

MATHER MINE "B" SHAFT
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9. EXPLORATIONS AND
FUTURE EXPLORATIONS: (Cont'd)

The following table shows the drilling for the year.

<u>Holes Drilled From 6th Level To Explore 6th Level</u>	<u>Drilled From</u>	<u>Footage Drilled</u>	<u>Total Depth</u>
Hole Number: 2	408'	171'	579'
11	429'	20'	449'
19	148'	331'	479'
21	0'	202'	202'
22	0'	93'	93'
24	0'	124'	124'
26	0'	347'	347'
27	0'	135'	135'
28	0'	147'	147'
31	0'	143'	143'
32	0'	365'	365'
33	0'	235'	235'
41	0'	163'	163'
45	0'	274'	274'
49	0'	230'	230'
53	0'	259'	259'
56	0'	240'	240'
58	0'	300'	300'
59	0'	105'	105'
61	0'	203'	203'
64	0'	186'	186'
70	0'	375'	375'
<u>Holes Drilled From 6th Level To Explore 7th Level</u>			
23	0'	373'	373'
30	0'	303'	303'
34	0'	273'	273'
39	0'	235'	235'
43	0'	235'	235'
63	0'	220'	220'
68	0'	304'	304'
<u>Holes Drilled From 6th Level To Explore 5th Level</u>			
20	0'	422'	422'
25	0'	343'	343'
29	0'	313'	313'
35	0'	487'	487'

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<u>Holes Drilled From 6th Level To Explore 5th Level</u>	<u>Drilled From</u>	<u>Footage Drilled</u>	<u>Total Depth</u>
Hole Number: 36	0'	341'	341'
47	0'	335'	335'
51	0'	223'	223'
52	0'	472'	472'
55	0'	195'	195'
60	0'	191'	191'
65	0'	198'	198'
69	0'	108'	108'
<u>Holes Drilled From 7th Level To Explore 7th Level</u>			
44	0'	444'	444'
46	0'	375'	375'
50	0'	431'	431'
54	0'	428'	428'
57	0'	430'	430'
62	0'	417'	417'
67	0'	354'	354'
71	0'	292'	292'
<u>Holes Drilled From 7th Level To Explore 8th Level</u>			
72	0'	10'	10'

Holes No. 37, 38, 40, 42, 48 and 66 were drilled by Mather Mine "A" Shaft on Mather Mine "B" Shaft property to explore the area they are mining.

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10. TAXES:

	<u>1951</u>		<u>1950</u>	
	<u>VALUATION</u>	<u>TAXES</u>	<u>VALUATION</u>	<u>TAXES</u>
Mather Mine "B" Shaft, including Stockpile, Supplies & Equipment as placed by State Tax Commission:				
Real Estate	\$1,475,000	\$67,709.13	\$ 980,000	\$46,966.01
Personal Property	<u>460,000</u>	<u>21,116.07</u>	<u>215,000</u>	<u>10,303.77</u>
Total	\$1,935,000	\$88,825.20	\$1,195,000	\$57,269.78

	<u>1951</u>		
	<u>TAXES</u>	<u>PER TON PRODUCED</u>	<u>PER TON SHIPPED</u>
Total	\$88,825.20	\$0.186	\$0.225

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11. ACCIDENTS AND
PERSONAL INJURY:

There was one fatal injury and eighteen compensable injuries during the year. The eighteen compensable injuries occasioned lost time of 689 days. There were also thirty-five non-compensable injuries, which added 74 days lost time, for a grand total of 763 days. This resulted in a severity rate of 7.225 days lost per thousand man hours, and a frequency rate of 57.69 injuries per million man hours, compared with company averages for underground mines of 2.975 and 47.85. The total hours worked were 935,918½ as compared with 468,073 for 1950, an increase of approximately 99.9%. The following is a brief summary of the fatal accident:

On November 28, 1951, Robert Lerlie, a surface laborer, was fatally injured from falling into the sand batching hopper of the concrete mixing plant. Although there were no actual witnesses to the accident it is believed that Lerlie attempted to walk across the sand bin. Just before the accident, three 650 pound bucket-fulls of sand had been removed which is believed to have caused a large void in the bottom of the bin, and when Lerlie walked over it his weight caused the bridging effect to give way.

The following is a brief summary of the compensable accidents:

<u>DATE</u>	<u>NAME</u>	<u>NATURE OF INJURY</u>
1-8-51	Thomas Beltrame	Bruised right side and bump on right side of head.
2-15-51	John Ducoli	Bruises on hip, thigh and lower back. Dislocation of right hip joint.
3-5-51	Robert Johnson	Broken little finger on left hand.
3-5-51	John Fomish	Laceration of right index finger.
3-11-51	Walter Nourala	Injured left foot.
2-24-51	Alfred Plattenburg	Wrenched left hip.
5-19-51	John Kelly	Broken bone in thumb of left hand.
5-28-51	Keith Cain	Three broken ribs, dislocated collarbone.
7-13-51	Edward Peterson	Bruised right hip and thigh.
7-25-51	Raymond Kivela	Laceration left hand below little finger.
8-29-51	Axel Pelto	Contusions- nose, chest and right forearm.
8-31-51	Russell Kulju	Laceration palm of right hand.
9-11-51	Howard Setter	Fractured instep - right foot.
9-11-51	John Chetto	Sprained lower back.
10-17-51	Vincent Mingorie	Laceration thumb of left hand.
11-6-51	Erland Hill	Laceration of index and third finger.
12-19-51	Howard Setter	Laceration first joint, little finger left hand.
12-21-51	Douglas Quayle	Fractured bone in right leg between knee and ankle, bruised right knee and bruises on back of head.

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12. NEW CONSTRUCTION AND
PROPOSED NEW CONSTRUCTION:

The major items of new construction were the extension to the timber tunnels, expansion of timber yard facilities, erection of the east stockpiling conveyor, and grading, landscaping, and paving around the plant site.

New construction planned for 1952 includes erection of the west extension stockpile conveyor trestle, erection and installation of railroad loading pockets, construction of a private road between Mather "A" and Mather "B" for moving of heavy equipment and other miscellaneous small jobs to complete the surface plant.

13. EQUIPMENT AND
PROPOSED EQUIPMENT:

New items of equipment purchased for surface were:

- (1) A 120 B Electric Shovel at a cost of \$133,450.
- (2) A "Snogo" at a cost of \$9,990.48.
- (3) An RD-8 Tractor at a cost of \$22,767.39.

New equipment proposed for surface for 1952 includes purchase of a new 5 ton truck and equipment to be installed in the west extension stocking conveyor gallery and the railroad loading pockets.

New items of equipment purchased for underground included:

- (1) A Vulcan 125 H.P. hoist at a cost of \$9,675.80.
- (2) A Joy 125 H.P. hoist at a cost of \$10,215.
- (3) Two concrete placers and concrete forms, the total cost amounting to \$16,680.60.
- (4) Thirty Lo-hed cars with rollers at a total cost, including freight, of \$42,519.60.

Other items of equipment purchased for underground included several 25 H.P. Joy and Ingersoll-Rand hoists, several Holcomb scrapers, drill machines and other mining equipment.

Proposed new equipment for underground includes purchase of four 125 H.P. Joy scraper hoists. Three additional combination locomotives, several new lo-hed cars, additional all steel timber trucks and other miscellaneous drifting and mining equipment.

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14. MAINTENANCE
AND REPAIRS:

Maintenance and repairs were all of a minor nature such as: replacing of a few liner plates in the headframe pockets, etc.

The Regular Lay 6 x 19, 1 7/8" hoist rope used on the cage drum was replaced with a 6 x 27 type H Lang Lay flattened strand hoist rope. The Lang Lay flattened strand rope offers a smoother operation. The 6 x 19 Regular Lay rope did considerable scrubbing in wrapping the second layer. The 6 x 19 rope removed from the cage drum will be used as a spare for the counter weight drum for either Mather "A" or Mather "B" hoists.

15. POWER:

	<u>CONSUMPTION K.W. HOURS</u>	<u>AVERAGE MAX.DEMAND</u>	<u>AVERAGE DEM. FACTOR</u>	<u>COST OF CURRENT</u>	<u>AVERAGE PRICE PER K.W. HOUR</u>
1951 -	8,680,000	1,876 K.W.	52.8%	\$138,129.28	\$0.0159

16. WATER SUPPLY:

	<u>CONSUMPTION</u>	<u>COST</u>	<u>COST PER THOUSAND GAL.</u>
1951 -	22,144,000	\$1,562.81	\$0.0705

All of the City water consumed at the property was measured through the new water meter installed on the 8" water main leading into the property.

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18. NATIONALITY OF EMPLOYEES:

	<u>American Born</u>	<u>Per Cent</u>	<u>Foreign Born</u>	<u>Per Cent</u>	<u>Total</u>	<u>Per Cent</u>
English	75	14.8%	6	1.2%	81	16.0%
Finnish	167	32.6	20	3.9	187	36.5
Swedish	57	11.1	-	-	57	11.1
Norwegian	8	1.6	-	-	8	1.6
German	15	2.9	-	-	15	2.9
Irish	15	2.9	-	-	15	2.9
Danish	2	.4	-	-	2	.4
Italian	55	10.7	10	2.0	65	12.7
French	60	11.7	1	.2	61	11.9
Austrian	2	.4	-	-	2	.4
Polish	3	.6	-	-	3	.6
Belgian	5	1.0	-	-	5	1.0
Yugoslavian	1	.2	-	-	1	.2
Slavanian	1	.2	-	-	1	.2
Manx	-	-	1	.2	1	.2
Bohemian	1	.2	-	-	1	.2
Scotch	3	.6	-	-	3	.6
Serbia	1	.2	-	-	1	.2
Polish	1	.2	-	-	1	.2
Greek	-	-	1	.2	1	.2
	<u>472</u>	<u>92.3%</u>	<u>39</u>	<u>7.7%</u>	<u>511</u>	<u>100.00%</u>

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1. GENERAL:

During the first quarter of 1951 preparatory operations were continued in advance of shaft sinking. The repair to the old shaft was completed by Mid-February and this crew then assisted in dismantling the old headframe. The lower portion of the new headframe was erected in March to serve temporarily for sinking operations and late in March sinking was started.

MacDonald and Kaake Contractors continued erection of the engine house addition and at the same time our mechanical crew rushed assembly of the Kennedy Mine Hoist which was to be used for sinking. This work was completed late in March.

Plans for an addition to and remodeling of the old dry house were completed and in April a contract was awarded to Froksch Construction Company for this work.

2. LABOR AND WAGES:

The initial shaft sinking crew consisted of 24 men plus a shift boss on each of the three shifts. As the harder greywacke was encountered the drilling time increased and it was necessary to add three additional men to offset this increased drilling time. In addition to the sinking crew there were two men on a chain gang plus a leader and three men on the electrical crew. The electrical crew worked only part time in the shaft.

The following table gives additional information relative to labor and wages:

<u>Average Number of Men Working:</u>	<u>1951</u>	<u>1950</u>
Surface	54	11 $\frac{1}{2}$
Underground	34 $\frac{1}{2}$	6 $\frac{3}{4}$
Total	88 $\frac{1}{2}$	18 $\frac{1}{4}$
 <u>Average Wages Per Day:</u>		
Surface	12.94	12.43
Underground	21.31	12.49
Total	16.19	12.46
 <u>Total Number of Days:</u>		
Surface	15941	3128
Underground	10122	1831
Total	26063	4959
 <u>Amount For Labor:</u>		
Surface	206,387.40	38,893.76
Underground	215,729.14	22,863.66
Total	422,116.54	61,757.42

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2. LABOR AND WAGES: (CONT'D)

No. of Men 1-1-1951	- 51	<u>Additions Include:</u>	
Added During Year	56	New Hires	37
Total	<u>107</u>	Transfers	19
Separations	24	Mather "A"	7
Total	<u>83</u>	Mather "B"	3
Net Gain	32	Maas Mine	3
		Cliffs Shaft	2
		Gen. Storehouse	2
		Tilden Mine	1
		Athens Mine	1

3. SURFACE:

There was considerable activity on construction work particularly during the first half of 1951 when there was a rush to get the temporary headframe ready and also, to install the Kennedy Mine Hoist to meet our scheduled date for the start of shaft sinking. The steel for the lower half of the headframe was received in January and fabrication was done in the Ishpeming shops. By the middle of February this was completed and the steel erection crew with the assistance of our shaft repair crew dismantled the old headframe which was badly deteriorated and started erection of the lower portion of the new headframe which serves temporarily for sinking operations. This work was completed late in March and at the same time the assembly of the Kennedy Mine Hoist was completed enabling us to start sinking late in March month. The headframe was still an open structure with no enclosure of any kind and it was necessary to cover this portion and enclose the rotary dump before going into the following winter. This was done later in the summer and a suitable frame structure was built over the dump.

The assembly of the Kennedy Mine Hoist was continued during January, February and March concurrently with the construction of the new engine house addition by MacDonald and Kaake. There was some delay during this period when it was necessary to stop assembly while the contractors formed and poured the main floor slab around the hoist foundation. However, the contractor cooperated to the fullest extent and within a very few days this work was completed and we were able to continue our work. A temporary frame engine house, which had been pre-fabricated was assembled over the hoist and the electrical equipment was then installed and by the end of March the hoist was in operation.

The erection of the engine house addition was continued by MacDonald and Kaake. They completed the foundations, main floor slab and basement by the end of April and then there was a delay due to late steel deliveries for that portion of the building above ground level. This did not delay sinking operations however, because as mentioned previously we had constructed a temporary frame housing over the Kennedy Hoist and electrical equipment. By May month steel had arrived and the structure then progressed to completion in the month of September.

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3. SURFACE: (CONT'D)

Proksch Construction Company was awarded the contract for the addition to and remodeling of the dry house and work was started by the end of April. The addition is mainly improved quarters for supervisory personnel and also improved surface dry facilities. The old section underwent renovation and painting along with some other improvements such as baskets and chains in place of the old style lockers which were difficult to keep clean. This latter work was done mainly by our own surface crew. The construction work progressed very satisfactorily and by late September it was essentially complete.

The mine mechanical and surface crews started dismantling the two old hoists in the engine house as soon as sinking was started with the Kennedy Hoist. This is being done to make room for the old Republic Hoist which is to be used as a permanent skip hoist. The smaller parts were boxed, labeled and stored away in buildings at the mine. The electrical equipment was also placed under cover and the drums, bed plates, etc were stored outside. Following dismantling of the old hoists the surface crew started demolition and excavation of the old foundations. At this same time it became necessary to pour columns under the south wall of the old engine house for additional support as the original footings extended only a few feet below surface. This work was continued during the summer and in October the foundation was poured for the cage hoist. The Republic Hoist which was located at Mather Mine "B" Shaft was also dismantled by our crews and some of the larger parts sent to Lake Shore Engineering Company for repair. The main shaft was repaired and one new spider was made. This was completed late in the year and assembly was started in December.

There was considerable general surface work during the year keeping up with all incidentals connected with shaft sinking. All supplies were kept in readiness near the shaft collar where they would be easily accessible to the shaft crew. Temporary aggregate bins and a concrete mixer were housed in over the timber tunnel for underground concrete work.

4. UNDERGROUND:

a. Shaft Repair:

Repair of the old Negaunee Mine shaft was continued during the early part of the year. This shaft was 1400' below collar with the first 950' of concrete and steel construction, and the bottom 450' of timber construction. The steel sets which were badly rusted and of light weight and originally on 10' centers were removed in the skip compartment and replaced with heavier steel on 7' centers. New shaft guides were also installed in this section. The steel dividers in the ladder road section were not changed at this time but will eventually be done on week ends and vacation periods. In the timber section repair consisted mainly of replacement of wood sheathing and installation of new guides. Also, a new 6" air line was installed from the collar to 9th level replacing the old one which had numerous leaks due to corrosion. This work was completed by Mid-February and the crews then assisted on surface where the old headframe was removed and the lower portion of a new one erected to be used temporarily for sinking operations.

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4. UNDERGROUND: (CONT'D)

b. Shaft Sinking:

Shaft sinking was started late in March with small crews on a three shift basis. Getting started from the bottom of the old shaft was somewhat laborious and required considerable hard work during mucking for the first 40 or 50 feet as there was no room for the hydro-mucker unit to operate properly. With the benefit of three men who had experience with the hydro-mucker at Mather Mine "B" Shaft the crews were broken in to its use.

The first two months was a period of frustrated effort on the part of the sinking crews due to numerous delays caused by brake, rope and electrical difficulties with the Kennedy Hoist. Plans were immediately underway to replace the 800 H.P. A.C. Motor which came with the hoist with a 1500 H.P. D.C. Motor and Ward Leonard control. (This change was in the planning before but was not contemplated until the end of the shaft sinking period.) Toward the end of the month of May sinking was interrupted for 2 1/3 days while this change over to D.C. power was made. All of the preliminary work had been completed earlier in the month. During the following month it was necessary to make frequent electrical adjustments to the hoist and the hoisting operation was then greatly improved. There were also delays due to a rope condition which made it necessary on several occasions to respool the rope on the drum. The drum spools three full layers and at the start of sinking only 1 1/3 layers were actually used with the remainder of the rope length being dead wraps. A condition developed whereby small amounts of slack in the bottom layer of rope was accumulated into one or two turns of rope and these turns would then push up thru in a kink above the second wrap. It was felt that if a similar situation arose in the future sinking would be started with a shorter length of rope so that the dead wraps would include only those on the first layer of rope.

In general sinking operations were quite similar to Mather Mine "B" Shaft however, there was one advantage at Negaunee Shaft in that hoisting of rock was done in balance with a sinking skip and cage. This did not become of importance until a depth of 2000 feet was attained but from there on time checks indicated that the cage alone could not keep pace with the miners.

Starting with June month, following the electrical change to the hoist and deducting $\frac{1}{2}$ of the month of July while the Mine was on strike, the average monthly advance in shaft sinking was 153 feet. In addition to sinking, the preliminary plat development for 6th and 10th levels was completed. Adding an equivalent shaft footage of 55 feet for this work it increases the monthly average to 161 feet. The month of October was the best sinking month when a total of 201 feet was attained.

The material penetrated during the year consisted of hard slates and greywacke. The greywacke required a longer drilling period however, longer cuts could be attained due to its brittle nature as compared to the slates;

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4. UNDERGROUND: (CONT'D)

b. Shaft Sinking: (Cont'd)

The following table reviews the shaft sinking progress during the year.

Shaft Sinking Advance - 1951

Month	Shaft Advance	No. Cuts Blasted	Avg. Break per Cut	Pocket and Plat Advance (equiv. shaft ft.)	Total Advance	Advance per Working Day
April	62	12	5.16		62	2.66
May	114	21	5.43		114	4.89
June	126	23	5.48		126	5.64
July	104	20	5.20		104	5.89
August	176	28	6.28	6	182	6.74
September	124	20	6.20	24	148	6.08
October	201	28	7.18		201	7.44
November	126	19	6.63	25	151	6.55
December	137	22	6.23		137	6.32
Total	1170	193	6.06	55	1225	5.84

The following table gives a time analysis of the various operations in the shaft sinking cycle.

