peeled Untreated Tbr. On Hand 12/31/40
9 ft. Pcs.	160	None
8 ft. Pcs.	0	None
Total	160	None
On Hand 12/31/39	148	None
Increase		
Decrease	12	

d. Water Purchased for Heating, Cooling, Etc.

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

	1940		1939		1938	
	Gals	Amount	Gals	Amount	Gals.	Amount
1st Quarter	3,116,000	228.99	1,351,000	105.80	1,945,000	140.31
2nd. "	1,246,000	98.07	874,000	71.42	1,846,000	141.29
3rd. "	2,376,000	177.08	2,093,000	157.28	2,257,000	169.64
4th. "	2,414,000	179.44	3,461,000	252.92	1,981,000	149.63
Total	9,152,000	683.58	7,779,000	587.42	8,029,000	600.87
Product - Tons	515,725		404,877		268,050	
Cost per Ton	.001325		.001451		.002242	

Due to the increase in shifts worked in 1940 more water was used than in the two previous years.

e. Grounds:

The grounds around the mine buildings were kept in good condition during the year. The rainfall during the Summer made it unnecessary to use water on the lawn. Some pruning of the Lombardy Poplars was necessary due to damage to the branches by snow and ice.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1940.

b. Development:

The major portion of the development work in 1940 was confined to the 9th level. Several new raises were put up from the 7th level during the year and a rock drift from the end of No. 1 cross-cut advanced 119 ft. to the North to hole to a ventilation raise located back in the footwall. Late in the year the development of the 4th level for ore production was started and this will be rushed as rapidly as possible to provide additional working places for gangs which will soon have to be moved from the sub levels that are approaching the 6th level elevation.

b-1. Development in Rock:

A summary of the development in rock during 1940 follows:

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7. UNDERGROUND: (Cont'd)

b-1. Development in Rock: (Cont'd)

4th Level

To provide room for construction of a double track for handling timber trucks some rock stripping was required at the plat , also a small amount of stripping was done from the side of the main level haulage drift adjacent to the storage pockets to provide sufficient room at the car dumping station. A total of 87 ft. of stripping averaging 3 ft. to 4 ft. in width, was required.

During December a new cross-cut to the Southeast was started in the slate footwall. At the start of the curve some rock stripping was done for about 40 ft. The total equivalent rock drifting on the 4th level during the year was 53 ft.

-565' Sub

A total of 44 ft. of drift was advanced through dike during the progress of mining to enable recovery of the ore adjacent to the footwall in block 3, South of the fault dike.

6th Level

No development in rock was done on the 6th level during 1940.

7th Level

One hundred nineteen feet of drift was advanced in diorite formation to provide a ventilation connection from the end of No. 1 cross-cut to No. 808 ventilation raise.

8th Level

Upon completion of No. 941 raise from the 9th level a total of 278 ft. of drift was advanced in slate and dike to provide drainage for the large amount of water coming from the mining areas in block 8.

9th Level

The main level cross-cut to the Southeast was advanced 141 ft. in slate and completed in April.

A total of six additional raises were completed from the 9th level during the year, two of which were started late in 1939. Each of the raises were advanced through footwall material before encountering the ore.

No. 932 raise which was started last year was advanced 23 ft. in slate before encountering the ore.

No. 933 raise which was also started last year was advanced 86 ft. in slate before encountering the ore.

No. 935 raise advanced 95 ft. in slate and dike before encountering the ore.

No. 941 raise advanced 93 ft. in slate and dike to a total height of 103 ft. above the level - completed.

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7. UNDERGROUND: (Cont'd)

b-1. Development in Rock: (Cont'd)

No. 942 raise advanced 99 ft. in slate and jasper before encountering the ore.

No. 943 raise advanced 104 ft. in slate and jasper before encountering the ore.

There was a total of 141 ft. of rock drifting and 500 ft. of rock raising on the 9th level.

The following is a summary of the rock development footage for 1940:

	Drifting	Raising	Total
4th Level	53'		53'
-565' Sub	44'		44'
7th Level	119'		119'
8th Level	278'		278'
9th Level	141'	500'	641'
Total	635'	500'	1135'
Total 1939			807'
Increase			328'

b-2. Development in Ore:

Development in ore was considerably less than in the previous year. The development program on the 9th level was completed during the year and accounts for the major part of the ore development, the balance was confined to the 7th and 8th levels and also a small amount on the -615' sub.

-615' Sub

To provide a ventilation connection from this sub level to the 6th level, 14 ft. of raise was advanced.

7th Level

A branch drift from the side of No. 3 cross-cut was advanced 35' to provide tail track for an additional raise.

No. 735 raise advanced 103 ft. in ore to a height of 113 ft. above the level - completed.

No. 704 raise was started in November and had advanced 70' in ore by the end of the year.

There was a total of 35 ft. of ore drifting and 173 ft . of ore raising on the 7th Level.

8th Level

The remaining 16 ft. of drift in ore for a traveling and ventilation connection was completed in January. This drift which follows along the old main level drift that has been completely crushed also serves as a means of draining off a large amount of water coming from the area being mined in block 2.

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7. UNDERGROUND: (Con t'd)

b-2. Development in Ore: (Cont'd)

8th Level (Cont')

While advancing the drainage drift from No. 941 raise to the Southeast about 27 ft. of ore drift was driven to provide a connection to No. 942 raise.

9th Level

No. 932 raise which was started late in 1939 encountered the ore 46 ft. above the level and advanced 108 ft. in ore to a height of 146 ft. - completed.

No. 933 raise which also started late in 1939 encountered th e ore 103 ft. above the level and advanced 59 ft. in ore to a height of 162 ft. - completed.

No. 935 raise encountered the ore 105 ft. above the level and advanced 52 ft. in ore to a height of 157 ft . - completed.

No. 942 raise encountered the ore 109 ft. above the level and advanced 35 ft. in ore to a total height of 144 ft. - completed.

No. 943 raise encountered the ore 114 ft. above the level and advanced 31 ft. in ore to a heigh t of 145 ft. - completed.

The total development in ore on the 9th level was 285 ft. of raising.

The following is a summary of the development footag e in ore during 1940:

	Drifting	Raising	Total
-615' Sub		14'	14'
7th Level	35'	173'	208'
8th Level	43'		43'
9th Level		285'	285'
Total	78'	472'	550'
Total 1939			989'
Decrease			439'

c. Stopin g:

(1) General:

The product in 1940 was obtained from mining in blocks 2, 3, and the West half of block 4. These three blocks extend from East to West for a total distance of 720'. The width from North to South is variable due to the width of the orebody on each side of the fault dike being greatly influenced by the Southward dip of this dike and the Northward dip of the South footwall. The North limit of the Athens ore body is fairly constant as the large dike which forms the North boundary is almost vertical. Mining in the West half of block 4 is underway on both

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7. UNDERGROUND: (Cont'd)

c. Stoping: Cont'd)

(1) General: (Cont'd)

the North and South sides of the fault dike. The increased production made possible by the continuation of the five day per week schedule throughout the year has resulted in the mining of more sub levels than ever before in an equal period of time. The area being mined in block 4 directly South of the fault dike above the 6th level has reached a point so close to the level that in a relatively short time it will be necessary to temporarily stop mining in this area until the block further to the South near the footwall has reached a corresponding elevation. Mining in the small area North of the dike has reached an elevation about 90' above the 6th level and this area is decreasing in size due to the Westward pitch of the footwall which is advancing much more rapidly than the mining limit is receding. Consequently mining from 6th level raises will be abandoned here sooner than in the area adjacent to the South footwall and 7th level raises will be put up into this area. The South footwall area is also decreasing in size due to the encroachment of the footwall from the East and South but it is still relatively large. Mining here has been interrrupted frequently due to crushing of the three 6th level raises which reach this territory, and while repairs are being made in the chute compartments, mining must necessarily be temporarily stopped.

The main product was obtained from block 3 on the North and South sides of the fault dike. On the North side mining has now reached the third sub below the 6th level and on the South side has reached the elevation of the 6th level. All the ore mined in block 3 is now being handled on the 7th level, and due to these raises being only a little over 100' in length, much less trouble is experienced in maintenance and transferring the ore through them because the broken ore does not tend to hang up as it does in the long raises above the 6th level. Block 2 above the 9th level is being mined in three separate small areas, two of which are North of the fault dike and one South of the dike. Mining in the most Northerly area at the end of the year had reached the elevation of the 8th level. Further to the South is a wet area where mining has been carried on under extreme difficulties. In this area the ore is extending Westward under jasper hanging and mining is under way here directly beneath the cave to surface. This explains the large amount of water encountered here which enters the mining area through the break in the ledge near surface.

South of the fault dike between the dike and the South slate footwall a small ore body has been mined on one sub level. Due to the Southerly pitch of the fault dike and the advance of the footwall to the North, the ore area here is rapidly decreasing in size and with the decrease in size the water has become more concentrated. This has resulted in an extremely difficult mining condition. Although a water drainage raise was put up in this territory and pipe lines extensively used for drainage of water it has not been possible to mine dry ore. The soft character of the Athens ore and its tendency to run with water has made it very difficult to obtain anything approaching a normal production from this area.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

(1) General: (Cont'd)

Summarizing the above data shows that mining has been underway on 17 sub levels in 1940 as compared with 16 sub levels in the previous year. Mining has been underway in blocks 2, 3, and the West half of block 4 in a total of eight separate areas at different elevations compared with six separate areas being mined in 1939. The Athens ore body is not large enough for a production in excess of 300,000 tons per year except by mining at a number of various elevations in several blocks. This fact has made it imperative to open the 4th level where it is planned to develop and start mining two areas under the hanging. Mining in the Eastern area will be started at a much higher elevation than in the Western area above the 4th level, although the latter area will be developed first under the hanging which will be encountered less than 100' above the level. The Eastern area may extend 150 ft. above the 4th level and will be developed from a new 4th level cross-cut.

(2) Detail of Stoping:

The eight different areas mined in 1940 are reported separately as in previous years, starting with the highest area in the West half of block 4 above the 6th level.

South Side of Fault Dike - West Half of Block 4 - Ore Body on South Footwall

This area was opened for mining in 1935 at the elevation of the 4th level, 200 ft. vertically above the 6th level. At the end of 1939 mining was 80% completed on the -450' sub level 140 ft. above the 6th level. Upon completion of mining on this sub level, the 460' sub level was opened and mining completed. During the year this area was mined on 3 sub levels, and four contracts worked here until the middle of the year and then three contracts have worked here during the balance of the year. The noteworthy feature on this sub level was the further encroachment of the slate footwall from the South and on two-thirds of the East side which decreased the area by about 15%. Late in the year the -470' sub level was opened where mining was about 40% completed at the end of the year. There has been a further encroachment of the slate footwall, particularly from the East and this sub level will show a further decrease in area of at least 10% as compared with the sub above. The ore from this area can not be stored in the raises but must be dumped directly into motor cars. This interfers with production from this area which under normal conditions due to the character of the ore and the favorable length of slices would equal that of any other part of the mine. Every effort is being made to speed up mining in this area due to the difficulty of maintaining the raises and the 6th level haulage drifts.

North Side of Fault Dike - West Half of Block 4

(This area has been mined on 3 sub-levels during 1940 by 2 contracts.) Mining was underway on the -470' sub level the first half of the year where 20% of the ore had been mined in 1939. The ore on this sub level showed a decrease of about 15% as compared with the sub above and mining was completed early in 1940 and was then started on the -485' sub level. Mining was completed on this sub level in the latter part of the year and was then started on the -500' sub where approximately 40% of the ore had been mined at the

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

end of the year. The 500' sub level shows a decrease of about 20% in the ore area as compared with the sub level above due to the footwall pitching to the West at a flatter angle than the limit of mining of block 3 recedes to the West. Due to the loss of a direct connection from this area to the 4th level, ventilation is maintained by booster fans.