Month	Drilling Hrs. per cycle	Blasting Hrs.*	Mucking Hrs. per cycle	Placing Steel Hrs. per cycle	Misc. Hrs. per cycle**	Total Hrs. per cycle
April	5.2	2.9	23.0	8.8	2.2	42.1
May	2.9	2.1	13.0	5.5	0.8	24.3
June	2.9	2.2	11.6	4.6	1.3	22.6
July	2.7	2.5	9.9	4.2	1.2	20.5
August	3.6	2.0	11.6	3.7	1.0	21.9
September	3.5	2.3	12.1	5.1	2.3	25.3
October	3.3	2.2	12.2	3.1	1.6	22.4
November	3.9	2.3	13.3	4.2	1.2	24.9
December	2.9	2.3	12.3	4.3	1.2	23.0
Total	3.3	2.3	12.7	4.5	1.4	24.2

* The time represented in this column includes the time for charging the the holes, blasting and clearing smoke.

** Miscellaneous hours includes moving of pumps, tugger, pipes, etc.

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4. UNDERGROUND: (CONT'D)

b. Shaft Sinking: (Cont'd)

The following table gives additional information relative to shaft sinking.

Shaft Sinking Data

April 5 - December 31, 1951

Month	Cu. Yds.	Cu. Yds.	Bag	Steel Sets Placed		Total
	Rock Hoisted	Concrete Poured		Umbrella	Bearer	
April	1446	60	2	2	1	5
May	2348	36	7	9		16
June	2442	37	9	6	1	16
July	2002	17	12	3	1	16
August	3334	37	22	4		26
September	2642	28	11	6	1	18
October	3656	42	19	6	1	26
November	3058	26	11	8	1	20
December	2770	32	12	7	1	20
Total	23698	315	105	51	7	163

The general drilling practice during sinking was essentially standard in that a double V cut was drilled for the cut holes. There was one change of previous drilling practice in sinking in that intraset steel rods were used in place of detachable carbide tipped bits. The intraset steel has a carbide tip which is an integral part of the drill rod. The rods used were 7/8" quarter-octagon alloy steel with a starting bit of 1 7/16 inch gauge. This is somewhat smaller than generally used and it did increase the drilling speed which was of importance particularly in the hard greywacke.

Following is a statement of drill rod and bit costs during the period April to December 1951. This does not include drill machine maintenance costs which would add approximately 5 cents per foot of hole drilled raising the total for drills and machine maintenance to 24 cents per foot of hole drilled.

Intraset Drill Rod Cost

Holes drilled (to December 31, 1951) - 13128
 Feet drilled - 91843
 No. rods used - 753
 Cost of rods - \$16011.47
 Average Cost per rod - \$21.26
 Cost per foot drilled - 17.15 cents
 Total Advance (shaft, pockets, etc.) - 1225 ft.
 Cost per foot advance - \$12.85
 Feet drilled per rod - 122 ft.

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4. UNDERGROUND: (CONT'D)

b. Shaft Sinking: (Cont'd)

Rod dressing cost - Labor - \$760.45
Stores - 545.40

Total \$1305.85

Rod dressing cost per foot drilled - 1.42 cents
Total cost per foot drilled - 18.57 cents

The explosives used were mostly 80% gelatin with some 90% used in the bottom over a portion of the shaft length. Electric caps were used for detonating with the leads connected to an open fence placed on small posts around the bottom of the shaft. The following table indicates the quantity and costs of the various blasting supplies used in shaft sinking.

<u>Item</u>	<u>Quantity</u>	<u>Amount</u>
Bare Copper Wire	38.3 lbs.	21.07
Lead Wire	10,000 ft.	360.00
No. 14, 2 Cdr, red shot cord	600 ft.	23.52
Electric Blasting Caps	13,550	3,119.30
60% Gelatin Dynamite	1,500 lbs.	281.25
80% Gelatin Dynamite	42,700 lbs.	8,540.00
90% Gelatin Dynamite	6,850 lbs.	<u>1,609.75</u>
Total		\$13,954.89

c. Pumping:

Pumping from the shaft bottom was done with a Cameron air pump and a series of Ingersoll Rand electric motor pumps located in the ladder compartment. Steel tanks were installed at each pump serving as a small sump. Pumping from the shaft bottom gave very little trouble but it did require regular and frequent cleaning of the settling tanks..

The main pumping system of the mine continued to operate very well and the number of gallons per minute for each month for the past four years is indicated in the following statement.

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4. UNDERGROUND: (CONT'D)

c. Pumping: (Cont'd)

<u>Month</u>	<u>1951</u>	<u>1950</u>	<u>1949</u>	<u>1948</u>
January	1075	1090	776	787
February	966	1086	781	616
March	911	1063	771	764
April	933	1084	750	763
May	1031	1201	781	775
June	1015	1359	818	723
July	1097	1407	776	790
August	1168	1400	932	812
September	1198	1323	1034	764
October	1254	1162	1031	766
November	1307	1165	1046	753
December	<u>1285</u>	<u>1210</u>	<u>1068</u>	<u>773</u>
Total Average	1095	1212	880	757

The following statement shows the average number of gallons pumped per minute for the past ten years.

<u>Year</u>	<u>Gallons Per Minute</u>
1951	1095
1950	1212
1949	880
1948	757
1947	745
1946	682
1945	681
1944	713
1943	770
1942	656

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4. UNDERGROUND: (CONT'D)

d. Shaft Sinking Costs:

The detailed costs for sinking in December and for the year are given below. The shaft is complete with the exception of power and signal cables, and guides in the north skip compartment.

E & A CC-345 REHABILITATING NEGAUNEE SHAFT

E & A CC-345 Cost of Sinking Shaft For December 1951 and For Year 1951

J - Sinking Shaft	Labor	Supplies	Total	Total For Year	Cost Per Foot
a - Shaft Equipment	--	--	--	32097.19	27.46
b - Sinking Shaft					
137' Month (December)					
1169' Year	23853.02	10656.28	34509.30	280082.44	239.58
- Stocking Rock	989.35	351.27	1340.62	11177.95	9.56
- Temporary Air & Water Lines		102.82	102.82	6358.62	5.44
- Cleaning Steel	355.06		355.06	2505.78	2.14
c - Steel Sets, Sheathing & Guides		6349.21	6349.21	53576.96	45.82
d - Installing					
- Steel Sets	1471.74		1471.74	12830.87	10.98
- Sheathing	616.38	271.56	887.94	4603.91	3.94
- Ladders	40.88		40.88	78.58	.07
- Bearers				2843.32	2.43
- Runners	287.37		287.37	1782.28	1.52
e - Concreting					
- Concrete	953.52	1057.62	2011.14	18198.14	15.57
- Forms	425.89		425.89	4056.55	3.47
f - Ventilation Seal				1681.08	1.44
g - Discharge Line				197.49	.17
h - Counterweight Pipe					
- Pipe	83.52	656.00	739.52	6646.82	5.69
i - Air Lines	46.96	859.44	906.40	6799.66	5.82
j - Power Cables				474.68	.41
k - Signal Cables				219.12	.19
l - Permanent Water Lines	72.29	169.53	241.82	1848.17	1.58
Total For Month	29195.98	20473.73	49669.71		
Total For Year	247533.17	200526.44		448059.61	383.28

Total general expense charged to shaft sinking in year 1951 - \$97,501.25

166 steel sets installed during year.

Total cars of rock for month - 1375

Total cars of rock for year - 11734

Shaft - Inside Dimensions - 10' 10" x 15'

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5. TAXES:

Following is a statement of taxes for 1951 and 1950:

Description	1951		1950
	Valuation	Taxes	
E & A CC-345 Negaunee Shaft	200,000	9,090.00	Was under The Negaunee Mine Company.
That part of NW $\frac{1}{4}$ Sec. 5, 47-26			
E $\frac{1}{2}$ of NE $\frac{1}{4}$ of " 6, "			
SW $\frac{1}{4}$ of " 32, 48-26			
As described and assessed by Michigan State Tax Commission 235 acres.			
Personal Property, Stockpiles, Sup. & Equipment.	30,000	1,363.50	
Total		10,453.50	
Collection Fee		104.54	
Total Negaunee Mine	230,000	10,558.04	

6. ACCIDENTS AND PERSONAL INJURY:

The accident record for Negaunee Shaft compared favorably with other underground mines. The severity rating of 1.801 was well below the 2.975 average rating for underground mines. There were two compensable injuries during the year which was a commendable accomplishment on the part of the supervisors considering that they were working with inexperienced men, many never having been in a mine before.

7. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

a. Engine House Addition:

A new addition to the east side of the old main engine house was completed during the summer. This building measures approximately 50' x 80' and houses the skip hoist and electrical equipment as well as providing storage space in the basement. The total cost of the structure was approximately \$75,000.

b. Dry House Addition:

A new addition extending 63 feet south from the old surface dry and approximately 30 feet wide was built by Proksch Construction Company at a cost of approximately \$57,350 which includes some repairs to the old dry house. This addition provides dry facilities for all of the mine supervisors and engineers.

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7. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION: (CONT'D)

c. Headframe, Conveyors And Pocket Loading Station:

The lower portion of the permanent new headframe was erected early in the year. Plans have been completed and a contract let for the fabrication and erection of all of the headframe facilities including conveyor, pockets, etc. The pocket or railroad car loading station will be located approximately 300 feet east of the shaft collar and the ore will be elevated by means of a conveyor belt. For the winter operations or when ore must be stocked a second conveyor will elevate back to the headframe into pockets above the top tram cars. This structure is scheduled for completion in the fall of 1952.

8. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Headframe Equipment:

Included in the new headframe will be two pan feeders, a vibrating screen and jaw crusher. This equipment will be located on foundations on the ground and the ore will again be elevated for pocket loading or stocking, by means of conveyor belts. This plant is very similar to Mather Mine "B" Shaft's headframe and crushing plant except it is on a smaller scale.

b. Shop Equipment:

Late in the year orders were placed for new shop equipment. The old equipment is completely worn out and obsolete. All of the new equipment is independently powered and will not require the old pulley and belt system.

c. Drifting Equipment:

All of the necessary drifting equipment has been ordered for the development of the plats and main levels. The old haulage motors are in the process of repair as well as the cars.

d. Surface Equipment:

All of the surface equipment operated satisfactorily during the year. The Insley Crane purchased late in 1950 has been especially valuable in unloading heavy supplies.

During the year a new 15 ton Euclid truck was purchased to be used for rock disposal. This unit will also serve for emergency ore stocking in the event of a break down in the headframe flow sheet.

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9. POWER:

The following is a detail of electric current purchased in 1951.
The distribution of charges to various accounts and other data.

<u>Cost</u>		
Compressors	25708.43	
Hoisting	8907.69	
Pumping	40065.56	
Shops	335.75	
Change House	1750.74	
Mine Office	125.21	
Idle Expense	2100.05	
Outside Parties	<u>1772.00</u>	
 Total	 80765.43	
 Main Line Meter - K. W.	 5,083,200	
Separate Meter Readings - K. W.	4,576,148	
Line Loss - K. W.	507,052	
 Cost Per K. W. (Avg. for Year)		 .01765
15 Min. Demand (Avg. for Year)	1,093	

10. NATIONALITY OF EMPLOYEES:

The nationality record of employees is submitted in two forms, one as to parentage, the other as to country of birth:

<u>As to Parentage:</u>	<u>1951</u>	<u>Percent</u>
Finnish	36	43.3
English	15	18.0
Italian	9	11.0
Swedish	9	11.0
French	7	8.3
German	3	3.6
Austrian	2	2.4
Irish	1	1.2
Canadian-French	<u>1</u>	<u>1.2</u>
Total	83	100.0

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10. NATIONALITY OF EMPLOYEES: (CONT'D)

<u>As to Birth:</u>	<u>American Born</u>	<u>Foreign Born</u>
Finnish	32	4
English	12	3
Italian	8	1
Swedish	7	2
French	7	-
German	3	-
Austrian	1	1
Irish	1	-
Canadian-French	1	-
Total	72	11

SPIES-VIRGIL MINE
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1. GENERAL

The production was 237,589 tons and is the largest annual tonnage realized in the history of the mine. Shipments from the mine were slightly less than in the previous year, being 250,123 tons compared to 257,838 tons in 1950. The operating schedule was two eight hour shifts per day, six days per week from January 1st to February 1st. Effective February 1st, the operating schedule decreased to two eight hour shifts per day, five and one-half days per week. This schedule was maintained for the balance of the year. The one contract advancing the 8th level drift heading continued on a three shift per day, six day per week schedule. There was a substantial decrease in the production labor force due to the 8th level development program being charged to an E & A.

The drilling program was conducted throughout the year. One underground hole was drilled to the South of the orebody in an effort to explore the area where a surface hole showed a small run of ore. However, no ore was found in this hole. With the completion of this hole, drilling was initiated on the 4th level in the area Southwest of the present orebody in an effort to explore any Westward extent of ore along the South limit of the property. None of these holes proved up any ore. At the end of the year, a hole was being drilled in this same area from the 6th level elevation with no ore having been encountered. A badly deviating condition developed in all the holes which were drilled to the South resulting in high drilling cost and slow advance.

During the year, the plat and loading facilities on the 8th level were completed and the 8th level drift had been advanced to within 650' of the ore body. A considerable thickness of iron formation was encountered in the drift. This area required support and steel sets were installed. Due to the timbering, the advance was considerably less than had been anticipated with the result that production in the early part of the 1952 shipping season would be seriously effected, since the reserves above the 6th level will nearly be depleted.

The wages remained the same with the deferred adjustment of eight and one-half cents an hour being withheld awaiting the completion of the job evaluation program. There were six regular holidays observed during the year and a one week vacation was allowed employees during the week of July 1st at which time there was no production from the mine. There were two walkouts of three and one half days duration during the months of June and July.

As stopes above the 6th level were being mined, and the footwall and hanging-wall slates caved, there was a gradual increase in the amount of highly acid water requiring acid resisting pumping equipment.

Spies ore continued to be mined by the Pickands-Mather and Company through the James mine shaft in accordance with the operating agreement entered into on January 1, 1948, by the Cleveland-Cliffs Iron Company and the James Mining Company.

SPIES - VIRGIL MINE
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1. GENERAL (Continued)

The following table shows the ore produced, shipments, and ore on hand at the James mine:

<u>Year</u>	<u>Production Tons</u>	<u>Shipments Tons</u>	<u>Balance on Hand End of Year Tons</u>
1948	1,203	-	1,203
1949	3,776	4,411	568
1950	3,670	3,085	1,152
1951	29,997	27,604	3,546

2. PRODUCTION, SHIPMENTS, AND INVENTORIES

a. Production by Grades

	<u>1951</u>	<u>1950</u>
Spies	237,589	205,619

There was no high-sulphur grade produced and in the coming year, production again will be on the basis of one grade.

b. Shipments

The following table shows the shipments for the past five years:

<u>Year</u>	<u>Spies</u>
1951	250,123
1950	257,838
1949	88,453
1948	183,574
1947	151,670

There was a slight decrease in the shipments with most of the tonnage being shipped directly from the pocket. Of the shipments, 95,298 tons were shipped all-rail, 73,377 tons were shipped from the Escanaba docks as straight Spies grade, and 81,448 tons were shipped from the Escanaba docks as Cliffs Group.

c. Stockpile Inventories

<u>Grade</u>	<u>Tons</u>
Spies	34,990

There was a slight decrease in the inventory being 34,990 tons in 1951, compared to 47,524 tons in 1950.

d. Division of Product by Levels

4th Level	10,510
6th Level	227,079
Total	237,589

SPIES - VIRGIL MINE
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2. PRODUCTION, SHIPMENTS, AND INVENTORIES (Continued)

e. Production by Months

<u>Month</u>	<u>Days</u>	<u>Spies Grade Tons</u>	<u>Total Rock Tons</u>	<u>Tons Per Man Per Day</u>
January	26	21,470	192	7.98
February	22	18,415	1,304	7.82
March	24½	22,456	2,236	9.04
April	23	21,490	1,364	9.71
May	24	21,292	4,904	9.45
June	20	17,393	4,048	8.88
July	15	12,346	3,676	7.31
August	25	20,478	4,356	8.64
September	21½	20,982	2,300	9.80
October	25	26,342	1,640	11.29
November	23	18,902	3,032	8.51
December	19½	16,023	3,468	9.03
Total	268½	237,589	32,520	8.97

f. Ore Statement

	<u>Spies Grade</u>	<u>Total</u>	<u>Total Last Year</u>
On hand January 1, 1951	47,524	47,524	99,743
Output for year	237,589	237,589	205,619
Total	285,113	285,113	305,362
Shipments	250,123	250,123	257,838
Balance on Hand	34,990	34,990	47,524
Increase in Output		31,970	
Decrease in Shipments		7,715	
Decrease in ore on hand		12,534	

The operating schedule for the past five years follows:

1951 - Hoisting and mining operations: Two ~~eight~~ hour shifts per day six days per week January 1st to February 1st. Effective February 1st, two eight hour shifts per day five and one half days per week.

1950 - Hoisting and mining operations: Two eight hour shifts per day four days per week January 1st to May 15th. Schedule increased to five days per week effective May 15th, and later to six days per week effective Aug. 21.

SPIES - VIRGIL MINE
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2. PRODUCTION, SHIPMENTS, AND INVENTORIES (Continued)

f. Ore Statement (Continued)

Operating schedule for the past five years (continued):

1949 - Hoisting and mining operations: Two eight hour shifts per day, six days per week January 1st to June 27th. Schedule decreased to five days per week effective June 27th and later four days per week effective September 1st.

1948 - Hoisting and mining operations: Two eight hour shifts per day six days per week.

1947 - Hoisting and mining operations: Two eight hour shifts per day six days per week.

g. Delays

There were a number of minor delays to operations that were of no serious consequence but the two delays listed below were more serious in nature and caused some loss in production.

On November 17th there was a twelve hour delay when a bad leak developed in the discharge line in the shaft. This leak was caused by the corrosion of the old eight-inch iron pipe. There was a loss in production of 530 tons.

On December 27th there was a delay of sixteen hours due to ice in the shaft with an estimated loss in production of 700 tons.

3. ANALYSIS

a. Average Mine Analysis on output

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>
Spies	237,589	56.08	.245	9.35	.087

b. Analysis of Ore in Stock

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist</u>
Spies Dried	56.22	.218	9.28	.23	2.05	.15	.42	.106	7.04	
Spies Nat'l	51.05	.198	8.43	.21	1.86	.14	.38	.096	6.39	9.20

c. Analysis of Shipments

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist</u>
Spies	56.20	.247	9.12	.18	2.17	.13	.31	.078	6.90	9.17

d. High-Sulphur Ore

There was no high-sulphur grade produced.