South Side of Fault Dike - West Half of Block 4
Ore Directly South of Fault Dike

The third area mined in the West half of block 4 during 1940 comprises a block directly South of the fault dike that is approximately 180 ft. square. In 1939 this area was being developed from four raises on the 530' sub and due to its proximity to the 6th level and the freedom from water, mining progressed at a rapid rate. During 1940 mining was also completed on the -540' sub level and approximately 25% of the -550' sub had been mined at the end of the year. Early in the year four contracts worked here but in order to slow up mining the number had been reduced to three at the end of the year. This area is worked on a two shift basis and when mining is completed on the -550' sub, places will be made available for these contracts in the new territory being opened above the 4th level.

Block 3 - South Side of Fault Dike - Ore Body Extending From South Footwall to the Fault Dike

Mining has been underway in this area on three sub levels during the year by nine contracts. The area being mined here is the largest of the eight areas from which the production during the year has been obtained. In 1939 mining on the -565' sub was about 33% completed at the end of the year with nine contracts working in this area. Mining was then started on the -575' sub where it had been completed at the end of the year except for two small pillars near the Eastern limit of the block. Two contracts were completing mining the remaining pillars here at the end of the year while the other seven contracts had moved to the next lower sub level which was opened at the elevation of the 6th level. Eight of the connecting drifts between the raises were being advanced late in the year and mining had started under the hanging adjacent to block 2. Mining on this sub level will be somewhat handicapped by the necessity of advancing slices through the old 6th level haulage drifts which are crushed and in which there is considerable amount of timber which must be removed as the slices cross them. The horse of jasper which persisted in this area for many sub levels disappeared on the -575' sub except for a very small area at the Southwest corner and it is expected that it will disappear entirely at the 6th level elevation. The ore will then extend to the mined area in block 2 where the hanging was encountered at the 6th level elevation. The 7th level raises in this area were laid out to give long slices for each contract and the fact that very little water is encountered here and good ventilation can be maintained favorable mining conditions

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

(2) Detail of Stoping: (Cont'd)

Block 3 - South Side of Fault Dike - Ore Body Extending From South Footwall to the Fault Dike (Cont'd)

have been experienced. As the mining in this area progresses below the 6th level however there will be a gradual decrease in the size of the ore area due to the advance of the South footwall to the North and the Southerly pitch of the fault dike consequently as this area is reduced contracts will be transferred above the 4th level where new mining areas will be made available.

North Side of Fault Dike - Block 3

Mining has been continued in this area during the year by four contracts until late in the year. This number was then reduced to three to provide more efficient operation for one contract in the East half of this block which has been reduced somewhat in area as compared with sub-levels above. Mining has been underway here on three sub levels.

At the end of 1939 mining was nearly completed on the -600' sub which is the first sub below the 6th level, and the -615' sub level had also been opened late in 1939 from the two raises above No. 1 cross-cut on the 7th level. Four contracts working in this territory where mining conditions are the most favorable in the entire mine, completed operations on this latter sub late in the year and then opened the -625' sub level. The number of gangs was then reduced to one in the East half above No. 1 cross-cut. Two contracts continue mining in the West half of this block where the ore area is considerably larger . At the end of the year mining at the East end was about 80% completed and at the West end about 25% completed. The ore area here maintains its size and as it approaches the 7th level shows an increase due to the Southerly pitch of the fault dike while the dike forming the North boundary maintains almost a vertical position.

Block 2 Above the 9th Level

Upon completion of four additional raises from the 9th Level footwall drift early in the year two contracts started mining on the -760' sub level, and about the middle of the year a third contract was transferred here. Two small pillars at this elevation North of the fault dike near the South footwall were all that were left when mining was abandoned in this area a number of years ago. When recovery of these pillars was underway a considerable amount of water was encountered along the Southern boundary of the ore and also adjacent to the jasper hanging. This area is almost directly below the cave to surface which unquestionably explains the source of the water encountered here. Upon completion of mining on this sub level late in the Summer, mining was started on the -770' sub level, and about 85% completed at the end of the year. On this sub level the ore area extended to the North to the area that had been mined several years ago above the 8th level and was much larger than on the first sub opened here. Water proved

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont 'd)

(2) Detail of Stoping: (Cont'd)

Block 3 - South Side of Fault Dike - Ore Body Extending From South Footwall to the Fault Dike (Cont'd)

a serious hindrance to production in this area and this condition will doubtless persist all the way down to the 9th Level, although this condition is alleviated somewhat by draining large amounts away through pipes in the old slices and raises.

Block 2 - Area Near North Footwall

Two contracts have continued mining in this area on two sub-levels during 1940. Mining was started here on the -780' sub level late in 1939 and was completed at this elevation early in 1940. The next sub level opened in this area was approximately at the elevation of the 8th level and at the end of the year 90% of the ore here had been mined. Some water is encountered here also but, it has been possible to control most of it by piping it to one of the raises. As this sub is approximately at the 8th level elevation some trouble has been experienced due to the timber encountered in the old 8th level drifts which are completely crushed. The area being mined here is the most favorable for production of any of the three areas that are being mined above the 9th level in block 2.

Block 2 - Area Near South Footwall

Mining of the small area near the South footwall was started on the -780' sub by one contract upon the completion of two raises into this ore-body during the year. This area is extremely wet and mining has progressed under great difficulty. The large amount of water coming into this relatively small ore area which is approximately 100' in length by 50' in width exceeds by far the amount encountered in other wet areas. Mining was completed on the -780' sub late in the year and opening of a new sub level at the 8th level elevation was underway at the end of December. This will be the last sub level in this area as the Northerly pitch of the slate footwall cuts off the ore body a short distance below the 8th level. The two raises from the 9th level to this ore body will be used for drainage purposes when mining is completed, as this water must be kept under control to prevent it from finding its way through the ground to the area being mined North of the fault dike.

The work done on the 9th and 7th levels during the year has been described under development in Ore and Rock.

d. Timbering:

The total cost for timber, lagging, poles and wire netting increased $120,435.81 or 26% and the cost per ton was practically the same as in 1939 due to the larger product in 1940. There was very little difference in the cost per ft. for stulls and cribbing timber. Slightly less timber was used per ton of ore, due to less timber used in repair of main level drifts. The cost per ton for timber decreased 5.4%, while the cost per

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

ton for 7' lagging and 9½' poles increased 7% and 5% respectively. More lagging was used per ton of ore also more Poles. Great care was taken to cover the floors of the sub levels especially in areas under new hanging to prevent runs of jasper.

The total cost for timbering was .445 per ton as compared with .481 in 1939 or a decrease of 7½%. If repairs to haulage drifts and raises could be eliminated the timbering cost would compare favorably with the other soft ore mines in the Negaunee district. Due to the heavy pressure larger timber is used at the Athens Mine which slightly increases the cost as compared with the Negaunee or Maas Mines. Timbering cost still exceeds the cost of stoping at the Athens Mine but provided the heavy pressure subsides somewhat in 1941 the cost for timbering will equal or be less than the stoping cost for the first time in many years. A larger product necessary influences the relationship of these two costs as repair costs are more or less constant irrespective of the product.

Statement of Timber Used:

Kind	Linnal Feet	Avg. Price Per Foot	Amount 1940	Amount 1939
6" to 8" Cribbing	103,633	.0379	3,930.77	4,326.93
8" to 10" Stulls	46,718	.0675	3,153.82	1,441.94
10" to 12" "	118,274	.0948	11,216.52	7,864.94
12" to 14" "	62,195	.1309	8,143.18	6,318.29
14" to 16" "	12,882	.1324	1,705.51	2,152.49
Treated Timber	1,881	.3546	666.96	1,813.00
Total 1940	345,583	.0833	28,816.76	
Total 1939	293,324	.0815		23,917.59
		Per 100'		
7' Lagging	1,378,268	.7793	10,741.56	7,853.23
9½' Poles	1,471,109	1.3301	19,568.09	14,568.94
Total 1940	2,849,377	1.0637	30,309.65	
Total 1939	2,037,441	1.1005		22,422.17
Wire Netting	8,085		463.25	814.07
Product			515,725	404,877
Ft. Timber per Ton of Ore			.6701	.7245
Ft. Lagging " " "			2.6725	2.4051
Ft. Poles " " "			2,8525	2.6271
Ft. Lagging per ft. of Timber			3.9882	3.3198
Cost per Ton for Timber			.0559	.0591
Cost per ton for Lagging			.0208	.0194
Cost per Ton for Poles			.0379	.0360
Cost per Ton for Wire Netting			.0009	.0019
Cost per Ton for Timber, Lagging, Poles & Netting			.1155	.1164
Equivalent of Stull Timber to Board Measure			722,146	556,379
Feet of Board Measure per Ton of Ore			1.4000	1.3741
Lin. Ft. of Netting per Ton of Ore			.0156	.0350
Sq. ft. of Netting per ton of Ore			.0653	.1460

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

Total Cost for Timber, Lagging, Poles, etc., and Cost per Ton:

Year	Amount	Cost per Ton
1940	59,589.66	.1155
1939	47,153.85	.1164
1938	35,920.27	.1340
1937	49,763.66	.1123
1936	35,719.77	.1149
1935	22,585.11	.1173
1934	19,546.06	.1201
1933	11,372.50	.2401
1932	11,794.89	.1541
1931	28,704.68	.1141

Repairing:

The high cost of timbering in this mine exceeding the cost of stoping warrants a detailed explanation which is included as part of the 1940 annual report.

The persistent heavy crushing of portions of the 6th level haulage drifts and raises has made it necessary to continue with a large repair program to eliminate interruptions to mining. The largest amount of repair work is confined to the haulage drifts in portions where extremely heavy back pressure either break the timber sets or the leg pieces are pushed into the floor and in time reduce the size of the drift so as to interfere with the haulage trains. As a result the back must be raised to provide room for installing regular 9' timber again. This work is laborious and consequently slow and only experienced timber men are employed at it. Very often the ground must be blasted to make room for the new timber which indicates that the ore surrounding the drifts that are crushing is not broken or fractured and movement takes places in large masses. Raises in these heavy areas are similarily subject to crushing. When repairs are required to the raises the mining contracts are temporarily taken off production. This has occurred numerous times during the year to contracts working in the areas above the 6th level. Repair work in the raises is of such nature that progress is also quite slow. Miners working in areas where repairs are frequently required in their respective raises become very proficient at this work and consequently the period for repairs is shorter.

No appreciable relief from crushing on the 6th level has occurred during 1940. It was anticipated that when mining in block 4 directly South of the fault dike extended under the jasper hanging some relief would result. This mining is now approaching the 6th level elevation and as mentioned in detail under stoping, mining in this area will be temporarily abandoned until the South footwall area reaches a corresponding elevation. This ore area will then be mined from the 7th level raises and maintenance of these drifts for tramming will also be abandoned. This will eliminate repair work here and consequently reduce the amount and cost of repair work. Due to larger product the cost for timber was lower in 1940.

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

Repairing: (Cont'd)

4th Level:

On several occasions during the year a repair crew worked here maintaining lining sets and replaced rotted timber sets in the portion of the main level drift which serves as an exhaust air way.