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore

The following is an estimate of the reserves made as of December 31, 1951, using a factor of 12 cubic feet per ton:

	<u>Spies</u>	<u>Total</u>
Above 6th level	153,672	153,672
Between 6th and 8th levels	213,917	213,917
Total Gross as of Aug. 1, 1951	367,589	367,589
Less Aug. - Dec. 31, 1951 Production	102,727	102,727
Total Gross as of Dec. 31, 1951	264,862	264,862
Less 10% for mining and rock	34,711	34,711
Net Total as of Dec. 31, 1951	230,151	230,151

The reserves are considerably less than a year ago due to mining which occurred during the current year. The reserves included only ore that is available for mining and excluded is a substantial tonnage that must be left as pillars. The persistent narrow width of the deposit continues to be very disappointing from the standpoint of both reserves and mining.

A comparison of reserves with a year ago shows a net loss of 18,000 tons of mineable ore. This is due to outlining the ore limits more completely by the mining.

b. Estimated Analysis of Ore Reserves

	<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Spies Dried		56.50	.256	8.11	.23	2.67	.24	.21	.100	7.78	
Spies Nat'l		50.85	.230	7.30	.21	2.40	.22	.19	.090	7.00	10.00

5. LABOR AND WAGES

a. General

As in the past, employee membership in the Union has been 100%. However, contrary to past experience, friendly relations existed between the Company and Union which was demonstrated by only one formal grievance submitted in 1951, compared to six in 1950. This grievance was dropped in the second step after an explanation was given to the grievance committee. A 1950 grievance was brought into the arbitration step during the year at which time the arbiter ruled in favor of the Union.

There were 111 employees on the payroll compared with 113 employees a year ago. There were 14 separations, of which nine quit and five retired. Twelve new men were hired resulting in a net decrease of two men in 1951.

SPIES-VIRGIL MINE
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5. LABOR AND WAGES

b. Statement of Wages and Product

	<u>1951</u>	<u>1950</u>
Product	237,589	205,619
Number of Shifts and Hours	2-8	2-8
 <u>Average Number of Men Working</u>		
Surface	29½	35¼
Underground	70	78½
Total	<u>99½</u>	<u>113½</u>
 <u>Average Wages per Day</u>		
Surface	13.97	11.63
Underground	16.04	13.84
Total	<u>15.42</u>	<u>13.15</u>
 <u>Average per Month of 22 Days</u>		
Surface	307.34	255.86
Underground	352.88	304.48
Total	<u>339.24</u>	<u>289.30</u>
 <u>Average per Month of 24 Days</u>		
Surface	335.28	279.12
Underground	384.96	332.16
Total	<u>370.08</u>	<u>315.60</u>
 <u>Product per Man per Day</u>		
Surface	30.31	24.26
Underground	12.74	10.90
Total	<u>8.97</u>	<u>7.52</u>
 <u>Labor Cost per Ton</u>		
Surface	.461	.481
Underground	1.258	1.270
Total	<u>1.719</u>	<u>1.751</u>
Average Product Breaking and Trammig	55.16	47.31
Average Wages Contract Miners	17.84	16.45
 <u>Total Number of Days</u>		
Surface	7,839½	8,474¾
Underground	18,644½	18,871
Total	<u>26,484</u>	<u>27,345¾</u>
 <u>Amount of Labor</u>		
Surface	109,491.38	98,859.17
Underground	299,003.71	261,196.90
Total	<u>408,495.09</u>	<u>360,056.07</u>

Proportion of Surface to Underground Men

1951	1 to 2.37
1950	1. to 2.22
1949	1 to 2.76
1948	1 to 2.48
1947	1 to 2.35

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6. SURFACE

a. Buildings

Early in the year the interior of the addition to the office building was completed and the office was completely redecorated. An insulating sheeting was applied to the exterior of the office building greatly improving the appearance. Also at this time, minor repairs were made and paint applied to the surface buildings. To further improve the appearance, the area immediately surrounding the office building was landscaped. The interior and the equipment in the machine shop was cleaned and painted.

b. Stockpile

Shipments from the stockpile were made from the pile Northwest of the shaft. Exercising considerable care, it was again possible to remove the ore without dismantling the trestle. Consequently, a considerable savings was realized. The bulldozer was employed in spreading the pile and cleaning off the scattered ore at the end of the season.

7. UNDERGROUND

a. Shaft Sinking

There was no shaft sinking done in 1951.

b. Development

A large amount of stope development was driven and it was confined mostly to the two shrinkage stopes and the stope that was started on the South end of the orebody.

A six-foot by six-foot air raise was driven in rock from the 4th level to the bottom of the air shaft to replace the old raise in the orebody which had become inaccessible due to caving conditions.

Development for #7 and #10 shrinkage stopes has comprised driving short drift connections to the stope in the pillars for drill stations as mining progressed to completion.

Development for #11 stope at the South end of the orebody was completed. The area was divided into two stopes with the top stope extending from midway between 4th and 6th levels to the plus 1150' sub level above the 4th level.

Upon completion of mining in #8 stope a small scam stope was developed to recover the ore left between the transfer and the mill sub.

Two drilling stations were cut out on 4th level and one on 6th level. From these sites, several holes were drilled to the south in conjunction with the exploration program.

On 8th level, loading pockets and a storage trench were completed. The new skip-pit was also completed. Drifting towards the orebody on 8th level commenced early in the year, and at the end of the year the heading had been advanced to within 650' of the orebody.

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7. UNDERGROUND (Continued)

b. Development (Continued)

The following table shows the development footages:

	<u>Drifting</u>		<u>Raising</u>		<u>Slicing</u>		<u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	
Large	288'	110'	35'	176'	542'	68'	1219'
Medium			24'				24'
Small	2411'	197'	1726'	69'			4403'
Total	2699'	307'	1785'	245'	542'	68'	5946'

Development Footages Under E & A cc-390

Small Rock Drift	21'
Large Rock Drift	3267'
Slicing	121'

c. Stoping

The production was obtained primarily from stopes and ore development above the 6th level. The main source of production was from three sub level stopes and the two shrinkage stopes. Approximately 37% of the current year's product was obtained from the two shrinkage stopes.

During the year, mining was completed in #6, #8, and #9 stopes. As mining neared completion in each area, caving occurred and several underground fires started. As a result, these areas were completely sealed off.

Mining in the two shrinkage stopes was completed and as rapidly as possible, the broken ore remaining in the stopes is being recovered. Due to caving in these two areas, and the resulting fires, it has been necessary to seal off these areas as the ore is being removed. As of the end of the year, approximately 90% of the broken ore had been removed from the South shrinkage stope, and 65% from the North shrinkage stope.

At the end of the year, mining in the top half of #11 stope was nearing completion. Mining in the bottom portion had reached the point where it is possible to maintain a maximum daily rate of production.

d. Timbering

Only a small amount of wood stull timber was used in the production areas, being less than last year. However, steel timber sets were substituted for the wood timber in several transfer drifts, resulting in a higher overall timber cost. Due to several of the stopes being mined out during the year, resulting in excessive weight on the transfer drifts, it was necessary to install steel sets for additional support in these drifts.

Due to poor ground conditions encountered in the 8th level heading, a considerable amount of steel sets have had to be installed.

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7. UNDERGROUND (Continued)

d. Timbering (Continued)

The following is the comparative timber statement:

<u>Kind</u>	<u>Lineal Feet</u>	<u>Avg. Price Per Foot</u>	<u>Amount 1951</u>	<u>Amount 1950</u>
6" to 8" Cribbing				
8" to 10" Stull Timber	207	.1635	33.85	261.15
10" to 12" Stull Timber				57.10
Total Timber	207	.1635	33.85	318.25
Total Steel Sets	724	.7123	515.72	
Lagging	14,208	.0097	137.80	150.01
Poles	12,777	.0436	557.78	781.99
Total lagging and Poles			695.58	932.00
Product			237,589	205,619
Cost per ton for Timber			.00014	.0015
Cost per Ton for Steel Sets			.00217	
Cost per ton for Lagging			.00058	.0007
Cost per Ton for Poles			.00235	.0038
Cost per Ton for Timber, Sets, Lagging, and Poles			.00524	.0060
Cost of Timber, Sets, Lagging, and Poles			1245.15	1250.25

e. Explosives, Drilling, and Blasting

There was more powder consumed than last year due to an increase in the amount of ore produced and the secondary blasting, necessitated by the large chunks in the shrinkage stopes. Due to an increase in the price of powder, the cost per ton was slightly higher than last year. During the year, Gelex #1 powder, used in the development and sub level stoping methods, was replaced by Gelex #2 making possible a substantial saving in powder cost. Gelex #2 and a special gelatin are used in large size cartridges in the shrinkage method of mining.

Electric blasting is being continued in all work and the advantages this offers from a safety and ventilation standpoint warrants its continuance in preference to conventional fuse blasting. Mili-second electric caps were used in the open stopes and in the heavy charges in the shrinkage stopes. Favorable results were realized from the standpoint of fragmentation and concussion.

Tungsten carbide bits were used primarily in the mining and development. The relatively hard ground encountered in the work justifies continued use of this type of bit. Several tests were made with the one use type of bit. This bit, however, can only be used in the softer ore areas.

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7. UNDERGROUND (Continued)

e. Explosives, Drilling and Blasting (Continued)

The following is the comparative explosives statement:

<u>Ore Development and Stopping</u>	<u>Quantity</u>	<u>Average Price</u>		<u>Amount 1951</u>	<u>Amount 1950</u>
No. 1 Gelex	66,903	.1682	Lb.	11254.87	13246.32
No. 2 Gelex	49,720	.1676	Lb.	8333.12	1826.85
Hi-Vel 5 x 5					340.00
Duplex 40% Special Gel.	9,500	.1788	Lb.	1699.00	1512.50
Electric Caps - Regular Delays	34,238	21.461	C	7347.88	6147.63
Electric Caps - Mili-Second	6,675	23.521	C	1570.02	1266.92
Connecting Wire - Lbs.	578	.974	Lb.	563.11	1576.00
Connecting Wire #22 - Feet	99,606	.0039	Ft.	389.69	
Blasting Wire - Feet	500	.33	Ft.	16.50	
Blast Cord 182 - Feet	4,500	.167	Ft.	75.15	
Fuse - Feet	29,100	9.449	Ft.	274.97	68.19
Blasting Caps #6	5,400	1.559	C	84.18	19.64
Hot Wire Lighters	1,800	.90	C	16.20	5.85
Squibs					2.16
Powder Bags No. 1	1	5.35	Ea.	5.35	5.35
Powder Bags No. 2	45	2.139	Ea.	96.25	163.02
Primacord - Feet	14,000	33.89	M	474.50	416.00
Total Explosives				32200.79	26596.43
Production - Tons				237,589	205,619
Lbs. Powder per Ton of Ore				.5308	.5200
Cost per ton for Powder				.0896	.0750
Cost per ton for All Explosives				.1355	.1293
<u>Rock Development</u>					
No. 1 Gelex	987	.1675	Lb.	165.33	1503.70
No. 2 Gelex					21.81
Electric Caps - Regular Delays	190	21.34	C	40.56	839.54
Connecting Wire - Lbs.	50	1.00	Lb.	50.00	124.80
Connecting Wire No. 22 - Feet	1354	.0039	Ft.	5.30	
Powder Bags No. 1	1	2.15	Ea.	2.15	12.30
Fuse					23.34
Blasting Caps #6					1.47
Hot Wire Lighters					.45
Total Explosives				263.34	2527.41
<u>E & A Development</u>					
No. 1 Gelex	8,645	.1676	Lb.	1449.43	243.75
No. 2 Gelex	59,350	.1675	Lb.	9941.13	
Duplex 40% Special Gel.	2,750	.1859	Lb.	511.25	
Electric Caps - Regular Delays	12,967	21.41	C	2776.29	
Electric Caps - Mili-Second	11,775	21.55	C	2538.19	
Connecting Wire - Lbs.	506	.993	Lb.	502.49	
Connecting Wire #22 - Feet	38,940	.0039	Ft.	152.35	
Fuse - Feet	1,600	8.987	Ft.	14.38	4.59
Blasting Caps #6	700	1.541	C	10.79	.88
Powder Bags No. 1	4	2.10	Ea.	8.40	2.05
Total Explosives				17904.70	251.27
Total Expense All Explosives				50368.83	29375.11

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7. UNDERGROUND (Continued)

f. Ventilation

Good ventilation has been maintained in the mine by the Aerodyne fan at the collar of the ventilation shaft. The fan is delivering a volume of approximately 25,000 C.F.M. which has been adequate to ventilate the working places. A new air raise was driven from the 4th level to the bottom of the air shaft to replace the air raise that was left due to caving ground in an ore area.

Due to the fires that started in several stopes, after these stopes had caved into the footwall and hangingwall slates, it was necessary to completely seal off each stope area in order to smother the fires and insure adequate ventilation throughout the mine. Brattices were constructed of concrete and cement block in each stope opening. As soon as mining is completed in a stope area, the area is sealed off and cut out of the mine ventilation airways.

Auxiliary fans with 14" metal pipe extending to the breast have been used to provide ventilation for the 8th level drift heading. The exhaust air is discharged into the skip compartments of the shaft. In freezing weather the direction of the ventilating fan is reversed to exhaust up the hoisting shaft on weekends and reduce the formation of ice. This method supplements the oil burning heater that is operated during freezing weather to preheat the intake air.

8. COST OF OPERATING

a. Comparative Mining Costs

	<u>1951</u>	<u>1950</u>
Product	237,589	205,619
Underground Costs	2.046	2.186
Surface Costs	.344	.356
General Mine Expense	.530	.433
Cost of Production	<u>2.920</u>	<u>2.975</u>
Depreciation and Depletion	1.203	.912
Taxes	.092	.090
Loading and Shipping	.103	.127
Total Cost at Mine	<u>4.318</u>	<u>4.104</u>
Budget Estimated Cost at Mine	4.297	4.037
Number of Operating Days	268 $\frac{1}{2}$	240 $\frac{3}{4}$
Average Daily Product	885	897
Number of Shifts and Hours	2-8	2-8

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8. COST OF OPERATING (Continued)

b. Detailed Cost Comparison

	<u>1951</u>		<u>1950</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Cost</u>				
1. Exploring in Mine	342.94	.001	1,160.17	.006
2. Additional Wage Adjustment	20,687.03	.087		
3. Development in Rock	1,659.67	.007	14,004.35	.068
4. Development in Ore	58,441.59	.246	67,979.87	.331
5. Stopping	157,126.55	.661	124,791.40	.607
6. Timbering	13,406.35	.056	11,509.29	.056
7. Trammig	41,842.75	.176	43,524.67	.212
8. Ventilation	8,015.39	.033	2,334.83	.011
9. Pumping	42,912.66	.181	49,327.36	.240
10. Compressor and Air Pipes	21,033.02	.089	17,873.23	.087
11. Underground Superintendence	25,354.53	.107	22,805.49	.111
12. Compressor and Power Drills	3,432.17	.015	1,510.10	.007
13. Scrapers and Mech. Loaders	39,263.08	.165	28,861.18	.140
14. Trammig Equipment	24,646.36	.104	13,957.44	.068
15. Pumping Machinery	27,958.56	.118	49,757.63	.242
Total Underground Cost	<u>486,122.65</u>	<u>2.046</u>	<u>449,397.01</u>	<u>2.186</u>
<u>Surface Costs</u>				
16. Hoisting	24,183.46	.102	22,092.83	.107
17. Stocking Ore	9,008.15	.038	11,141.01	.054
18. Screening and Crushing at Mine	10,683.42	.045	7,788.78	.038
19. Dry House	6,858.49	.029	7,102.51	.035
20. General Surface Expense	13,686.16	.058	11,050.89	.054
21. Hoisting Equipment	8,307.04	.035	5,231.48	.025
22. Shaft	525.94	.002	1,937.56	.009
23. Top Tram Equipment	907.98	.003	991.27	.005
24. Docks, Trestles and Pockets	1,020.31	.004	101.48	.001
25. Mine Buildings	6,724.23	.028	5,900.28	.028
Total Surface Costs	<u>81,905.18</u>	<u>.344</u>	<u>73,338.09</u>	<u>.356</u>
<u>General Mine Expense</u>				
26. Additional Wage Adjustment			1,738.27	.009
27. Geological	1,178.45	.005	1,659.46	.008
28. Insurance	8,824.70	.037	9,566.29	.046
29. Mining Engineering	10,281.72	.043	8,068.65	.039
30. Mechanical and Elec. Engineering	2,039.20	.009	1,304.55	.006
31. Analysis and Grading	9,685.45	.041	7,608.89	.038
32. Personal Injury	8,642.55	.036	1,871.01	.009
33. Safety Department	2,709.64	.011	1,628.62	.008
34. Telephone and Safety Devices	1,903.30	.008	1,237.68	.006
35. Local and General Welfare	1,941.18	.008	1,683.68	.008
36. Special Expense, Pensions, Allow.	4,298.00	.018	3,936.11	.019
37. Ishpeming Office	13,710.63	.058	9,063.43	.044
38. Social Security Tax	11,705.27	.049	8,946.98	.043
39. Mine Office	26,705.20	.113	17,022.32	.083
40. Employees Vacation Pay	22,224.20	.094	13,620.00	.067
Total General Mine Expense	<u>125,849.49</u>	<u>.530</u>	<u>88,955.94</u>	<u>.433</u>
Cost of Production	693,877.32	2.920	611,691.04	2.975

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8. COST OF OPERATING (Continued)

b. Detailed Cost Comparison (Continued)

	<u>1951</u>		<u>1950</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
41. General Supplies	24,274.73	.102	31,258.99	.152
42. Iron and Steel	15,325.48	.065	13,244.14	.064
43. Oil and Grease	2,652.16	.011	3,158.59	.015
44. Machinery Supplies	38,901.18	.164	39,285.81	.191
45. Explosives	32,978.74	.139	31,278.58	.152
46. Lumber and Timber	4,149.41	.017	3,764.99	.018
47. Fuel	7,891.81	.033	6,711.74	.033
48. Electric Power	62,720.26	.264	53,554.79	.261
49. Other Items of Expense	15,245.48	.064	13,213.20	.064
Total per Cost Sheet	<u>204,139.25</u>	<u>.859</u>	<u>195,470.83</u>	<u>.950</u>

The following are explanations of operating costs that show significant variations compared with last year:

2. Additional Wage Adjustment

The deferred adjustment of 8½ cents an hour was being withheld awaiting the completion of the job-evaluation program.

3-4. Development in Rock and Ore

The large decrease in this expenditure is due to less development in rock and ore being done during the year, since most of the development was completed in the previous year.

5. Stoping

There was a slight increase in this expenditure due to a wage increase and scrambling a considerable tonnage of ore under more difficult mining conditions.

7. Tramming

There was a decrease in this expenditure due to better organization of the tramming system.

8. Ventilation

There was an increase in this expenditure due to fires which developed during the year, requiring brattice construction, and a ventilation connection which was completed from the 4th level to the bottom of the air shaft 300' above.

9. Pumping

There was a decrease in this expenditure due to the installation of automatically controlled pumps.

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8. COST OF OPERATING (Continued)

b. Detailed Cost Comparison (Continued)

12. Compressor and Power Drills

There was an increase in this expenditure due to an increase in maintenance on this equipment.