Subs Above the 6th Level:

Some repair work was required in the ventilation drifts on sub levels between the 4th and 6th levels. In the ventilation drift on the -500' sub lining sets were installed at frequent intervals and also on the -550'sub level. The raises which serve for ventilation required very little attention.

6th Level:

The major portion of the repair work as mentioned previously was confined to the 6th level. The portion of main level drift from No. 617 to 619 raises and at the switch between these raises required nearly constant repairing, also around the curve leading into No. 610 crosscut. Tramming operations must be maintained through this portion and it is the part of the 6th level where repair work was concentrated. Several times during the year it was necessary to completely retimber about 140' of the drift by raising the back 3' to 4' each time to provide room for 9' timbers. This required about two months time and after a relatively short period it was necessary to repeat the work again. In the East-West drift from No. 609 switch to No. 608 raise portions of the drift were retimbered by raising the back and numerous lining sets were also installed here. Incidently this drift is requiring more and more repair work to maintain it for haulage. No. 610 crosscut from No. 611 to No. 614 raises has also been retimbered several times during the year. It is in footwall formation which is very badly fractured and broken up. Close timbering is required and the work here has consisted mainly of installing lining sets and replacing broken legs and caps.

A large amount of repairs have been done in raises above the 6th level during the year. Both No. 618 and No. 619 raises have been completely recribbed a number of times as these are in the area of extremely heavy crushing. Mining from these two raises is approaching the 6th level elevation and due to the relative short length of these raises repairs do not require as much time. The three raises in No. 610 crosscut namely Nos. 614, 615, and 616 have also been recribbed for their entire length several times during the year. The work is not required so much from crushing but mainly due to the wearing out of the lining plank and the cribbing. All the ore transferred through these raises is scrapped directly into the motor cars, as the character of the Athens Mine ore is such that it can not be stored in long raises without causing trouble due to blocking. Nos. 607 and 608 raises have also been recribbed during the year. Mining from NO. 607 raise has been interrupted on two occasions while the chute compartment was recribbed and also No. 608 raise was recribbed once during the year for its entire length. In previous years no appreciable crushing of drifts and raises North of the fault dike was evident, but as mining has progressed to lower elevations more repair work has been required.

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

Repairing: (Cont'd)

7th Level:

Heavy crushing in the section of the main level ore drift around the curve into No. 4 crosscut made it necessary to retimber this section several times during the year. The back was raised to provide room for the timber and as on the 6th level the largest green timber available was used. No mining is carried on near the 7th level and the heavy pressure in the ore drift is caused by the swelling action of the ground surrounding the drift. Raises from the 7th level have not required as much repairs as the 6th level raises. The raises in No. 3 crosscut have required the most attention. No. 730 was recribbed once for its entire length due to the cribbing wearing out near the lower portion and crushing near the top at the 6th level elevation. Late in the year No. 732 raise was being recribbed. Large cribbing was used in this raise when it was put up in 1939. In areas under heavy pressure the results show that the raises last longer when extra large cribbing is used. A number of other raises were replanked and portions recribbed.

8th Level:

Repairs on this level consisted mainly of replacement of rotted timber sets in the drifts which serve as airways. Some of the treated timber on this level has been in service for over 10 years in ground where no crushing is present.

9th Level:

Due to heavy pressure it became necessary to close timber with lining sets a section of the main level ore drift Southwest of No. 906 raise.

e. Drifting and Raising:

The following statement gives comparative figures of drifting and raising footages for the years 1940 and 1939.

	Drifting			Raising			
Year	Ore	Rock	Total	Ore	Rock	Total	Grand Total
1940	78'	635'	713'	472'	500'	972'	1685'
1939	95'	598'	693'	894'	209'	1103'	1796
Increase		37'	20'		291'		
Decrease	17'			422'		131'	111'

Development work decreased in 1940. It was confined mainly to the 9th level with some work on the 7th and late in the year on the 4th level. Due to the heavy production schedule in 1940 and the increase planned for 1941, development work must be increased in 1941.

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7. UNDERGROUND: (Cont'd)

f. Explosives, Drilling and Blasting:

The cost per lb. for powder decreased 2.5% in 1940 while the lbs. of powder per ton of ore increased 2% resulting in a slight decrease one-half of one per cent in the cost per ton for powder. The cost per ton for fuse and caps was the same as in 1939. The cost per ton for all explosives was therefore approximately .5% lower than in 1939, .0533 as compared with .0535 in 1939.

Gelamite No. 1 was used exclusively for breaking ore during 1940. This explosive has been used since 1938, prior to which time Gelatin dynamite was in use. Gelamite No. 1 has 25 more sticks per 100 lb. and pound for pound has the strength of 60% Gelatin dynamite. Less drill holes are required to break a cut at the Athens Mine than at any other Company soft ore mine hence less powder is required. This is due to the ore being softer and easier to break which results in a lower cost for all explosives at this mine.

Statement of Explosives Used:

	Quantity	Average Price	Amount 1940	Amount 1939
60% Am. Gelatin, lbs.				26.00
No. 1 Gelamite	189,584	11.50	21,802.15	17,164.99
Total Powder 1940	189,584	11.50	21,802.15	
" " 1939	145,730	11.80		17,190.99
Fuse - Feet	791,300	5.05	3,992.47	3,052.50
Caps - Each	110,930	12.20	1,353.34	1,040.28
Electric Caps & Delays	825	11.06	91.27	167.48
Tamping Bags	21,000	2.00	42.00	42.00
Fuse Lighters	17,500	6.752	118.16	89.78
Master Fuse Lighters				10.18
Connecting Wire	80	.40	32.00	48.00
Shot Firing Cord- Feet	500	11.90	5.95	17.00
Cap Crimper	1	50.65	50.65	
Cap Seal - Pint	12	.60	7.20	
Total Fuse, etc.1940			5,693.04	
" " " 1939				4,467.22
Total All Explosives 1940			27,495.19	
" " " 1939				21,658.21
Product			515,725	404,877
Pounds Powder per Ton of Ore			.3676	.3599
Tons of Ore per lb. of Powder			2.720	2.778
Cost per Ton for Powder			.0423	.0425
Cost per Ton for Fuse, Caps, Etc.			.0110	.0110
Cost per Ton for All Explosives			.0533	.0535

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7. UNDERGROUND: (Cont'd)

f. Explosives, Drilling and Blasting: (Cont'd)

Statement of Explosives Used: (Cont'd) (Sinking, Rock Development, Etc.)

	Qauntity	Average Price	Amount 1940	Amount 1939
60% Am. Gelatin Powder	1,250	12.00	150.00	
No. 1 Gelamite "	5,666	11.50	651.60	487.69
Total Powder 1940	6,916	11.58	801.60	
" " 1939				487.69
Fuse - Feet	21,700	5.05	109.49	89.76
Caps - Each	3,070	12.20	37.46	30.88
Electric Caps & Delays	1,325	11.23	148.77	5.48
Shot Firing Cord	1,000	11.15	11.15	
Total Fuse, etc. 1940			306.87	
" " " 1939				126.12
Total All Explosives 1940			1,108.47	
" " " 1939				613.81
Total Explosives Used in Mine			28,603.66	22,272.02
Average Price per Pound for Powder			.1150	.1180

g. Mining and Loading:

Due to the large production scheduledfor the Athens Mine and the comparatively small lateral extension of the ore bodies it is necessary to maintain haulage on three levels, which will shortly be increased to four. At present haulage is underway on the 6th, 7th, and 9th levels and will shortly start on the 4th. This is not economical from a standpoint of tramming costs but there is no other way in which a product in excess of 500,000 tons can be obtained at this property. Within a year tramming can be abandoned on the 6th level with a resultant increase on the 7th level. This will be possible by the extension of new 7th level raises some distance above the 6th level to reach the area being mined in West half of block 4. Abandonment of haulage on the 6th level will result in a large decrease in the cost of maintenance of the 6th level haulage drifts which, however by propping and occasional repairs, will be kept open for ventilation.

There was no change in general mining practice in 1940. The layout of raises on the levels opened in recent years has been designed to give maximum economical scraping distances. The general average of these distances has shown a steady increase during the past several years as it has been found possible to mine ore economically at distances as great as 140 ft. from a raise. Due to the heavy pressure at the Athens Mine, raises have been laid out so that this long scraping distance exists on only one side of the raises that is in a radius of 180° rather than a complete radical slice which would cover 360°. It has been found in actual practice on a five day schedule that it is usually possible to mine the ore out before the timber at the raise has crushed. Crushing of timber near the raises on the sub levels has been reduced by building timber bulkheads in the completed slices a short distance away from the raise.

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7. UNDERGROUND: (Cont'd)

g. Mining and Loading: (Cont'd)

The excellent results obtained by using large sized cribbing at this property has resulted in an increase in the size of cribbing ordered for the mine from 6" to 8" size, to 8" to 10" in size. The only drawback to the very large cribbing, up to 12" or more, is that large size raises are necessary for installation of this large cribbing and where the ground is soft and tends to slab it introduces a hazard due to the large openings which must be carried. However, it is to be noted that the men engaged in this work have not suffered any injuries over the past several years as they have become very expert in installing head boards and props to hold the ground while installing cribbing and doing other work at the top of the raise.

h. Ventilation:

Considering the depth of the Athens Mine and the system of ventilation, viz., a fan located on the 10th or bottom level, taking air down through one compartment of the shaft and forcing it upward through the mine, then to surface through another shaft compartment. Ventilation has been better in 1940 than in any prior year. Ventilation raises have been maintained at full size and circulation has been materially helped by the large number of raises put up from the 9th to 8th and from 7th to 6th level. There is less restriction of air than formerly with the result that a larger volume reaches the area where mining is underway. By the installation of ventilation doors on the main levels it has been possible to force air to the areas above the 6th level through one raise and by covering intermediate raises, the air passes down at the other end of the area. In one area it h as been impossible to maintain ventilation outlets to levels above and here booster fans have been used. The cost for ventilation was a little higher than in 1939 due to the mine operating more days but the cost per ton was lower due to the larger product.

i. Pumping:

The following table gives data on pumping at the Athens and Breitung shafts:

Period	Avg. K.W.Per Day - Athens	K.W.Per Month Breitung Pump	Avg. Gals. Per Min.- Athens	Total Cost Both Mines From Athens Cost Sheet
Janu ary	3955	500	325	2289.89
February	3800	300	318	1998.34
March	3790	100	322	2080.25
April	3773	100	318	2178.54
May	3720	3100	340	2104.99
June	4493	1700	380	2624.06
July	5003	*	420	2648.42
August	4200	*	350	2585.93
September	4269	2000 (Est.)	369	2782.68 (1)
October	4470	1100	373	2751.39 (1)
November	3974	800	343	2167.42
December	4223	600	348	2368.37

*No charge for current for pump at Breitung shaft due to error in reading meter in May and June.
(1) Total pumping cost includes $247.80 for cleaning sump in September and $322.42 in October.