14. Tramming Equipment

There was an increase in this expenditure due to more repairs on tram cars.

15. Pumping Machinery

A large decrease in this expenditure is due to an installation of stainless-steel equipment, eliminating considerable maintenance which was required on the former type of machinery.

17. Stocking Ore

The smaller expense is due to the larger amount of all-rail shipments.

32. Personal Injury

There was an increase in this expenditure due to a greater number of loss time injuries.

37-40. Inclusive

There was an increase in these items due to an increase in wages.

41. General Supplies

There was an decrease in this expenditure due to less development work being done.

45. Explosives

The decrease was due to a larger tonnage being realized from the shrinkage stopes which required less explosives.

9. EXPLORATION AND FUTURE EXPLORATION

A drilling program was conducted throughout the year. One underground hole was drilled to the South of the ore body to explore an area where a small run of ore had been cut by a surface hole. No ore was encountered. Upon completion of this hole, a program was initiated to explore the area Southwest of the present orebody to determine any possible Westward extention of ore along the South limit of the property. Three holes were drilled from the 4th level and no ore was encountered. Considerable difficulty was experienced in all three holes due to a badly deviating condition which developed, necessitating the abandoning of the holes before the desired depth was reached. At the close of the year, a hole was being drilled in the same area from the 6th level where a similar condition developed. No ore has been found.

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9. EXPLORATION AND FUTURE EXPLORATION (Continued)

Due to iron formation which was crossed in the 8th level drift, it is planned to drill two holes, one horizontal and the other inclined below the level, to test the Northward extent of the formation. As soon as advancement of the 8th level drift permits, a program to explore the downward extension of the present orebody below 8th level will be initiated. It is planned to explore the area for a considerable depth below the level. The following are logs of drilling completed during 1951:

<u>D. D. H. No. 48</u>	
<u>6th Level - Dip 3° - S 7° W</u>	
0' - 120'	Hematitic Cherty Carb. Argilite
120' - 145'	Hematitic Cherty Iron Formation
145' - 150'	No Core
150' - 182'	Dark Gray Slate
182' - 317'	Gray Slate and Graywacke
317' - 333'	Dark Gray Slate
*333' - 566'	Cherty Carb. Argilite
566' - 590'	Cherty Carb. Argilite
590' - 830'	Cherty Carb. Argillaceous Iron Formation
830' - 986'	Cherty Carb. Iron Formation
986' - 1155'	Cherty Carb. Iron Formation
1155' - 1281'	Dark Gray Slate

* Drilled in 1951

<u>D. D. H. No. 54</u>	
<u>4th Level Dip $2^{\circ} 10'$ S $0^{\circ} 8'$ E</u>	
0' - 130'	Graywacke and Carb Gray Slate
130' - 300'	Interbedded Graywacke and Slate
330' - 400'	Gray and Dark Gray Slate
400' - 663'	Graywacke and Gray Slate
663' - 691'	Chert and Slate Breccia
691' - 862'	Argillaceous and Cherty Iron Formation
862' - 885'	Guage
885' - 945'	Graywacke and Cherty Carb Slate
945' - 1006'	Cherty Carb Iron Formation
1006' - 1050'	Cherty Argillaceous Carb Iron Formation

<u>D. D. H. No. 55</u>	
<u>4th Level Dip 2° Due South</u>	
0' - 22'	Slate
22' - 100'	Cherty Carb Iron Formation
100' - 389'	Argillaceous Cherty Carb Iron Formation

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9. EXPLORATION AND FUTURE EXPLORATION (Continued)

D. D. H. No. 55-A

4th Level Dip -7° -10' S 2° 15' E

0' - 92'	Cherty Carb Iron Formation
92' - 200'	Argillaceous Cherty Carb Iron Formation
200' - 215'	Gray Slate
215' - 240'	Argillaceous Cherty Carb Iron Formation
240' - 260'	Gray Slate
260' - 303'	Cherty Carb Iron Formation
303' - 331'	Argillaceous Cherty Carb Iron Formation
331' - 400'	Carb Argilite
400' - 599'	Argillaceous Cherty Carb Iron Formation

D. D. H. No. 56

4th Level Dip 0° -00' S 0° -07' W

0' - 296'	Cherty Carbonate Iron Formation
296' - 343'	Dark Gray Carbonate Argilite
343' - 351'	Cherty Carbonate Iron Formation
351' - 836'	Cherty Carbonate Iron Formation
836' - 1108'	Very Lean Carbonate Iron Formation
1108' - 1324'	Lean Cherty Argillaceous Iron Formation Slate

10. TAXES

There was an increase in the taxes due to an increase in the tax rate in the Village of Mineral Hills and a substantial increase in the valuation of the Spies-Johnson property. The following is a comparison of the taxes in the past two years in Iron County:

<u>Description</u>	<u>1951</u>		<u>1950</u>	
<u>Iron County</u>	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Iron River Township</u>				
<u>Spies Mine</u>				
NE $\frac{1}{4}$ of NW $\frac{1}{2}$ of Sec. 24, 43-35, 40A)				
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, " 40A)				
<u>Virgil Mine Lease No. 51</u>				
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35, 40A)	35,000	770.00	25,000	550.00
Per. Prop. Stkple. Supp. & Equip.	265,000	5,830.00	325,000	7,150.00
Total Spies Mine	300,000	6,600.00	350,000	7,700.00
W $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec. 27, 43-35. 80A)	700	15.40	700	15.40
Spies Dwellings and Mineral Lands	1,250	27.50	1,250	27.50
Total Iron River Township	301,950	6,642.90	351,950	7,742.90
Tax Rate		2.20		2.20

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10. TAXES (Continued)

Description	1951		1950	
	Valuation	Taxes	Valuation	Taxes
<u>Village of Mineral Hills</u>				
<u>Spies Mine</u>				
NE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35, 40A)				
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35, 40A)				
<u>Virgil Mine Lease No. 51</u>				
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35 40 A)	35,000	265.10	25,000	161.53
Per. Prop, Stkple, Supp, & Equip.	265,000	2,007.18	325,000	2,099.84
Total Spies Mine	300,000	2,272.28	350,000	2,261.37
Spies Dwellings	1,250	9.47	1,250	8.08
Total Village of Mineral Hills	301,250	2,281.75	351,250	2,269.45
Tax Rate		.75742764		.64610723
<u>City Of Iron River</u>				
<u>Spies-Johnson Fee</u>				
SE $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec. 24, 43-35, 40A	177,500	6,567.50	115,000	4,255.00
NE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 24, " 40A	177,500	6,567.50	115,000	4,255.00
<u>Mineral Lands</u>				
NE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35, 40A	2,000	74.00	2,000	74.00
NW $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec. 24, 43-35, 40A	1,600	59.20	1,600	59.20
NW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 24, 43-35, 40A				
NW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 24, 43-35, 40A	1,600	59.20	1,600	59.20
NE $\frac{1}{4}$ of SW $\frac{1}{4}$ of Sec. 24, 43-35, 25A	1,400	51.80	1,400	51.80
Mineral Lands	13,350	494.29	13,150	486.59
Collection Fees		138.74		92.53
Total City of Iron River		14,012.23		9,333.32
Paid in August, 1951		7,573.99		5,044.77
Paid in January, 1952		6,438.24		4,288.55
Total	374,950	14,012.23	249,750	9,333.32
Tax Rate				3.70

11. ACCIDENTS AND PERSONAL INJURY

The Accident frequency rate is slightly lower than last year, but the severity rate was higher. There were three compensable accidents compared with five in the previous year. There was a total of 33,645 man-hours worked and 199 days were lost on account of all injuries compared to 126 days in the previous year

	<u>Frequency Rate</u>	<u>Severity Rate</u>
1951	26.02	.739
1950	26.42	.565

Frequency Rate - Number of accidents per 1,000,000 man hours.

Severity Rate - Number of days lost per 1,000 man hours.

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11. ACCIDENTS AND PERSONAL INJURY

The following is a detailed description of the compensable accidents:

Accident No. 180, May 21, 1951, Nazzareno Paolini, Scrapperman. Paolini was trimming from the back and side of the transfer when a chunk hit him in the ankle. Bruised left ankle - time lost, 28 days.

Accident No. 181, September 28, 1951, Richard Hooper, Trackman. Hooper was pulling wire rope off the drum of a scraper-hoist when a steel sliver punctured his finger. Infected finger, time lost, 8 days.

Accident No. 182, December 20, 1951, John Swienty, Contract Miner. While Swienty was drilling in the breast of a transfer drift, a tugger was being moved in the drift. The wire rope used for moving tugger broke, striking Swienty in the leg. Compound fracture of the leg - time lost, 150 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

a. Surface

A concrete foundation was poured for a new sub-station which was installed by the Wisconsin-Michigan Power Company. Due to the crowded condition in the shop, a small addition was built, part of which was used for a storage room, and the remainder by the blacksmith shop. Because of the corrosive nature of the mine water, a concrete discharge line was poured from the headframe to the discharge ditch outside of the shaft house.

Construction of a large settling sump, immediately West of the present settling sump, is proposed but due to difficulty in obtaining the parcel of land it was not possible to begin construction. However, at the close of the year, efforts were being made to acquire the parcel. Immediately after these surface rights are obtained, it will be possible to construct the settling sump which will be capable of removing the solids from the mine water for a number of years. The Water Resources Commission of the State has for some time requested removal of the solids from the water prior to entering the Iron River.

b. Underground

A considerable number of concrete brattices were being built in order to smother the fires which developed in the ore area during the year. Due to caving, which took place in the mined out stopes, permitting the acid water from above the 4th level to reach the 6th level elevation, an extensive drainage project was initiated at the close of the year. With the completion of this program, it will be possible to intercept all the acid water on the 6th level before any damage is done to the haulage system and pumping equipment. In conjunction with this program, several concrete dams will be constructed and a pumphouse excavated. A small pump room was excavated on the 8th level plat permitting the installation of a pump operating under a flooded suction permitting an automatically controlled pumping system.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION (Continued)

b. Underground (Continued)

Loading facilities on the 8th level consisting of a plat, trench, and measuring pocket, were excavated and the trench and measuring pocket were lined with reenforced concrete and steel. To facilitate the removal of spillage from the measuring pocket, which accumulates at the bottom of the shaft, a raise was advanced from the shaft bottom to the 8th level and the necessary hoisting equipment was installed. Early in 1952, it is proposed to construct concrete dam in the 8th level drift capable of withstanding high water pressures. This dam is necessary in case of a large flood of water in the mine.

13. EQUIPMENT AND PROPOSED EQUIPMENT

A large amount of new pumping equipment and accessories was purchased and installed during the year. A second 500 G.P.M. stainless steel centrifugal pump was placed into service on the 4th level; a 500 G.P.M. stainless steel centrifugal pump was also installed on the 6th level at the shaft; and a 200 G.P.M. stainless steel centrifugal pump was installed on the 6th level adjacent to the ore area. To complete the 6th level pumping unit at the shaft, a booster pump with the necessary accessories has been ordered. Upon the installation of which the entire pumping system will be automatically controlled.

In conjunction with the acid resistant pump on 6th level, six-inch acid resistant rubber lined pipe was installed from the 4th level to the 6th level, connecting with the previously installed six-inch line from the 4th level to surface. A 250 G.P.M. pump, complete with four-inch rubber lined discharge, was installed in the new pump room on the 8th level. This unit is designed to automatically pump the water from the 8th level to the 6th level. On order is a 225 G.P.M. stainless steel pump for installation in the 6th level drainage project.

During the year, a new model 40 Elmco Loader and drill jumbo was purchased which is used in advancing the 8th level drift heading. Only a small amount of new equipment was acquired for the stoping operations.

The following is a list of the larger items of equipment added to the inventory:

<u>Item</u>	<u>Number</u>	<u>Cost</u>
Electric Scraper Hoist 25 MM 3C	1	3870.00
Utility Air Hoist BU SD	1	475.00
Utility Air Hoist H5 NN DD	1	1670.00
Tugit Hoist - Two ton - 240C	2	151.18
Drill Machines, Paving Breaker Thor 23	1	320.00
Drill Machines, J-50 Ingersoll-Rand	3	1095.00
Sump Pump, Size 35 Ingersoll-Rand	1	462.00
Centrifugal Pump, 2X3X11L Byron-Jackson	1	1031.88
Rotating Pump Element, Byron Jackson SS	1	1904.66
Rubber lined pipe and fittings 6"	440'	3496.72
Rubber lined pipe 4"	630'	3789.16
Tram Cars (Used) 75 cu ft Lo Hed	5	1750.00
Welding Machine OBLW 250 V	1	200.00
Grinder, Drill Steel Cutter No. 500	1	357.47
Air Grinder, Portable Size two G	1	165.00
Impact Wrench, Size 5/4, 1"	1	315.00
Blacksmith Vice, 8" Jaw	1	147.10
Unit Heaters No. 160	2	120.73

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13. EQUIPMENT AND PROPOSED EQUIPMENT (Continued)

New Equipment Charged to E & A cc-390

<u>Item</u>	<u>Number</u>	<u>Cost</u>
Eimco Air Loader Model 40	1	12,625.69
Jumbo Mine Rig DJTA-3	1	8,350.00
Drill Machines, Drifters T-350	4	2,220.00
Utility Air Hoist H5 UL	1	1,036.00
Fan, Jeffrey Aerodyne Midget Blower	1	348.12
Steel Track with Bars and Bolts 60 pound	3200'	7,360.16
Trolley Wire 4/0	3200'	1,426.24

New Equipment Charged to E & A cc-423

Centrifugal Pump, Stainless Steel BJ	1	5,833.92
Motor, 200 HP for Above Pump	1	2,876.64
Starter, 200 HP Above Pump	1	728.74
Rubber Lined Pipe, Six-inch	513'	5,261.78

New Equipment Charged to E & A cc-389

Pump, Stainless Steel BJ 150 HP	1	3,378.06
Motor, 150 HP for Above Pump	1	1,891.50

14. MAINTENANCE AND REPAIRS

a. Mine

Maintenance and repairs to pumps and pumping equipment was less due to the installation of acid resistant pumps and discharge lines throughout the mine. Considerable maintenance and repairs to the haulage system was necessary. The corrosive nature of the water required continual track replacement and repair. Repairs to tram cars were above normal principally because of wear due to the length of time that they have been in service. Maintenance on other underground equipment was normal.

Shaft repairs consisted of occasional replacement of worn runners, dividers, casing plank and repairs to the ladderway. A reconditioned cage was placed in operation replacing one that required a general overhaul.

b. Surface

In the headframe some minor repairs to the grizzly and pockets were made and a loading pocket chute was replaced. A new wearing ring was installed in the crusher. Late in the year, a larrycar was derailed and fell to the ground. Necessary repairs were made in the mine shop.

SPIES-VIRGIL MINE
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14. MAINTENANCE AND REPAIRS (Continued)

b. Surface (Continued)

The compressor was cleaned and a new intercooler was installed. A new rope was installed on the North skip. The old one had been in service for two years and ten months and had hoisted 285,642 tons. Three test sections of the rope were sent to John A. Roeblings' Sons Company, Wire Rope Engineering Division. The testing results indicated severe internal corrosion of the rope resulting in considerable loss in strength.

Stockpile loading was delayed considerably due to the many minor repairs that were made to the steam shovel. The overall condition of this unit is such that it should be replaced in the near future.

c. Location

Maintenance expense on the Captain's and Mine Clerk's house was small during the year. The Master Mechanic moved into the vacant house formerly occupied by the Captain. The following table shows the maintenance cost on rented houses.

	<u>1951</u>	<u>1950</u>
Maintenance Expense	91.91	8.34

15. ELECTRIC POWER

There was more electric power consumed due to mine operating on five and one half days per week in 1951 compared with four days per week for the first five months of 1950. There were no delays due to power failure, although there were several short interruptions that were of no serious consequence.

<u>Year</u>	<u>Average Maximum Demand</u>	<u>Rate Per K. W. H.</u>	<u>Total K. W. H.</u>	<u>Cost Per Ton</u>
1951	864	.0140	4,847,500	.286
1950	816	.0144	3,742,000	.262

16. WATER SUPPLY

There were no extensions or changes made in the water mains and the supply has been continued to be obtained from the Homer Mine.

17. CONDITION OF PREMISES

An insulating sheeting was applied to the office building and other minor repairs were made to the other surface buildings, resulting in an approved appearance of the premises.

SPIES-VIRGIL MINE
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18. NATIONALITY OF EMPLOYEES

	<u>American Born</u>	<u>Foreign Born</u>	<u>Total</u>	<u>Percent</u>
English	11	7	18	16.2
Finnish	12	6	18	16.2
Polish	12	3	15	13.5
French	14		14	12.7
Italian	9	3	12	10.8
Swedish	8	1	9	8.1
German	4	2	6	5.4
Danish	4		4	3.6
Austrian	1	2	3	2.7
Lithuanian	3		3	2.7
Irish	2		2	1.8
Scotch	2		2	1.8
Croatian	1		1	.9
Belgian	1		1	.9
West Indian	1		1	.9
Welsh	1		1	.9
Russian	1		1	.9
Total	87	24	111	100.%

GILBERT BOND
38% COTTON FIBRE
U.S.A.

AGNEW MINE
ANNUAL REPORT
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1. GENERAL

Mining operations at the Agnew Mine were carried forward from January 8th to the end of the year on a 2-shift, 6-day a week basis. Mining did not start until January 8th due to a delay in completion of shaft repairs. In addition to time lost on holidays, five regular working days were lost due to the walkout of men from June 9th to June 15th.

Ore was placed in stockpile from January 8th to April 10th. Loading of direct ore into cars from the pocket started on April 10th and continued until November 21st, at which time stockpiling was resumed for the balance of the year. The direct ore stockpile was loaded out as cars were available from April 10th to May 13th. Due to a slide from the M. A. Hanna stripping dump which destroyed road and railway tracks into Agnew Mine, it was necessary to stockpile all production from August 20th to August 25th.

The M. A. Hanna Company loaded ore intermittently all through the season under the Agnew-South Agnew cross-mining agreement.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

a. <u>Production - Crude Ore</u>	<u>Tons</u>
Agnew Crude	15,547
Agnew N. B. <u>Concentrates</u>	10,302
	<u>Direct Ore</u>
Agnew Bess. Shaft	1,427
Agnew N. B. Shaft	275,239
Agnew Bess. Direct	1,054
Agnew N. B. Direct	43,584
Total -----	321,304
b. <u>Shipments</u>	
Agnew N. B. Concts.	10,302
Agnew Bess. Shaft	1,427
Agnew N. B. Shaft	267,182
Agnew Bess. Direct	1,054
Agnew N. B. Direct	43,584
Total -----	323,549
c. <u>Stockpile Inventories</u>	
Agnew Shaft	35,418
d. <u>Production by Months - Crude Ore</u>	

<u>Month</u>	<u>Tons</u>
May	1,213
June	9,195
July	-
August	4,363
Sept.	776
Total -----	15,547

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

E. Production by Months

<u>Month</u>	<u>Agnew Conc.</u>	<u>Agnew Direct</u>	<u>Agnew Shaft</u>	<u>Total</u>
January			22,659	22,659
February			26,796	26,796
March			29,934	29,934
April			25,002	25,002
May	1,185	6,764	30,477	38,426
June	6,360	9,427	17,098	32,885
July	7,462	7,462	20,374	27,836
August	2,757	9,913	23,419	36,098
September		11,072	21,019	32,091
October			19,376	19,376
November			17,973	17,973
December			22,539	22,539
Total	10,302	44,638	276,666	331,606

f. Ore Statement

The 1950 stockpile balance and the ore placed in stock during the winter of 1951 was loaded out completely by the end of June. Agnew-South-Agnew direct and concentrates were loaded for our account by Butler Bros.

3. ANALYSIS

a. Tonnage & Analysis - Crude Ore

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Silica</u>
Agnew Crude	15,547	52.15	.051	15.939

b. Tonnage & Analysis of Ore Produced

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Moist.</u>	<u>Iron Nat.</u>
Agnew N.B. Conc.	10,302	56.02	.052	12.06	.65	1.73	11.53	49.56
Agnew Bess.Shaft	1,427	51.48	.044	17.37	.58	1.99	12.75	44.92
Agnew N.B. Shaft	275,239	54.78	.051	12.42	.65	1.47	12.94	47.69
Agnew Bess.Direct	1,054	57.13	.020	15.39	.13	.91	9.43	51.75
Agnew N.B. Direct	43,584	55.22	.045	14.07	.41	1.88	11.41	48.92
Total	331,606	54.87	.050	12.66	.62	1.53	12.68	47.91

c. Tonnage & Analysis of Ore Shipped

Agnew N.B. Conc.	10,302	56.02	.052	12.06	.65	1.73	11.53	49.56
Agnew Bess.Shaft	1,427	51.48	.044	17.37	.58	1.99	12.75	44.92
Agnew N.B. Shaft	267,182	54.79	.051	12.41	.64	1.43	12.69	47.84
Agnew Bess.Direct	1,054	57.13	.020	15.39	.13	.91	9.43	51.75
Agnew N.B. Direct	43,584	55.22	.045	14.07	.41	1.88	11.41	48.92
Total	323,549	54.88	.050	12.65	.61	1.51	12.47	48.04

d. Mine Analysis of Ore in Stockpile

Agnew Shaft	35,418	54.77	.051	12.84	.60	1.37	14.48	46.84
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3. ANALYSIS (Continued)

e. Complete Analysis of Season's Shipments

	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph</u>	<u>Loss</u>
Agnew Bess. Shaft	51.48	.044	17.37	.58	1.99	.33	.21	.011	5.55
Agnew N.B. Shaft	54.79	.051	12.41	.64	1.43	.34	.21	.011	6.22
Agnew Bess. Direct	57.13	.020	15.39	.13	.91	.33	.21	.011	1.23
Agnew N.B. Direct	55.22	.045	14.07	.41	1.88	.33	.21	.011	3.85
Agnew N.B. Conct.	56.02	.052	12.06	.65	1.73	.34	.20	.010	4.51

Concentration

	<u>Tons</u>	<u>Iron</u>
Crude Ore Through Plant	15,547	52.15
Concentrates Produced	10,302	56.02
Screen Rejects *	1,568	29.68

*Miscellaneous to roads, etc.

4. ESTIMATE OF ORE RESERVES

	<u>Reserve</u> <u>12-31-50</u>	<u>Mined</u> <u>1951</u>	<u>Balance</u> <u>After Mining</u>	<u>Changed by</u> <u>Re-Estimate</u>	<u>Reserve</u> <u>12-31-51</u>
Agnew					
NE-NE 11,57-21	974,658	336,851	637,807	-43,159*	594,648

* 1950 Tresspass production which was not deducted in obtaining 12-31-50 reserve.

Ore Reserve Factors

	<u>Cu.Ft. Per</u> <u>Ton</u>	<u>Rock Deduction</u>	<u>Recovery</u>
Merch.	14	0	100.00 per cent

Estimated Analysis of Ore Reserves

	<u>Non.-Bess.</u> <u>Ore</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Moist.</u>	<u>Fe.</u> <u>Nat.</u>
NE-NE 11,57-21	594,648	57.08	.054	9.53	.67	1.40		

5. LABOR & WAGES

a. Comments

The labor supply was ample throughout the year, but there continued to be a shortage of experienced miners. A program of training available men was continued and no serious shortage developed for present operations. Local labor relations continued satisfactorily. No general increase was granted during the year, but an estimated wage increase of \$.085 per man hour worked was carried on the cost sheet throughout the year.

Relations with the local Union were favorable with comparatively few grievances.

b. Comparative Statement of Production and Wages

Production

Direct Ore	276,666 tons
Number of days operated	296 days
Average Daily Production	934.7 tons
Average Number of Men Working	106 3/4 men
Tons per man - per miner	18.054 tons
" " " -Total Underground	12,132 tons
" " " -Total Mine	9.925 tons

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5. LABOR & WAGES (Continued)b. Comparative Statement of Production & Wages (Continued)

<u>Average Rates per Day</u>	
Surface	\$12.48
Underground	17.48
Contract Miners	17.92
Total Mine	16.53
Amount paid for Labor	\$460,988.28
Labor Cost per Ton	\$1.666

6. SURFACEa. Buildings & Repairs

Minor maintenance repairs to buildings were carried on throughout the year.

b. Roads, Transmission Lines, etc.

None

7.c. UNDERGROUND MININGa. Shaft

Completed the replacing of wooden shaft sets with steel sets from collar to ledge on January 8th.

b. Development

No extensive development was done in the old part of the mine. A few short drifts and raises were driven to open up ore areas for mining.

Approximately 720 ft. of conveyor belt line was installed to mine ore from old 6th sub. Three drifts were driven from the belt line drift to explore and mine this pillar of ore. Approximately 83,000 tons of ore were estimated to be in this block, a substantial increase over prior estimates.

c. Mining

Mining was carried forward during the year with an average of 11 gangs employed. Of these 11 gangs, 6 mined by slicing, 3 by sub-level caving, and 2 developing and making timber repairs. The height of the slices varied from 6 ft. to 13 ft. and varied in width from 10 ft. to 12 ft. In the sub-level caving places, blocks approximately 28 ft. high and 25 ft. wide were caved. Pillars were mined back in an orderly manner on the various sub-levels.

During the transition period, when gangs were moved from the old mine to the 6th sub, production was below normal. After developing the 6th sub, the west side of the pillar was found to be an extremely high manganese ore; the east side of the pillar was found to be a soft ore with a low mining height of six feet. These two factors decreased production considerably.

The main level drifts on the north end of the mine were completely retimbered. Two gangs are now mining these pillars back.

The M. A. Hanna Company operated intermittently, mining both direct and wash ore from the Agnew-South Agnew line under cross-mining agreement. A total of 44,638 tons of direct ore and 10,302 tons of concentrates were produced.

7. UNDERGROUND MINING --(Continued)

d. Timber, Explosives, etc.

The supply of timber was ample and of good quality. Due to shortage of tamarack timber, elm was substituted for about one-half of the tamarack. Maple has been substituted in a limited supply and has proven satisfactory. During the next season, approximately three-fourths elm will be used instead of tamarack.

Lineal feet of timber used per ton of ore	.675 ft.
Cost per ton for timber	\$.107
Cost per ton for lagging, poles and boards	\$.086
Cost per ton for wire	\$.005
Pounds of explosives per ton	.89 lbs.
Cost per ton for explosives	\$.109

e. Pumping & Drainage

The pumping problem at this property, except during severe rainstorms and spring break-up, has eased considerably. This is due entirely to the lowering of pit bottoms on the neighboring properties.

8. BENEFICIATION
None

9. MAINTENANCE & REPAIR

A continuous program of maintenance and repair was carried forward throughout the year as the need arose.

10. COST OF PRODUCTION

a. Comparative Cost Statement

<u>PRODUCT</u>	<u>1951 Budget</u>	<u>1951 Cost Per Ton</u>	<u>1950 Cost Per Ton</u>
Direct Ore	300,000	273,476	307,351
Stockpile Overrun		3,190	11,952
Total		<u>276,666</u>	<u>319,303</u>
So. Agnew Boundry Ore		54,940	33,442
Total	<u>300,000</u>	<u>331,606</u>	<u>352,745</u>
Average Daily Output	-	937.85	1,191.43
Tons Per Man Per Day	-	9.925	10.770
Days Operated	-	295	268
<u>COSTS</u>			
Total U. G. Costs	\$1.932	\$2.000	\$1.639
Total Surface Costs	.183	.217	.199
Total Gen'l Mine Expense	.306	.356	.257
Cost of Production	<u>\$2.421</u>	<u>\$2.573</u>	<u>\$2.095</u>
Depreciation-Plant & Equipment	-	.047	.123
Development	-	.003	-
Depreciation - Movable Equipment	-	.005	.002
Taxes - Ad Valorem	-	.047	.055
" - Occupational	-	.006	.036
" - Royalty	-	.064	.061
Total Depreciation & Taxes	-	<u>.172</u>	<u>.277</u>
Loading and Shipping Costs	-	.039	.054
Total Cost at Mine	-	<u>2.784</u>	<u>2.426</u>
Administrative Expense	-	.050	.064
Misc. Expense & Income	-	.028	-
Total CCI CO Production Cost	-	<u>2.862</u>	<u>2.490</u>

(Continued on next page)

10. COST OF PRODUCTION
Comparative Cost Statement (Continued)

	1951 <u>BUDGET</u>	1951 COST <u>PER TON</u>	1950 COST <u>PER TON</u>
So. Agnew Boundry Ore by Contract	-	\$2.152	\$1.932
GRAND TOTAL	-	\$2.744	\$2.437

b. Cost Comments

The cost of production for 1951 was \$.152 higher than the budget and \$.478 higher than the 1950 cost.

Total underground costs were \$.068 higher than the budget and \$.361 higher than the 1950 cost. During the year of 1951, gangs had to be switched from sub-level caving to top slicing as the pillars were of a low mining height. This type of mining increased the actual mining cost and also increased the timbering cost. Near the end of the year, extra timbering was done on main level drifts on the North end of the mine.

Total surface costs were \$.034 higher than the budget and \$.018 higher than the 1950 costs. The increase was under the item "shaft maintenance", which was completed during the month of January, 1951.

Total general mine expense was \$.050 higher than the budget and \$.099 higher than 1950 costs. The additional wage adjustment increased the costs \$.071. This item was not figured in the budget.

11. EXPLORATION & FUTURE EXPLORATION

No extensive program of exploration during 1951 was conducted. Several shallow test pits and test holes with augers were put down to test bottoms for operations.

12. TAXES

The following is a statement of the taxes for the years 1950 and 1951:

	<u>1951</u>	<u>1950</u>	<u>Increase</u>	<u>Decrease</u>
Agnew Mine	\$12,096.92	\$15,841.92		\$3,745.00
Personal Property	873.30	1,773.60		900.30
Total	\$12,972.22	\$17,615.52		\$4,645.30
Average Tax Rate (Mills)	98.89	90.14	8.75	

Reduction in ad valorem taxes by decrease in reserve value by mine depletion. Personal property value decreased because of smaller stockpile on hand May 1, 1951.

Mill rate increased by new per capita tax law.

13. ACCIDENTS & PERSONAL INJURIES

There were 3 compensable accidents at the Agnew during the year of 1951, as follows:

13. ACCIDENTS & PERSONAL INJURIES (Continued)

- (1) Name: John Bashel
Date of Injury: November 23, 1951
Cause: Bashel was standing in front of the tugger winding up the return cable. The clutch handle on the pulling cable dropped, causing the pulling cable to pull scraper ahead and the bail of scraper struck him on the left leg.
Nature of Injury: Cominuted fracture of distal portion left fibula.
Time Lost: 32 days
Compensation: \$192.00

- (2) Name: Joseph Minerich
Date of Injury: Dec. 7, 1951
Cause: Minerich was spotting an old tram car which was being used temporarily to haul some sand for track ballast on the 6th sub level. The car was secured to the motor with a short chain. Instead of standing inside the frame to run the motor, he stood on the step and when he stopped the motor the slack in the chain let the car come ahead and his left leg was caught between the car and motor.
Nature of Injury: Simple fracture left tibia and fibula. Tibia about 3½ inches above distal end. Fibula 1/2 inch above distal end.
Time Lost: 20½ days
Compensation: \$128.00

- (3) Name: John Bashel
Date of Injury: Sept. 17, 1951
Cause: Bashel was in the act of using a blow pipe to loosen dirt in chute. His foot slipped and he fell down near chute, striking his right shoulder.
Nature of Injury: Contusion of right shoulder X-ray negative for fracture
Time Lost: 11 days and differential pay
Compensation: \$118.43

14. PROPOSED NEW CONSTRUCTION

A small addition to the present dry house building.

15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT

The following equipment was purchased and put into use in 1951:

- 1 - A256 Wright Air Saw
- 1 - 7/8" electric drill
- 2 - 15 H.P. Sullivan tuggers
- 400 ft. 24" Conveyor belting and equipment

Proposed new equipment:

- 1 - Aerodyne Migit Blower
- 2 - 15 H.P. Double Drum Scraper Hoists
- 2 - RB-12 Ingersoll-Rand Jackhammers

ALWORTH LAND RESERVE

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1. GENERAL

The Oliver Iron Mining Company built a new road around the lean ore dump area on the NW-NW 12,57-21.

The Pickands-Mather Company loaded ore intermittently from the area under sub-lease to them during the ore season.

The first ore from the underground development operation was shipped during the latter part of the month of August. This ore came from development of the main drift.

The pond above the 6th sub was pumped out several times in September and October due to the heavy rainfall. The Pickands-Mather Company dumped rock and waste material into this pond area and it was filled to the extent of about 60 per cent.

The Pickands-Mather & Company built new roads, graded the area, and started stockpiling of lean ore on area NW-NW 12,57-21.

After the end of the shipping season, the ore from the development drift was stockpiled with Agnew Mine ore.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

a. Production

	<u>Tons</u>
Alworth - C.C.I. Co.	10,213
Alworth - Pickands Mather	12,821

b. Shipments

Alworth - C.C.I. Co.	8,076
Alworth - Pickands Mather	12,821

c. Ore In Stockpile

Alworth - C.C.I. Co.	2,137
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3. ANALYSIS

a. Analysis of Production

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Moist.</u>	<u>Iron Nat.</u>
Alworth-C.C.I.	10,213	55.75	.061	9.30	1.05	1.74	14.39	47.73
Alworth-P.M.	12,821	51.89	.088	17.82	.79	2.21	15.56	43.82

b. Analysis of Shipments

Alworth C.C.I.	8,076	56.41	.061	8.15	1.12	1.74	14.31	48.34
Alworth-P.M.	12,821	51.89	.088	17.82	.79	2.21	15.56	43.82

c. Analysis of ore in Stockpile

Alworth-C.C.I.	2,137	53.26	.061	13.63	.79	1.72	14.71	45.43
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3. ANALYSIS (Continued)

d. Complete Analysis of Shipments

	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>
Alworth-C.C.I.	56.41	.061	8.15	1.12	1.74	.34	.20	.010	5.90

4. ESTIMATE OF ORE RESERVES

	<u>Reserve 12-31-50</u>	<u>Mined 1951</u>	<u>Balance After Mining</u>	<u>Changed by Re-Estimate</u>	<u>Reserve 12-31-51</u>
Alworth-Merch	1,708,404	10,213	1,698,191	x x	1,698.191

Estimated Analysis of ore reserves:

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Silica</u>	<u>Mang.</u>
Alworth Merch	1,698,191	56.71	.069	9.90	.78

5. LABOR & WAGES

a. Comments

The labor supply was ample throughout the year, but there continued to be a shortage of experienced miners. Local labor relations continued satisfactory. No general increase in wages was granted, but an estimated wage increase of \$.085 per man hour worked was carried from the first of the year.

6. SURFACE

a. Buildings & Repairs

The Agnew and Alworth are using the same buildings.

b. Roads, Transmission Lines, etc.

None

c. Miscellaneous General Construction

None

7. UNDERGROUND MINES

a. Ventilating Shaft

A churn drill hole with a six inch pipe casing was driven down from the surface to the 6th sub at approximately 351-S and 1038-E to drain water as the combined escape way and ventilating shaft was sunk. The distance from surface to the top of the drift was 108 ft., the total distance being sand, gravel and boulders. A small building was built for a change house and an inexpensive timber headframe was erected as well as a small hoist house. On November 30, 1951, miners began sinking a combined escape way and ventilating shaft and 96 ft. were put down during the month of December. In the first 68 feet of depth the sides were solid and progress was good, but from 68 feet to 96 feet progress was slowed up due to wet, loose sides. This shaft will be completed in the month of January, 1952.

7. UNDERGROUND MINES

b. Development

In January, one gang working two shifts was started driving an 8 ft. x 10 ft. drift Northeast from the Agnew shaft into the Alworth. The drift was driven 750 ft. in a slaty taconite before entering ore. After driving into the ore body, the drift was turned due East. On September 17 the schedule was changed to three shifts per day and late in November a second gang was started driving the first drift to the North at approximately 330-S and 1373-E. This North drift, also called 3N, was completed 30 ft. from the property line late in December. Small raises were put up every 75 feet to 100 feet to find the exact height of ore for future mining. The East drift ended now is 1800 feet from the Agnew shaft. The conveyor belt line was installed as the drift progressed. The ore outline as drawn from the drilling has checked very well with the information received from the development work.

A total of 10,213 tons of direct ore have been mined from the Alworth development work.

c. Mining

No mining to date.

d. Timber, Explosives, Etc.

Due to a shortage of tamarack, elm timber was used for posts and the tamarack for caps.

e. Pumping & Drainage

A wet area was encountered under the pond where a gathering sump was made and an electric pump was installed. The present breasts are dry and the drifts should be dry to the property lines as the neighboring pits should take care of the water problem on the 6th sub.

8. BENEFICIATION

None

9. MAINTENANCE & REPAIR

None

10. COST OF OPERATION

None - Development work only.

11. EXPLORATION & FUTURE EXPLORATION

The Atkins-Walker drilled on a straight footage basis from January to October. This drilling was done to fulfill our commitments to the fee owners and to definitely outline the ore body. A total of 2,378 feet were drilled in 8 holes. The ore outline from the drilling has been close to the present outline found in our development work.

12. <u>TAXES</u>	<u>1951</u>	<u>1950</u>	<u>Increase</u>	<u>Decrease</u>
Alworth Reserve	\$13,158.29	\$11,439.98	\$1,718.31	
Average Tax Rate(Mills)	128.44	111.59	16.85	

New per capita tax law allowances increased mill rate. Basic tax value was the same for 1950 and 1951.

13. ACCIDENT & PERSONAL INJURIES

None

14. PROPOSED NEW CONSTRUCTION

Continuation of the belt conveyor system.