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7. UNDERGROUND: (Con t'd)

i. Pumping: (Cont'd)

Avg. 6 Mos.	Avg.K.W.Per Day - Athens	K.W. Per Month Breitung Pump	Avg. Gals. Per Min. - Athens	Total Cost Both Mines From Athens Cost Sheet
1935	3103	4366	265	2087.93
Avg. Year 1936	2949	3583	255.5	1766.08
" " 1937	3003	3283	257	1749.12
" " 1938	3767	3433	314	2350.42
" " 1939	3991	4391	331	2291.90
" " 1940	4141	858	351	2381.69

Average cost in 1934 prior to pumping at the Breitung	2611.79
Saving in 1935 when expense was heavy account of installing pump at Breitung.....	2600.59
Saving in 1936	10148.52
Saving in 1937	10352.04
Saving in 1938	3135.96
Saving in 1939	3838.65
Saving in 1940	2761.20
Total Saving in Six Years	32836.96

The water pumped at the Athens Mine in 1940 showed a further increase and has now reached a figure greater than in 1934 but slightly under the amount pumped in 1933 at the time of the cave to surface. It is difficult to account for the increase. It is true that the ground adjacent to the cave on surface is settling quite a long distance East of the cave. Whether this indicates a break beyond the original limits of the cave or represents more free channels for water flowing along the ledge with the possible washing out of material which in turn explains the settlement of the surface, which is approximately 6" at a distance of 500 ft. East of the cave is open to question. This seems, however a possible explanation as the breaking of the ledge to the East would produce a greater settlement than has occurred. It is also possible that the ledge has cracked Eastward from the original cave and that the increase in water finds its way into the mine through these cracks. The costs for pumping were higher in 1940 due to cleaning the main sump on the 10th level. Due to the water encountered in mining operations adjacent to the 8th level there has been much more mud or fine ore carried to the sump. When it is considered that over 700 cars of mud were removed from the sump in the cleaning operations and that only two years have elapsed since the sump had been cleaned, it can readily be seen how mining under wet conditions effects the deposit of material in the sump.. The increase in Athens mine water started in May and reached a maximum of 420 gal. per minute in July. It receded in August but gained in September and October finishing the year at a higher figure than in the previous year.

Pumping at the Breitung is influenced to a great extent by rainfall, primarily by the Spring break-up. There is always a very large increase at this time which lasts until the surface water is drained after which the amount of water is comparatively small. Due to the favorable load factor, the cost for current per kilowatt hour was lower than in 1939 and the larger production also decreased the cost per ton. The actual money expended however, was greater than in 1939 or 1938.

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7. UNDERGROUND: (Cont'd)

i. Pumpin g Cont'd)

The number of gallons pumped per minute at the Athens Mine in each month of the year for the past seven years is given in the following statement:

Month	1940	1939	1938	1937	1936	1935	1934
Januar y	325	297	266	244	242	367	318
Febr uary	318	282	273	239	244	361*	317
March	322	279	277	237	235	313	313
April	318	293	305	242	238	292	307
May	340	338	343	266	261	290	329
June	380	357	364	269	274	293	361
July	420	382	341	271	284	288	373
August	350	375	333	271	266	278	360
September	369	360	336	263	258	263	356
October	373	348	311	262	261	261	354
November	343	334	307	260	255	253	355
December	348	329	309	263	249	249	355

*Pumping started at the Breitung Shaft.

j. Shaft:

Expense for maintenance of the shaft was greater in 1940 due to more work in the shaft, repairing the steel sets in the circular portion. Due to the heavy production schedule it was deemed expedient to inspect the shaft twice each week to avoid accidents to the skip and skip roads which increased the labor expense. A section of the gunited division wall between the cage and skip road was disturbed by repairs to the steel sets, and this had to be repaired. New wire lath was required also application of gunite. The cage road is the downcast airway and the skip compartment the upcast for the air forced through the mine by the fan on the 10th level. A tight seal must be maintained between the downcast and upcast airways otherwise the air will short circuit.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1940	1939	Increase	Decrease
PRODUCT	515,725	404,877	110,848	
Underground Costs	1.313	1.356		.043
Surface Costs	.167	.173		.006
General Mine Expenses	.200	.227		.027
Cost of Production	1.680	1.756		.076
Taxes	.183	.243		.060
TOTAL COST	1.863	1.999		.136
No. of Days Operated	260	245	15	
No. of Shifts & Hours	6, 1-8 Hr.	5, 1-8 Hr.	1	
	254, 2-8 Hr.	240 2-8 Hr.	14	
Avg. Daily Product - Tons	1984	1653	331	

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8. COST OF OPERATING: (Cont'd)

a. Comparative Mining Costs: (Cont'd)
COST OF PRODUCTION:

	1940	%	1939	%	Increase	Decrease	
Labor	1.059	63.1	1.079	61.4	1.7%	.020	
Supplies	.621	36.9	.677	38.6		.056	1.7%
Total	1.680	100.0	1.756	100.0		.076	

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts Worked
1940	260	1&2 8 Hr.	357	87,896
1939	245	1&2 8 Hr.	326	69,484
Increase	15		31	18,412

(2) Wages:

There was no change in wages in 1940, the last increase was on March 16th. 1937.

(3) Comparison of Production:

Production - 1940	515,725 Tons
Production - 1939	404,877 Tons
Increase	110,848 Tons

(4) Comparison of Number of Men and Wages:

	No. Men	No. Days	Amount	Rate Per Day
1940	357	87,896	537,871.94	6.12
1939	326	69,484	429,205.04	6.18
Increase	31	18,412	108,666.90	
Decrease				.06

(5) Tons per Man per Day:

	1940	1939	Increase	Decrease
Surface	31.13	30.20	.93	
Underground	7.23	7.22	.01	
Total	5.87	5.83	.04	

(6) Cost of Production:

	Total	Cost Per Ton
1940	866,416.57	1.680
1939	710,994.03	1.756
Increase	155,422.54	
Decrease		.076

	Labor	%	Supplies	%
1940	546,290.43	63.1	320,126.14	36.9
1939	427,016.09	61.4	273,977.94	38.6
Increase	109,274.34	1.7	46,148.20	
Decrease				1.7

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8. COST OF OPERATING: (Cont 'd)

b. Detailed Cost Comparison: (Cont'd)

(7) Detail of Accounts:

	1940		1939		Inc. or Dec.	
Days Per Week	5		3, 4, & 5			
Shifts & Hours	1, & 2 8 Hr.		1, and 2 8Hr.			
Production - Tons	515,725		404,877		110,848	
Avg. Daily Product - Tons	1,984		1,653		331	
Number of Days Worked	260		245		15	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
UNDERGROUND COSTS:						
1. Exploring in Mine	228.62	.000	238.34	.001	9.72	.001
2. Sinking in Shaft						
3. Development in Rock	9613.07	.019	6853.00	.017	2760.07	.002
4. Development in Ore	2863.63	.006	5435.61	.013	2571.98	.007
5. Stoping	220240.02	.427	168349.53	.416	51890.49	.011
6. Timbering	229476.32	.445	194690.19	.481	34786.13	.036
7. Tramming	78339.27	.152	60287.36	.149	18051.91	.003
8. Ventilation	5559.13	.011	5069.65	.013	489.48	.002
9. Pumping	28580.28	.055	27502.83	.068	1077.45	.013
10. Compressors & Air Pipes	48363.98	.094	36500.71	.090	11863.27	.004
12. Underground Superintendence	18314.64	.035	14210.75	.035	4103.89	.000
14. Maint:Comp. and Power Drills	1199.51	.002	826.96.	.002	372.55	.000
15. Scrapers & Mech. Loaders	16330.58	.032	11822.45	.029	4508.13	.003
16. Elec. Tram Equipment	12442.79	.024	15564.74	.038	3121.95	.014
17. Pumping Machinery	5694.02	.011	1694.43	.004	3999.59	.007
Total Undg. Costs	677245.86	1.313	549046.55	1.356	128199.31	.043
SURFACE COSTS:						
18. Hoisting	40392.26	.078	32943.91	.081	7448.35	.003
19. Stocking Ore	9166.37	.018	6316.68	.016	2849.69	.002
20. Screening , Crush. at Mine						
21. Dry House	6793.33	.013	7071.89	.018	278.56	.005
22. General Surface Expense	6839.95	.013	6080.81	.015	759.14	.002
23. Maint: Hoisting Equipment	10079.15	.020	11184.94	.028	1105.79	.008
24. Shaft	4353.59	.009	2906.96	.007	1446.63	.002
25. Top Tram Equipment	2854.08	.006	1729.90	.004	1124.18	.002
26. Docks, Trestles & Pkts.	1671.46	.003	898.21	.002	773.25	.001
27. Mine Buildings	3680.24	.007	893.71	.002	2786.53	.005
Total Surface Costs	85830.43	.167	70027.01	.173	15803.42	.006
GENERAL MINE EXPENSES:						
28. Mining Engineering	3639.09	.007	2209.61	.006	1429.48	.001
29. Mech.& Elect. Engineering	1941.94	.004	2442.16	.006	500.22	.002
30. Analysis & Grading	13581.27	.026	11066.92	.027	2514.35	.001
31. Safety Department	2034.78	.004	1982.36	.005	52.42	.001
32. Telephone & Safety Devices	3425.64	.007	2756.20	.007	669.44	.000
33. Local & General Welfare						
34. Special Exp.,Pensions, Allow.	5714.27	.011	6175.47	.015	461.20	.004
35. Ishpeming Office	10600.44	.021	11724.39	.029	1123.95	.008
36. Mine Office	13312.89	.026	13345.12	.033	32.23	.007
37. Insurance	2930.82	.005	3295.92	.008	565.10	.003
38. Personal Injury	16190.80	.031	12991.05	.032	3199.75	.001
39. Social Security Taxes	23444.26	.045	18906.45	.047	4537.81	.002
40. Employees Vacation Pay	6707.11	.013	5024.82	.012	1682.29	.001
Total Gen. Mine Expenses	103523.31	.200	91920.47	.227	11602.84	.027
COST OF PRODUCTION	866599.60	1.680	710994.03	1.756	155605.57	.076
41.Taxes	94100.95	.183	98200.56	.243	4099.61	.060
Total Cost	960700.55	1.863	809194.59	1.999	151505.96	.136

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8. COST OF OPERATING: (Cont'd)

b. Detailed Cost Comparison: (Cont'd)

(7) Detail of Accounts: (Cont'd)

1. Exploring in Mine:

Covers a proportion of Geological Department expense. Expense charged to Athens Mine - decreased $9.72 and $.001 per ton.

3. Development in Rock:

Total feet of drifting and raising in rock 1234 ft. in 1940 as compared with 844 ft. in 1939. Increase in expense $2760.07 and in cost per ton .002.

4. Development in Ore:

There were 17 ft. less ore drifting and 486 ft. less raising in 1940. The decrease in expense was $2571.98 and in cost per ton $.007.

5. Stoping:

The increase in expense was $51,890.49 and in the cost per ton .001. Production increased 110,848 tons.

6. Timbering :

The increase in expense was $34,786.13 and the cost per ton decreased .036. The cost per ton for timber, lagging and poles decreased .0009.

7. Tramming:

There was an increase in production of 110,848 tons due to more days worked and hoisting ore on a third shift. The increase in expense was $18,051.91 and in cost per ton .003.

8. Ventilation:

The increase in expense was $489.48 and the cost per ton was .002 less. The increase in expense was due to more repairs to ventilation fans and motors. The electric power used was $65.24 less than in 1939.

9. Pumping:

Expense increased $1077.45 and cost per ton decreased .013.

Year	Total Gallons Pumped	Gallons Per Minute
1940	185,418,833	351
1939	173,774,003	331
Increase	11,644,830	20

The increase in expense was due to cleaning mud from main sump on 10th level. The cost for electric power was $425.88 less in 1940 due to a decrease in cost per K.W. on account of a more favorable load factor.

10. Compressors and Air Pipes:

Expenditures increased $11,863.27 and cost per ton .004.

Cu. Ft. of Air Compressed - 1940	1,196,505,000
Cu. ft. of Air Compressed - 1939	819,405,000
Increase	377,100,000