15. EQUIPMENT RECEIVED &
PROPOSED NEW EQUIPMENTEquipment Received:

- 1 - L90 Pickhammer
- 2 - JL3 Jacklegs
- 1 - #25 Sump pump
- 1 - Aerodyne Midgit Blower
- 1 - TM6 Coppus Ventair Blower

Proposed New Equipment

- 5 - RB12 Jackhammers
- 1 - 5 H.P. blower
- 2 - Aerodyne Midgit Blowers
- 2 - 15 H.P. Double drum Scraper Hoists
- 1 - 25 H.P. Double Drum Scraper Hoist
- 2 - Spading Machiner - L90 Pickhammer

ATKINS MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL:

In an attempt to exhaust the Atkins open pit during the year of 1951, mining and stockpiling of ore continued throughout the months of January and February until unseasonably warm weather caused the road to slough and give way between February 14 and 28 to a point where operations began to become extremely hazardous, and by March 5th operations were completely discontinued due to the caving in of the approach road along the North bank.

It was decided that further attempted operation would be useless until a new approach could be cut, and all operations were halted as of March 5th, with the exception of pit pumping, which went on intermittently. Shipping of stockpiled ore began on April 15th and continued until June 8th, when this loading was closed down due to the strike. During the strike period from June 9th to June 15th, the operation was contracted out to the Range Improvement Company to attempt to mine and ship the balance of the ore. Stockpile loading was also contracted out to the Range Improvement Co. in order to eliminate the necessity of building up any further crews at the Atkins.

After completing the stockpile loading, the Range Improvement Co. began a rock cut in the North bank, which ultimately provided a very narrow approach road in this area, which was suitable, however, for small truck operations. The first loading by the Range Improvement Co. began on August 3rd. The Range Improvement Co. at the end of 1951 had removed and stockpiled a total of 40,877 tons of ore for the account of The Cleveland-Cliffs Iron Company.

The bulk of the Atkins equipment was shipped to the Inland Steel Company at its various properties on the Cuyuna Range in Minnesota and Michigan, with the exception of such equipment as was necessary to maintain the pumping from the pit. The garage and office were sold to the Range Improvement Company and some miscellaneous equipment sold. The 54-B dragline was moved to the Wanless, as mentioned in the Wanless Report, for use in digging out the sump areas required.

The mining of ore by the Range Improvement Company continued at year end and will continue into 1952. It is hoped that the amount of ore to be removed will satisfy the Arthur Iron Mining Company that all available ore has been taken out.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

A. Production by Grades

	<u>Tons</u>
Atkins Extension Lease-C.C.I. Co.	131,351
Atkins Extension Lease - Range Improvement Co.	40,877

b. Shipments

Atkins Extension Lease-C.C.I. Co.	247,206
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c. Stockpile Inventories

Atkins Extension Lease-Range Improvement Co.	40,877
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d. Production by Months:

(Continued on next page)

d. Production by Months (Continued)

<u>Month</u>	<u>C.C.I.Co.</u>	<u>Range Improvement Co.</u>
January	59,858	-
February	34,570	-
March	7,949	-
April	-	-
May	-	-
June	17,602	-
July	-	-
August	-	6,843
September	11,372	5,575
October	-	6,439
November	n -	11,448
December	-	10,572
Total	131,351	40,877

e. Ore Statement

Ore was produced by C.C.I. Co. through September, 1951, and all shipped out. For the last five months of the year ore was produced by the Range Improvement Co. and placed on the stockpile.

3. ANALYSIS

a. Tonnage & Analysis of Direct Ore Produced

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Moist.</u>	<u>Iron Mat.</u>
Atkins Extension Lease								
C.C.I. Co.	131,351	52.74	.083	12.19	.91	3.87	18.20	43.14
Atkins Extension Lease								
Range Improvement Co.	40,877	49.71	-	14.93	-	4.83	-	-

b. Tonnage & Analysis of Shipments

Atkins Extension Lease	247,206	51.34	.088	12.82	1.00	4.82	19.30	41.43
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d. Tonnage & Analysis of Ore in Stockpile

Atkins Extension Lease								
Range Improvement Co.	40,877	49.71	-	14.93	-	4.83	-	-

e. Complete Analysis of Shipments

<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mn.</u>	<u>Alu.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>
51.34	.088	12.82	1.00	4.82	.11	.10	.010	7.10

4. ESTIMATE OF ORE RESERVES

a. Developed Ore Factors

	<u>Cu. Ft. Per</u>	<u>Rock</u>	<u>Per Cent</u>
	<u>Ton Crude</u>	<u>Deduction</u>	<u>Recovery</u>
No. 1 Ore	14	10%	100.00
No. 2 Ore	14	10%	100.00

b. Reserve as of 12-31-51

	<u>Reserve</u>	<u>Mined</u>	<u>Bal. After</u>	<u>Changd. By</u>	<u>Reserve</u>
	<u>12-31-50</u>	<u>1951</u>	<u>Mining</u>	<u>Re-Estimate</u>	<u>12-31-51</u>
<u>Merritt</u>					
<u>SE-NW 12,58-19</u>	-	-	-	-	-

b. Reserve as of 12-31-51 (Continued)

	<u>Reserve</u> <u>12-31-50</u>	<u>Mined</u> <u>1951</u>	<u>Bal.After</u> <u>Mining</u>	<u>Chngd.By</u> <u>Re-Est.</u>	<u>Reserve</u> <u>12-31-51</u>
<u>Wade</u>					
NE-SW 12,58-19	71,928	72,243	-315	28,220	27,905
NW-SE 12,58-19	12,217	99,985	-87,768	123,928	36,160
Total Wade	84,145	172,228	-88,083	152,148	64,065
Total Atkins	84,145	172,228	-88,083	152,148	64,065

c. Estimated Analyses of Ore Reserves:

<u>Merritt</u>	<u>Tons</u>	<u>Iron</u> N O N E	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>
<u>Wade:</u>						
NE-SW 12,58-19						
No. 1 Ore	14,550	58.63	.079	7.01	-	2.04
No. 2 Ore	13,355	48.71	.113	11/29	-	5.56
NW-SE 12,58-19						
No. 1 Ore	18,024	58.63	.079	7.01	-	2.04
No. 2 Ore	18,136	48.71	.113	11.29	-	5.56
Total Wade	64,065	53.75	.096	9.11	-	3.77
Total No. 1 Ore	32,574	58.63	.079	7.01	-	2.04
Total No. 2 Ore	31,481	48.71	.113	11.29	-	5.56
Grand Total	64,065	53.75	.096	9.11	-	3.77

5. LABOR & WAGES

a. Comments

As was the case at the Wanless Mine, the labor supply continued to be fair for the short time The Cleveland-Cliffs Iron Co. operated the property, and the contractor has apparently had no trouble maintaining a crew.

b. Comparative Statement of Production & Wages
Production

Direct Ore	131,351 tons
Number of days operated	58 days
Average Number of Men Working	60 men
Average Wages Per Man	\$14.13
Production per Man per Day	23.36 tons
Labor Cost Per Man Per Ton	\$.611
Total Number of Man Days	5,623 days
Amount Paid for Labor	\$80,248.69

6. SURFACE

The general stockpile placed on surface by the CCI Co. operation was shipped out during the year and the areas made ready to stockpile the output mined by the contractor.

7. OPEN PITa. Stripping

The only stripping removed was a small amount of rock removed by the contractor to establish a new road bench.

b. Open Pit Mining

As noted above, the open pit was mined by the CCI Co. from the first of the year until March 5, 1951, when all open pit operations were discontinued, the contractor (being the Range Improvement Co.) taking over the operation during the strike period from June 9th to June 15th, with the first stockpiling of ore on the part of the contractor being on August 3rd.

During the operation of the CCI Co., 102,377 tons of ore were stockpiled, and, as noted above, all of this ore was shipped during the 1951 season, including an overrun of 17,602 tons. Merch ore stockpiles shipped out were numbers 1 and 2. An additional tonnage of ore was shipped after the sorting out of rock by means of a shovel.

The Range Improvement Company, since they have taken over the project, have stockpiled 40,877 tons of merchantable ore and 11,372 tons of low grade ore which was shipped.

c. Pumping & Drainage

Pumping and drainage between the time of the last production by the CCI Co. to the time the contractor was able to enter the pit and begin producing, was carried on intermittently, allowing the water to rise between pumping periods. After the contractor began operations, the water was lowered by continual pumping to dry out the ore area and pumping has been continued since in order to provide a dry pit for the contractor to work in.

8. BENEFICIATION

N O N E

9. MAINTENANCE
& REPAIR

During the period from March 5th to the early part of May, some repair work was done to shovels and tractors, although trucks were not repaired, as it was felt that the old 15-ton models would not warrant additional work.

10. COST OF
OPERATIONa. Comparative Mining Cost Statement

(See next page)

a. Comparative Mining Cost Statement (Continued)

<u>PRODUCT</u>	<u>ATKINS</u> <u>C.C.I.CO.</u>		<u>ATKINS</u> <u>OPERATING AGENT</u>	
	<u>1951</u>	<u>1950</u>	<u>1951</u>	<u>1950</u>
Direct Ore	40,877	-	131,351	436,726
Average Daily Output Tons Per Man Per Day	(Contract)		2,265	2,552
Days Operated			24.52	30.54
			58	216
<u>COST (Per Ton)</u>				
Pit Operating	1.671	-	.842	.773
Loading Stkpile Ore	-	-	.394	.042
Gen'l Mine Expense	.080	-	.288	.185
Cost of Production	<u>1.751</u>	<u>-</u>	<u>1.524</u>	<u>1.000</u>
Depreciation-Plant & Eqpt.			.008	.003
" -Motorized Eqpt.			.136	.126
" -Movable Eqpt.			.005	.004
Amortization-Stripping	.080		.080	.264
Taxes-Ad Valorem	.014		.027	.023
" -Occupational			<u>.070</u>	<u>.168</u>
Total Depreciation, Amortization & Taxes . .	.094	-	.186	.587
Administrative Expense	-	-	.050	.050
Misc. Expense & Income	-	-	<u>.032</u>	<u>.018</u>
GRAND TOTAL	1.845	-	1.792	1.655

11. EXPLORATION &
FUTURE EXPLORATION

N O N E

12. TAXES

The following is a statement of taxes at the Atkins Mine for the years 1950 and 1951:

	<u>1951</u>	<u>1950</u>	<u>Increase</u>	<u>Decrease</u>
Atkins Mine	\$1,062.71	\$7,824.04		\$5,761.33
Personal Property	<u>3,036.89</u>	<u>2,321.36</u>	<u>\$715.53</u>	
Total	\$4,099.60	\$10,145.40		\$6,045.80
Average Tax Rates(Mills)	101.47			
(Village Kinney)		88.80		12.67
	129.11	99.81		29.30
(Great Scott)				

Ad Valorem taxes decreased because of depletion of reserve. Personal Property taxes increased because of large stockpile on hand May 1st. Mill rate increased on account of new per capita law allowances.

13. ACCIDENT &
PERSONAL INJURY

A total of 21 slight accidents occurred during the year, involving only slight injuries to the individuals and none of which were compensable accidents.

14. PROPOSED NEW
CONSTRUCTION

N O N E

15. EQUIPMENT RECEIVED
OR PROPOSED NEW
EQUIPMENT

N O N E

CANISTEO MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL

The winter stripping and repair programs that were underway at the close of the 1950 season were continued into 1951. The stripping program, which was on a twenty shift per week basis, was continued until March 11, when all pit operations were shut down. On April 16, stripping was again resumed on a three shift, five day per week basis. This schedule remained in effect until the beginning of the ore season, when stripping continued at the intermittent intervals of one, two, and three shift basis, depending on the availability of equipment.

The repair work on washing plant and pit equipment was carried on until the beginning of ore season. This work was conducted on a five day per week schedule. Repairs to the stripping conveyor equipment were also underway during this period and continued until June 25, when the erection of the new conveyor stripping screening plant was completed.

The 1951 ore season began on April 30, on a two shift, six day per week schedule, which continued through October 20. A total of 1,947,694 tons of gross crude ore, which included 160,758 tons of screen rock, was produced from three separate leases in the pit.

The plant operated on the same schedule as the pit, receiving a total of 1,786,936 tons of crude ore, which produced 924,036 tons of concentrates, for an average of 2,952 tons of concentrates per shift.

Conveyor-dragline stripping, which started June 25 on a three shift, six day per week schedule, was continued until October 30th. A total of 415,856 cu. yds. of surface overburden was removed.

At the close of the ore season on October 20, pit operations were immediately diverted to truck stripping on a twenty-one shift per week basis. This continued throughout the remainder of the year. A total of 1,115 190 cu. yds. of material was removed by truck stripping.

Repairs to plant, pit and stripping conveyor equipment were again resumed on a 5-day per week basis.

The exploratory drilling program under way at the close of the 1950 season was continued until November 15, 1951. A total of 7,636 feet of drilling was completed.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

A. Production by Grades

	<u>Tons</u>
Snyder wash crude	235,149
Snyder retreat crude	204,794
Bovey wash crude	253,752
Bovey retreat crude	740,552
Hemmens wash crude	55,309
Hemmens Retreat crude	297,380
Total	1,786,936
Snyder Bess. Wash Concts.	44,973
Snyder N.B. Wash Concts.	89,378
Snyder Bess. Retreat Concts.	12,737
Snyder N.B. Retreat Concts.	87,231
Bovey Bess. Wash Conct.	26,120
Bovey N.B. Wash Conct.	129,364
Bovey Bess. Retreat Conct.	52,643
Bovey N.B. Retreat Conct.	322,139
Hemmens Bess. Wash Conct.	9,621
Hemmens N.B. Wash Conct.	18,327

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

a. Production by Grades - Continued

	<u>Tons</u>
Hemmens Bess. Retreat Conct.	49,143
Hemmens N.B. Retreat Conct.	82,360
Total	924,036

b. Shipments by Grades

Snyder Bess. Wash Concts.	52,961
Snyder N.B. Wash Conct.	84,496
Snyder Bess. Retreat Conct.	12,737
Snyder N.B. Retreat Conct.	64,503
Bovey Bess. Wash Conct.	32,266
Bovey N.B. Wash Conct.	146,518
Bovey Bess. Retreat Conct.	52,643
Bovey N.B. Retreat Conct.	363,207
Hemmens Bess. Wash Conct.	9,621
Hemmens N.B. Wash Conct.	12,369
Hemmens Bess. Retreat Conct.	49,143
Hemmens N.B. Retreat Conct.	41,821
Total	922,285

c. Stockpile Inventory

Snyder Wash Concentrates	22,871
Snyder Retreat Concts.	22,728
Bovey Wash Concts.	9,196
Bovey Retreat Concts.	10,178
Hemmens Wash Concts.	5,958
Hemmens Retreat Concts.	40,539
Total	111,470

d. Production by Months - Crude Ore

<u>Month</u>	<u>Snyder Wash</u>	<u>Snyder Retreat</u>	<u>Bovey Wash</u>	<u>Bovey Retreat</u>	<u>Hemmens Wash</u>	<u>Hemmens Retreat</u>	<u>Total</u>
April	2,726						2,726
May	70,729	13,504	43,577	115,902	9,581	52,072	305,365
June	26,952	286	60,780	151,587	17,586	48,665	305,856
July	17,975	48,927	23,803	162,118	8,319	66,438	327,580
August	112,405	46,682	30,303	100,409	5,446	47,458	342,703
Sept.	4,362	80,079	43,886	138,466	10,060	7,068	283,921
October	--	15,316	51,403	72,070	4,317	75,679	218,785
Total	235,149	204,794	253,752	740,552	55,309	297,380	1,786,936

e. Production by Months - Concentrates

April	1,682						1,682
May	42,972	4,974	33,343	54,640	4,268	16,588	156,785
June	15,821	275	36,784	79,199	8,565	21,267	161,911
July	8,488	24,587	12,715	78,812	5,435	30,156	160,193
August	62,930	21,989	17,728	49,282	2,065	23,411	177,405
Sept.	2,458	38,566	24,774	74,385	5,687	3,059	148,929
October	-	9,577	30,140	38,464	1,928	37,022	117,131
Total	134,351	99,968	155,484	374,782	27,948	131,503	924,036

3. ANALYSIS

a. Analysis of Crude Ore

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Silica</u>
Snyder Wash Crude	235,149	42.86	.044	32.02
Snyder Retreat Crude	204,794	40.00	.045	36.82
Bovey Wash Crude	253,752	44.17	.055	30.31
Bovey Retreat Crude	740,552	41.92	.071	33.11
Hemmens Wash Crude	55,309	39.19	.040	37.11
Hemmens Retreat Crude	297,380	39.27	.031	36.96
Total	1,786,936	41.62	.055	33.76

3. ANALYSIS (Continued)

b. Tonnage & Analysis of Concentrates Produced

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>	<u>Moist.</u>
Snyder Bess.Wash Conct.	44,973	57.23	.031	10.69	.36	.35	9.22
Snyder N.B. Wash Conct.	89,378	55.87	.061	11.14	1.09	.43	8.67
Snyder Bess.Ret.Conct. e	12,737	56.71	.031	11.99	.43	.33	9.08
Snyder N.B. RetreatCon.	87,231	55.98	.057	12.06	.62	.360	8.40
Bovey Bess.Wash Conct.	26,120	57.13	.032	11.25	.47	.32	9.49
Bovey N.B.Wash Conct.	129,364	55.88	.073	11.69	.71	.42	8.56
Bovey Bess.Ret.Conct.	52,643	55.72	.036	12.44	.45	.41	9.03
Bovey N.B.Ret. Conct.	322,139	55.79	.073	11/64	.76	.38	8.49
Hemmens Bess.WashConct.	9,621	56.94	.035	10.20	.51	.42	9.50
Hemmens N.B.Wash Conct	18,327	52.03	.046	13.94	2.46	.39	10.57
Hemmens Bess.Ret.Conct.	49,143	55.63	.033	12.16	.49	.37	9.57
Hemmens N.B. Ret.Conct.	82,360	53.95	.042	13.00	1.36	.35	9.05
Total	924,036	55.71	.059	11.82	.79	.38	8.77

c. Tonnage & Analysis of Concts. Shipped

Snyder Bess.WashConct.	52,961	57.34	.031	10.81	.35	.36	8.72
Snyder N.B. WashConct.	84,396	56.20	.065	11.05	1.03	.43	8.34
Snyder Bess.Ret.Conct.	12,737	56.71	.031	11.99	.43	.33	9.08
Snyder N.B.Ret.Conct.	64,503	55.94	.057	12.00	.65	.36	8.54
Bovey Bess.WashConcts.	32,266	57.25	.033	11.24	.43	.33	8.76
Bovey N.B.Wash Conct.	146,518	55.96	.074	11.75	.66	.42	8.24
Bovey Bess.Ret.Conct.	52,643	55.72	.036	12.44	.45	.41	9.03
Bovey N.B.Ret.Conct.	363,207	55.83	.073	11.70	.72	.39	8.29
Hemmens Bess.WashConct.	9,621	56.94	.035	10.20	.51	.42	9.50
Hemmens N.B.WashConct.	12,369	52.56	.047	13.93	1.81	.39	10.90
Hemmens Bess.Ret.Conct.	49,143	55.63	.033	12.16	.49	.37	9.57
Hemmens N.B.Ret.Conct.	41,821	53.03	.048	13.29	1.70	.38	9.82
Total	922,285	55.87	.061	11.76	.73	.39	8.58

d. Mine Analysis of ore in Stockpile

Snyder Concts.	22,871	55.66	.053	11.78	.75	.37	8.48
Snyder Ret. Concts.	22,728	56.08	.056	12.21	.51	.38	8.02
Bovey Concts.	9,196	55.40	.081	12.32	.59	.41	8.48
Bovey Ret.Concts.	10,178	55.67	.089	11.68	.65	.39	7.76
Hemmens Concts.	5,958	50.93	.046	13.94	3.81	.39	9.89
Hemmens Ret.Conct.	40,539	54.90	.035	12.71	1.01	.32	8.26
Total	111,470	55.20	.052	12.36	.94	.36	8.32

e. Complete Analysis of Season's Shipments

	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph</u>	<u>Loss</u>
SnyderBess.Conct.	57.34	.031	10.81	.35	.36	.27	.18	.011	5.81
Snyder N.B.Conct.	56.20	.065	11.05	1.03	.43	.27	.18	.011	6.08
Snyder Bess.Retreat	56.71	.031	11.99	.43	.33	.27	.19	.011	5.44
Snyder N.B.Retreat	55.94	.057	12.00	.65	.36	.26	.18	.010	6.14
Bovey Bess.Conct.	57.25	.033	11.24	.43	.33	.27	.18	.011	5.42
Bovey N.B.Conct.	55.96	.074	11.75	.66	.42	.27	.19	.011	6.23
Bovey Bess.Retreat	55.72	.036	12.44	.45	.41	.25	.18	.010	6.31
Bovey N.B.Retreat	55.83	.073	11.70	.72	.39	.26	.19	.010	6.42
Hemmens Bess.Conct.	56.94	.035	10.20	.51	.42	.27	.18	.010	6.69
Hemmens N.B.Conct.	52.56	.047	13.93	1.81	.39	.27	.191	.011	7.35
HemmensBess.R. treat	55.63	.033	12.16	.49	.37	.25	.18	.010	6.71
Hemmens N.B.Retreat	53.03	.048	13.29	1.70	.38	.26	.19	.010	7.50

4. ESTIMATE OF
ORE RESERVES

a. Developed Ore - Factors Used

	<u>Cu. Ft.</u> <u>Per Ton</u>	<u>Rock Deduction</u>	<u>Per Cent</u> <u>Recovery</u>
Wash Conct.	14	0	60.66
Lean Wash Conct.	14	0	46.54
Low Grade Wash Conct.	14	0	58.62
Lean Low Grade Wash Conct.	14	0	48.81
Retreat Concts.	14	0	37.50

b. Ore Reserves as of 12-31-51

	<u>Reserve</u> <u>12-31-50</u>	<u>Mined</u> <u>1951</u>	<u>Bal. After</u> <u>Mining</u>	<u>Changed</u> <u>by Re-Est.</u>	<u>Reserve</u> <u>12-31-51</u>
<u>LEASE</u>					
<u>Bovey</u>					
S ₂ -NE 30,56-24	160,282	-	160,282	-22,315	137,967
NW-SE "	319,639	344,636	-24,997	355,243	330,246
NE-SE "	410,835	-	410,835	11,096	421,931
NE-NE 31,56-24	623,674	139,809	483,865	384,072	867,937
NW_NW 32,56-24	278,389	45,821	232,568	6,408	238,976
Total Bovey	1,792,819	530,266	1,262,553	734,504	1,997,057
<u>Hemmens</u>					
SW-SW 29, 56-24	3,070,932	159,451	291,481	300,728	3,212,209
<u>Snyder</u>					
NE-SW 30,56-24	-	-	-	62,747	62,747
SE-SW "	1,171,854	-	1,171,854	-4,294	1,167,560
SW-SE "	234,082	117,750	116,332	72,487	188,819
SE-SE "	379,588	116,569	263,019	14,068	277,087
Total Snyder	1,785,524	234,319	1,551,205	145,008	1,696,213
<u>GRAND TOTAL CANISTEO</u>					
.	6,649,275	924,036	5,725,239	1,180,240	6,905,479

c. Estimated Analyses

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>
<u>Bovey</u>						
Bess. Wash Conct.	422,397	57.66	.030	10.16	.42	.43
N.B. Wash Conct.	957,705	56.99	.079	10.27	.78	.51
Bess. Retreat Conct.	133,181	54.56	.031	11.89	-	-
N.B. Retreat Conct.	483,774	55.13	.083	11.45	-	-
Total Bovey	1,997,057	56.52	.066	10.69	-	-
<u>Hemmens</u>						
Bess. Wash Conct.	1,152,243	57.91	.032	10.06	.29	.50
N.B. Wash Conct.	1,103,411	57.12	.072	10.08	.38	.51
Bess. Retreat Conct.	312,871	55.74	.030	11.47	-	-
N.B. Retreat Conct.	643,684	55.74	.061	11.47	-	-
Total Hemmens	3,212,209	56.99	.051	10.49	-	-
<u>Snyder</u>						
Bess. Wash Conct.	735,343	60.42	.038	9.47	.18	.32
N.B. Wash Conct.	897,490	60.48	.061	7.98	.23	.38
Bess. Retreat Conct.	34,451	57.32	.030	10.87	-	-
N.B. Retreat Conct.	28,929	57.32	.509	10.87	-	-
Total Snyder	1,696,213	60.34	.050	8.77	-	-
Bess. Wash Conct.	2,309,983	58.66	.034	9.89	.28	.43
N.B. Wash Conct.	2,958,606	58.10	.071	9.50	.46	.47
Total Wash Concts.	5,268,589	58.35	.055	9.67	.38	.45

c. Estimated Analyses (Continued)

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>
Bess. Retreat Conct.	480,503	55.53	.030	11.54		
N.B. Retreat Conct.	1,156,387	55.52	.070	11.45		
Total Ret. Conct.	1,636,890	55.52	.058	11.48		
Bess. Concts.	2,790,486	58.12	.033	10.17	.28	.43
N.B. Concts.	4,114,993	57.37	.071	10.05	.46	.47
GRAND TOTAL	6,905,479	57.67	.056	10.10	.39	.45

5. LABOR & WAGES

a. Comments

Except for certain types of skilled men such as machinists, the labor supply was adequate. However, quite a large turnover in certain types of labor was experienced, thus making it necessary to break in a number of new men on semi-skilled jobs. Except for an unexplained walkout between June 9 and June 15, labor relations between the Company and the Union were generally good.

b. Comparative Statement of Production and Wages

Production-----	924,036 tons
Number of days operated -----	142 days
Number of shifts operated-----	313 shifts
Average daily product -----	6,507 tons
Average Product per Shift -----	2,952 tons
Average number of men employed -----	198 men
Product per man per day -----	38.48 tons
Average wages per day -----	\$14.97
Total Amount paid for labor -----	\$351,664.16
Labor Cost per Ton -----	\$0.380

6. GENERAL SURFACE

a. Buildings & Repairs

Because of the crowded conditions in our main shop building, a new carpenter shop is being constructed. This is an all steel building, 20 ft. x 30 ft. in size. Preparatory work was started in December, with the completion of the building scheduled for February of 1952.

b. Roads, Transmission Lines, etc.

In order to eliminate some very steep grades in the old pit approach road, a new road was constructed into the pit. Since this is the main haulage road between the pit and the dumps to the north, it was necessary to improve this road. Grades were reduced from a maximum of 12 per cent to 8 per cent.

The 22,000 volt power line and sub-station that serves the stripping conveyor is being moved into the pit. Work started on the project in November and will continue into 1952. This line is being moved to avoid interference with our conveyor stripping operation.

c. Miscellaneous General Construction

The development of a new mine by the Oliver Iron Mining Company cut off our fresh water line coming from the Village of Coleraine. This made it necessary to install our own domestic water supply system. A well was drilled, a 10,000 gallon water tank was erected, and pumping facilities installed. The system operated satisfactorily and the water supply is adequate and of good quality. It was found necessary to do some work on the tailings basin dykes before the beginning of the 1952 operation. The dykes are being raised and reinforced by casting up tailings with the 54-B dragline. This work was started in December, and will be completed in January of 1952.

7. OPEN PITa. Stripping

The truck stripping under way at the close of the 1950 season was continued into 1951. A new E&A, No. CC-414, went into effect on January 1, 1951. An estimated 705,000 cu. yds. of surface and lean ore materials was set up to be removed from the Snyder Point and Hemmens areas. This work was scheduled at twenty shifts per week, employing four complete crews, each crew working forty hours per week. This schedule continued until March 11, when all operations were temporarily suspended. On April 16, stripping was resumed on a three shift, five days per week schedule. During the ore season, which began on April 30, stripping continued on a one, two and three shift basis, depending on the availability of equipment.

A considerable part of the stripping in the Hemmens area consisted of cleaning up an old sump area. Ten to thirty feet of silt and slimes had been deposited in this area over a period of several years. It was impossible to dry this material out so that it could be loaded out satisfactorily. As a result it had to be loaded out at intermittent intervals along with other stripping so that a somewhat more reasonable production could be maintained.

A total of 595,598 cu. yds. was moved on E&A No. CC-414, of which 442,014 cu. yds. were surface, 87,254 cu. yds. surface slough, 20,900 cu. yds. lean formation and 45,430 cu. yds. lean ore. The average production per shift worked was 1,395 cu. yds. The cost per cubic yard on this project was \$.467, which was \$.069 over the budget. Both production and cost figures on this job were adversely affected by the nature of the material that had to be moved, and by the extremely long haul and steep grades out of the pit. The shortage of trucks during the ore season also had an unfavorable effect on production and costs.

Truck stripping E&A no. CC-414 was expended on September 1, 1951, and was followed by E&A No. CC-472, which covered the removal of an additional 700,000 cu. yds. of surface and lean ore materials from the Snyder Point and Hemmens areas to make ore available for 1952 and 1953. Shortly after the end of the ore season on October 20, stripping operations were scheduled on a twenty-one shift per week basis, using four crews. By the end of 1951, a total of 519,592 cu. yds. was moved on E&A No. CC-472, of which 138,467 cu. yds. were surface, 2,359 cu. yds. surface slough, 175,458 cu. yds. lean formation, 108,002 cu. yds. paint rock, 23,837 cu. yds. taconite, and 71,469 cu. yds. of lean ore. The average production per shift was 2,460 cu. yds, and the cost per cu. yd. on this project to Jan. 1, 1952 was \$.429, or \$.006 below the budget estimate.

A great deal of difficulty was experienced in keeping the truck fleet in operation. This was especially true during December, when it was necessary to cut back to a one-shovel operation with ten trucks hauling. Previous to that, two shovels had been used, with 14 to 16 trucks. The extremely long haul, well over 7,500 feet one way, and the high lift, contributed to the high cost of this operation.

The conveyor-dragline stripping was started on June 25, when the erection of the new screening plant was completed. Slow delivery of equipment for this plant caused considerable delay in getting this operation under way. The stripping program, covered under E&A No. CC-415, was a continuation of the previous year's operation, and called for the removal of 800,000 cu. yds. of surface overburden in the Hemmens. Work was scheduled on a three shift, six day week basis. This operation continued until October 30, when it was necessary to shut down because of very bad weather. A total of 415,856 cu. yds. of surface material was removed. The average yards per shift worked was 1,444. The cost per cubic yard at the end of October was \$.283, which was \$.073 over the budget estimate.

A great deal of difficulty was immediately encountered in the operation of the wobbler feeder, which had been installed in the new plant to separate the oversize rock from the rest of the overburden. The difficulty was caused by the oversize boulders wedging in between the wobbler bars, causing the machine to jam and usually stop. This continued until grizzly chains were looped around the last four wobbler bars, where most of the sticking was taking place. This helped the operation to the extent that in the

7. OPEN PITa. Stripping (Continued)

month of August 142,391 cu. yds. of overburden were removed at a cost of \$.177 per cu. yd.. On September 15, however, it was necessary to move into an area of very heavy and sticky blue clay. Almost continual wet weather from the beginning of September until the operation was shut down made it very difficult to operate in this type of material. Most of the difficulty was now caused by this heavy clay material sticking in the hoppers in the screening plant, both above and below the wobbler feeder. This clay material also plugged up conveyors and transfer points. A considerable amount of delay time was also caused by the mechanical failures in the operation of the wobbler feeder. This machine is now being completely overhauled and should operate much more satisfactorily next year.

The following is a tabulation by leases of the stripping moved during the year:

<u>Lease</u>	<u>Surface</u>	<u>Surface Slough</u>	<u>Lean Formation</u>	<u>Paint Rock</u>	<u>Taconite</u>	<u>Lean Ore</u>	<u>Total</u>
Bovey	126,786	-	40,622	748	19,437	220	187,813
Snyder	377,161	61,719	63,856	-	4,400	-	507,136
Hemmens	492,390*	27,894	91,132	108,002	-	116,679	836,097
Totals	996,337	89,613	195,610	108,750	23,837	116,899	1,531,046

*415,856 cu. yds. of this is conveyor stripping

b. Open Pit Mining

The 1951 ore season started April 30 on a 2-shift, 6-day per week basis. This schedule continued through October 20k except for the strike period and a short period between May 14 and June 25 when ore was produced on three shifts.

The pit operated 313 shifts, producing a total of 1,947,694 tons of gross crude, which included 160,578 tons of screen rock. The total net crude to the mill amounted to 1,786,936 tons. The gross crude per shift was 6,223 tons, while the net crude production per shift was 5,709 tons. The cost per ton of crude ore mined was \$.287.

Ore was mined from the Hemmens area that was uncovered by conveyor stripping, the Snyder Point area, and the pit bottom in the Hemmens, East Snyder and mid-Snyder forties.

The mining in the pit bottom was carried out to make barren ground available for rock and lean ore dumps. Ore was mined down to the hard, dense taconite.

By using the retreat plant and by mixing with better grades of ore from the bank, it was possible to mine 309,722 tons of gross crude ore from the lean ore stockpile, previously dumped in the pit.

Mining conditions were generally good throughout the year. One of the greatest difficulties in grading resulted from the mining of manganese ore in the Hemmens. This ore was very spotty in the bank, and the analysis indicated by the drilling was not dependable.

Most of the ore from the Hemmens area was from the upper cherty horizon. The top fifty feet of this material was a very low grade, painty and limonitic ore. Most of the material would not make a satisfactory concentrate without being mixed with higher grade ores from other parts of the pit.

The ore from the Snyder Point area was a good grade of wash and retreat ore. Some of the ore on the bottom, near the taconite contact, contained seams of high grade magnetite. At times this material caused some trouble in the medium circuit of the heavy density plant.

7. OPEN PIT

b. Open Pit Mining (Continued)

The Hemmens lease produced 365,443 tons of gross crude; the Snyder lease produced 474,998 tons of gross crude, of which 101,561 tons came from the lean ore stockpile. The Bovey lease produced 1,107,253 tons of gross crude ore, of which 208,161 tons came from the Bovey lean ore stockpile.

In addition to the actual mining, a total of 180,873 tons of pit rock, clean-up and other lean ore materials were moved during mining. Most of this material was moved on the night shift, or when one shovel could handle plant requirements. This material amounted to 2/10 of a ton per ton of concentrates produced. The cost of removal was \$.010 per ton of concentrates.

c. Pumping & Drainage

The sump that was dug during the 1950 ore season and the new pumps that were installed in May of 1951 took care of the pit drainage satisfactorily. Except for minor changes in the pipeline, the system remains as it was originally installed in the latter part of 1950. The mine water is being pumped north and eventually enters Prairie River. The cost of pumping per ton of concentrates during 1951 was \$.034.

8. BENEFICIATION

Plant Operations

The washing plant operated the same schedule as the pit, starting on April 30th and shutting down on October 20th. Crude ore feed to the plant totalled 1,786,936 tons, which produced 924,036 tons of concentrates. The average output of concentrates per shift was 2,952 tons, at a weight recovery of 51.71 per cent.

In general, the operation of the washing plant was satisfactory. The addition of another 5 ft. x 14 ft. primary screen during the previous repair period improved the screening operation, which in turn had a favorable effect on the production, and the grade of the ore produced. One of the main difficulties during the season was in the operation of the rock hopper and rock chute in the screening plant. This part of the structure is being remodeled, and it is expected a much improved operation will result.

Except for periods when only wash ore concentrates were being produced, the heavy media plant was operated on the same schedule as the washing plant. Operating 214 shifts, the heavy media plant received 272,007 tons of heavy media feed and produced 197,090 tons of heavy media concentrates, the remaining 74,917 tons being rejected as coarse tailings.

While 606,253 tons of retreat concentrates were produced, heavy media concentrates accounted for only 197,090 tons, or 32.50 per cent of this total. This was due primarily to the fact that, except on a very few occasions, just the 1/2" fraction of the crude was sent to the heavy media plant. When the 1/8" material was sent to the heavy media plant, the results were never very satisfactory because of difficulty in maintaining proper gravity for all sizes of material. As a result, it appears that when it becomes necessary to treat the finer sizes (1/8" to 1/2") a second unit of heavy media will be required.

During the past operating season, a Dorr Company cyclone (Dorrclone) was installed at the Canisteo plant on an experimental basis. The purpose of this installation was to determine the ability of this machine to deslime current classifier overflows prior to the conventional fine ore treatment.

The results indicated that this cyclone was very effective for this job, and it is expected that cyclones will be incorporated in the flowsheet on the installation for fine ore treatment.

During the season it was necessary to stockpile 222,558 tons of concentrates. 111,088 tons were removed during the current season, leaving a balance of 111,470 tons in stockpile on January 1, 1952.

8. BENEFICIATION (Continued)

Plant Operation

The following is a brief classification of the delays to the washing plant and retreat plant showing the time lost and a percentage of the total time worked.

<u>Washing Plant</u> <u>Source of Delay</u>	<u>Total</u> <u>Hours</u>	<u>% of Total</u> <u>Working Hours</u>
Out of ore	69.22	2.78
Screening Plant Equipment	41.78	1.68
Washing Plant Equipment	42.09	1.69
Electrical Power	3.41	0.14
Pumps & Pipe Lines	15.17	0.61
Conveyors	32.91	1.32
Railroad Cars & Tracks	6.42	0.26
Total	211.00 hours	8.48 per cent

<u>Heavy Density Plant</u> <u>Source of Delay</u>	<u>Total</u> <u>Hours</u>	<u>% of Total</u> <u>Working Hours</u>
Heavy Density Plant Machines	37.73	2.05
Electric Power	4.75	0.26
Pumps & Pipe Lines	31.17	1.69
Conveyors	54.76	2.97
Adjusting Gravity	2.00	0.11
Total	130.41 hours	7.08 per cent

The concentration data for the year was as follows:

	<u>Tons</u>	<u>Per Cent of</u> <u>Total Mined</u>	<u>Per Cent</u> <u>Iron Dried</u>	<u>Recoveries</u> <u>Tonnage</u>	<u>Iron</u> <u>Unit</u>
<u>Washing Plant</u>					
Crude Ore & Rock Mined	620,379	100.00	42.34		
Rock Removed in Mining	38,049	6.13	36.87		
Crude Ore Transferred to Screening Plant	582,330	93.87	42.70		
Rock Rejects in Screening Plant	38,120	6.15	36.92		
Crude Ore Entering Mill	544,210	87.72	43.10		
Concentrates Produced	317,783	51.22	55.98	58.39	75.84
Tailings (By Deduction)	226,427	36.50	25.02		
<u>Retreat Plant</u>					
Crude Ore & Rock Mined	1,369,882	100.00	40.59		
Rock Removed in Mining	4,518	.33	37.18		
Crude Ore Transported to Mill	1,365,364	99.67	40.60		
Rock Rejects in Screen Plant	122,638	8.95	36.91		
Crude Ore Entering Mill	1,242,726	90.72	40.97		
Concentrates Produced	606,253	44.26	55.57	48.78	66.17
Heavy Density Rejects	74,917	5.47	42.13		
Tailings (By Deduction)	561,556	40.99	25.05		

9. MAINTENANCE & REPAIRS

The winter repair program at the shops, washing plant and stripping conveyor were carried forward from the first of the year until the beginning of the mining and stripping operations. At the washing plant the usual repairs to plant equipment took place. The primary screen floor was revised and an additional 5' x 14' screen screen installed.

9. MAINTENANCE & REPAIRS (Continued)

The crude ore pocket was repaired and reinforced. Pit equipment that was not being used on stripping was overhauled. The repair program was again resumed at the end of the operating season and continued until the end of the year. At the plant, work on the revision of the rock pocket in the screening plant was started. In this revision, a 5 ft. pan conveyor, approximately 30 ft. in length, forms the bottom of the rock hopper. By use of this conveyor, rock will be deposited in a truck outside the screening plant. Repairs to the stripping conveyor equipment began immediately after the operation was shut down. The drive end of the trailing conveyor was repaired and reinforced. The repairs and alterations to the screening plant were started and will continue into 1952. A five foot pan conveyor will replace the three foot conveyor under the wobbler feeder. This is being done to eliminate delays caused by clay sticking to the side walls of the hopper under the wobbler feeder. A rock pocket is also being added to the screening plant. This will make it possible to use one truck instead of two for rock disposal.

10. COST OF OPERATION

a. Comparative Mining Costs

	<u>1951 Budget</u>	<u>1951 Cost Per Ton</u>	<u>1950 Cost Per Ton</u>
<u>Product</u>			
Wash Concentrates		317,783	644,554
Retreat Concentrates		606,253	115,926
Total Product	<u>800,000</u>	<u>924,036</u>	<u>760,480</u>
Percent Recovery		47.44	47.85
Average Daily Product		6,507	6,036
Tons Per Man Per Day		38.48	36.72
Days Operated		142 days	126 days
<u>Cost</u>			
Pit Operating	.268	.298	.231
Concentrating	.236	.202	.142
Loading Stockpile Ore	.012	.010	.007
General Mine Expense	.176	.179	.170
Winter & Idle Expense	.306	.402	.377
Cost of Production	<u>1.313</u>	<u>1.421</u>	<u>1.179</u>
Depreciation - Plant & Equipment		.071	.100
" - Motorized & Other		.059	.065
" - Movable Equipment		.008	.006
Amortization - Leasehold		.134	.151
" - Stripping		.570	.534
Taxes - Ad Valorem		.159	.168
" - Occupational		.256	.266
" - Royalty		.035	.036
Total Depreciation, Amortization and Taxes		<u>1.292</u>	<u>1.326</u>
Misc. Expense & Income		<u>.001</u>	<u>.001</u>
TOTAL COST AT MINE		\$2.712	\$2.506

b. Cost Comments

Crude ore mining costs are slightly over the budget and \$.056 over the 1950 costs. The expansion of the structure drilling program accounts for \$.040 of the increase. Slight increases were also noted in drilling and blasting and in truck maintenance.

While concentrating costs were below the budget, they were \$.060 over the 1950 costs. The purchase of screen cloth, amounting to about \$10,000.00 was charged against concentrating, since the material was not received until after the beginning of ore season. The 1950 concentrating costs were credited with an item of about \$17,000.00 from E&A No. CC-219 (re-circulation system at washing plant) which lowered the 1950 costs of concentrating \$.020 per ton, making an unfavorable comparison with 1951 costs.

10. COST OF

OPERATION (Continued)

b. Cost Comments (Continued)

General Mine Expense, which is up \$.009 per ton over 1950 costs, and \$.003 over the budget, can be accounted for by the additional social security taxes paid during 1951, and by the estimated wage adjustment noted on the cost sheet.

The Winter & Idle expense cost of \$.402 per ton is \$.096 above the budget estimate and \$.025 above the 1950 costs. This can be accounted for by the fact that several items were charged against Winter & Idle Expense that were not anticipated at the time the budget was prepared. Items such as repairs to the stripping conveyor and 7-W dragline from January to May, amounting to \$17,000.00, and the estimated wage adjustment of \$12,000.00 charged during the winter and idle period were not included in the budget estimate.

11. EXPLORATION & FUTURE EXPLORATION

Fifty-two holes were drilled during the year, for a total of 7,636 feet. Thirty-eight holes representing 5,325 feet were drilled by contract drillers. The remaining fourteen holes, or 2,311 feet, were drilled by Company crews.

The drilling was done in three separate areas during the year. A total of 4,698 feet of drilling was completed in the North Bovey extension, 1,636 feet in the Hemmens, and 1,302 feet in the pit bottom. The drilling in the North Bovey was a continuation of a program started in 1950, after it was decided that there might be a connection to a small ore body, explored by the Oliver Iron Mining Co. on the Morrison forty to the North. So far the drilling does not outline any definite trough, but indicates that the ore is rather spotty throughout the whole area. Most of the formation is a hard limonitic ore material that the test data indicates runs from a high grade but low recovery retreat ore to a very hard, irregularly banded limonitic taconite. Near the edge of the pit, however, this material is overlain with about twenty to thirty feet of wash ore. Between eighty and one-hundred-twenty feet of overburden overlie the ore formation. A thorough examination of the drilling already completed in this area should be made before future exploration is contemplated.

The drilling in the pit bottom indicated that except for a thin layer of retreat ore, the bottom of the mineable ore, as indicated by the original drilling, is generally correct.

Exploratory drilling in the Hemmens indicated that some layers of low grade ore extended out beyond the existing established pit limits. More drilling is required, however, to determine whether this ore is of sufficient quantity and quality to justify further pit extension in this area.

12. TAXES

	<u>1951</u>	<u>1950</u>	<u>Increase</u>	<u>Decrease</u>
Canisteo Mine, Washing Plant, Shops & Office.	\$130,376.75	\$114,142.09	\$16,234.66	
Washing Plant & Auxiliary Lands	1,427.24	1,310.63	116.61	
Personal Property	15,113.28	12,534.98	2,578.30	
Total	<u>\$146,917.27</u>	<u>\$127,987.70</u>	<u>\$18,929.57</u>	
Village Lots	238.75	214.59	24.16	
GRAND TOTAL	<u>\$147,156.02</u>	<u>\$128,202.29</u>	<u>\$18,953.73</u>	
Average Tax Rate(Mills)	133.68	120.25	13.43	

(Continued on next page)

12. TAXES (Continued)

Mineral reserve reviewed by State and reserve increased 1,180,240 tons, increasing tax value \$138,504.00 over our report.

Personal property tax value increased on account of additional new equipment. Mill rate increased by new per capita tax law allowances.

13. ACCIDENT & PERSONAL INJURY

There were 87 slight accidents at the Canisteo Mine during 1951. There were only two lost time accidents during the year, which are described as follows.

- (1) Name: Steve Latkovich
Date of Injury: Jan. 15, 1951
Cause: Latkovich was in the act of hooking a hook to a chain that lifts the drilling stem when he got his left hand caught between the hook and the chain.
Nature of Injury: Contusion of multiple lacerations 1st, 2nd and 3rd fingers left hand. Fracture middle phalanx proximal 3rd joint. Fractured terminal proximal end, fractured 4th metacarpal.
Time Lost: 101 days
Compensation: \$1500.00
- (2) Name: LeRoy Foix
Date of Injury: October 4, 1951
Cause: A rock or a chunk of ore became lodged in rolls of the crusher and Foix picked up a shovel that had the handle broken off and proceeded to use the end of the broken handle to break the chunk. The rolls caught the handle, pulled it down against guard of crusher and struck him on the jaw and both hands.
Nature of Injury: Laceration right lower jaw, laceration dorsum of both hands, simple fracture mid 1/3 mid metacarpal left hand, fracture 1st metacarpal right with displacement possibly compounded fracture proximal end of last metatarsal.
Time Lost: 75 days
Compensation: \$416.00

14. PROPOSED NEW CONSTRUCTION

Plans are under way for the construction of a fine ore plant to treat present classifier overflows and to reclaim fine ore from the existing tailings pond. Present plans are to construct this unit in 1952 so that it will be ready to go into operation in 1953.

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

Equipment received during 1951:

- 1 - New screening plant for conveyor stripping
- 1 - 4,112' length 36" conveyor belt for conveyor stripping
- 3 - Model 39TD Euclid rear end dump trucks
- 1 - Model 4161-E Marion electric shovel
- 1 - 5 ft. x 14 ft. double deck style "B" screen
- 2 - 10 x 8 S. J. pumps
- 2 - 200 H.P. motors for above
- 1 - 54-B Bucyrue-Erie shovel with dragline attachment, bucket & 60 ft. boom.

(Continued on next page)

15. EQUIPMENT RECEIVED
& PROPOSED NEW

EQUIPMENT (Continued) Equipment rec'd in 1951:

- 1 - Model 29TD Bucyrus blasthole drill
- 720 ft. of 16" iron pipe for tailings line
- 1 - Hoe front attachment
- 1 - fresh water well sunk by mine labor
- 1 - 50 GPM water softener
- 1 - 10,000 gallon wood water tank
- 1 - steel tower for above
- 1 - #42 peerless pump
- 1 - Model #12 motor grader - Caterpillar manufacture
- 1 - $\frac{1}{2}$ ton Ford pickup truck - #72
- 1 - $\frac{3}{4}$ ton Ford pickup truck - #77

Proposed new equipment for 1952:

- 1420 ft. 36" conveyor belt for crude ore conveyors
- 2 - 250 H.P. motors and gear reducers
(to be transferred from Holman-Cliffs Mine)
- 1 - New steel carpenter shop building
- 1 - 300 H.P. motor for tailings pump
- 1 - 8 cu. yd. Hendricks dragline bucket
- 1 - new tractor
- 4 - 34-ton Euclid rear end dump trucks

HAWKINS MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL

Stripping operations and general repair in progress at the close of 1950 continued in 1951, with stripping in taconite and paint rock on the east side of the pit conducted on a twenty-shift per week basis until March 12th, when operations were discontinued for necessary repairs to equipment for the 1951 season.

Winter repair work was carried on at the shops on a five day per basis. This included repairs to shovels, tractors, trucks, dump cars, etc., also repairs to pit screening plant, belts and conveyor system. Necessary shop repairs on all Hawkins washing plant equipment and some district repair work was included in this schedule. At the Hawkins concentrating plant the winter repair work was discontinued on January 26th and resumed again on March 19th.

To facilitate the moving of the washing plant to the proposed new plant site at the South end of the Hawkins pit, a crew of steel workers consisting of four men were engaged on May 15th. They removed all machinery and steel work that was not required for the 1951 ore operation. This work continued during the summer, rivets being punched out of steel columns and sections, with bolts and washers replacing the rivets, so that at the close of the washing operation on August 11th the steel columns and sections could more easily be taken down and sent to the new site.

The washing plant and pit operations for the 1951 ore season commenced on April 25th and during the month 74,387 tons of concentrates were loaded and shipped from stockpile and 2,487 tons were stocked due to lack of Great Northern cars.

With better weather conditions in 1951 than in 1950, plant and pit operation went on a single eight hour shift, five day per week basis on April 25th, and on April 26th this schedule was stepped up to eight hours five days per week. On May 16th this was again changed to a 3-8 hour shift, 6 day per week basis, to obtain the 1951 season ore requirements as soon as possible to expedite the plant moving program.

During the season's ore production program in 1951, a total of 1,389,634 tons of crude ore were mined and hauled to the pit screening plant, which delivered 1,348,369 tons of crude ore to the railroad equipment for haulage to the plant, after a total of 41,265 tons of rock rejects were removed.

From the ore hauled to the plant, a total of 666,848 tons of concentrates were produced by washing.

As of January 1, 1950, there was in the stockpile at the Hawkins washing plant a total of 113,162 tons, and during the shipping season a total of 199,714 tons were placed in stockpile due to lack of cars. During the shipping season a total of 104,907 tons of stockpiled ore was loaded out, leaving a balance at the end of the year of 1951 amounting to 207,969 tons. Final shipments from stockpile were concluded the latter part of October.

A contract was entered into between The Cleveland-Cliffs Iron Co. for the stripping and mining and washing of MacKillican Mine ore in order to allow The Cleveland-Cliffs Iron Co. to move and re-erect the Hawkins washing plant on the MacKillican property adjacent to the Hawkins. In addition to moving and re-erecting the washing plant, a heavy project involving the re-alignment of approach roads, power lines, transformer stations, construction of a new tailings basin, re-establishment of Great Northern tracks to the new plant site and many other details were started in the latter part of May.

In order to expedite removal of stripping from both the Hawkins and MacKillican pit to the dumps, it was necessary to build new bridges across Highway No. 169 as well as the Great Northern tracks in order to provide a two lane structure between the pit and

GENERAL (Continued)

the dump. These bridges were made up of wooden fence and steel girders and served as a one-way lane, while the two bridges formerly used by railroad equipment provided the return lane for stripping trucks. During the latter part of April brushing and clearing went on at the new plant site, followed by grading by means of tractors and shovels to provide areas for erection of foundations for the new plant. A contract was entered into with the Great Northern Railway to provide the cut and fill for the new railroad system serving this plant, which involved removal of a portion of an old dump to provide tail track space for cars serving the plant and stockpile grounds. This involved the placing of culverts, crossings, etc.

During July a new 20,000,000 gallon reservoir was excavated with the dikes and dams in place and 4,400 ft. of 16 inch water pipe installed from O'Brien Lake to the plant. New power lines were also installed and the transformers serving the shop area moved to a new site.

On August 11, 1951, washing plant operations were discontinued and the dismantling crew proceeded with the dismantling of all steel members of the plant, loading them onto flat cars and dump cars for distribution at the new plant site. During this period also all equipment was removed from the plant and that portion of the equipment which was to be used was transported to the new plant site. All dismantling work was completed and erection at the new site started on October 1st.

By December 31, 1951, work of re-erection and installation of equipment had proceeded to a point which indicated that this plant will be ready at the start of the 1952 shipping season to again produce concentrates. It will be necessary to move the entire screening plant in the pit to a new site, and this is being done without dismantling by moving the entire structure intact. Most of the conveyor equipment and galleries required to transport the ore from the screening plant to the pit were in place by the end of the year, with only a short section necessary to tie in once the screening plant move has been accomplished.

Preparation for stripping the MacKillican ore body, such as the grading of roads, the installation of culverts, etc., started early in the summer, and on July 16 the actual stripping of the MacKillican ore body was in progress. Surface material from the MacKillican Mine in the upper levels was made up of an old dump, with material of such consistency that rain seriously hampered the stripping operations, making it necessary to rock the road surfaces and log the 6 cu. yd. shovel on mats. A new P&H 6 cu. yd. shovel was delivered and used on the MacKillican stripping, together with spasmodic use of the 5 cu. yd. Marion shovel. As of December 1, 1951, 800,903 cu. yds. of surface and dump material were removed out of a total of 2,200,000 yds. estimated to be required for the 1952 program. It is anticipated that the balance of this stripping will be completed so that the necessary 200,000 tons of ore can be made available from the MacKillican in 1952. The stripping ratio is terrifically high for the first year and will gradually be reduced during subsequent years.

Stripping of taconite and paint rock on the East side of the Hawkins Pit was discontinued on March 12, and again resumed the latter part of July on a moderate scale; however, it is anticipated that there will be no difficulty in removing the balance of the stripping necessary for the Hawkins ore production for the 1952 season prior to the commencement of shipping operations and concurrently during the year. The Hawkins stripping program has produced a total of 569,084 cu. yds. of taconite and paint rock, which completed E&A No. 397 in January, 1951, at which time E&A No. CC-417 was begun.

The exploratory drilling program in effect in 1950 was continued from January, 1951 to July, 1951. One contract drill and one company drill put down 2938 feet of structure drill hole, adding both wash and retreat ore tonnages to the ore tonnage estimates and defined limits for sample drilling.

1. GENERAL (Continued)

A service garage for MacKillican trucks was built within the junction of the Hawkins and MacKillican haul roads, just North of the bridge over Highway 169. Foundations for the dry from the old plant were poured at the new plant site and a laboratory and crusher building erected and almost completed.

A strike of Cleveland-Cliffs Iron Company employees from June 9th to June 15th, amounting to six days, in violation of contract, contributed to delays during the year.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades

	<u>Tons</u>
Hawkins Crude-----	1,348,369
Hawkins Bess.Coarse Concts.-----	204,682
Hawkins N.B. " "-----	332,398
Hawkins N.B. Fines "-----	<u>129,768</u>
Total Concts. -----	666,848

b. Shipments by Grade

Hawkins Bess.Coarse Concts. -----	240,049
Hawkins N.B. " "-----	279,011
Hawkins N.B. Fines "-----	<u>52,981</u>
Total Concts. Shipped -----	572,041

c. Stockpile Inventories

Hawkins Coarse Concts.(1950)-----	8,255
Hawkins " " (1951)-----	122,927
Hawkins Fines " (1951)-----	<u>76,787</u>
Total -----	207,969

d. Production by Months - Crude Ore and Concentrates

<u>Month</u>	<u>Crude Ore</u>	<u>Coarse Concts.</u>	<u>Fines Concts.</u>	<u>Concts. Total</u>
April	32,779	17,127		17,127
May	367,081	151,517	38,438	189,955
June	354,421	142,617	37,538	180,155
July	403,998	159,644	34,543	194,187
August	190,090	66,175	19,249	<u>85,424</u>
Total .	1,348,369	537,080	129,768	666,848

a. Ore Statement

As of January 1, 1951, there was in stock 113,162 tons of coarse concentrates and no fines. Of the 113,162 tons, there were 104,907 tons shipped out during the season, leaving a balance as of Jan. 1, 1952 of 8,255 tons of 1950 production.

3. ANALYSIS

(Continued on next page)

3. ANALYSISa. Tonnage & Analysis of Crude Ore Produced

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>	<u>Moist.</u>
Hawkins	1,348,369	38.75	.027	40.00			

b. Tonnage & Analysis of Concentrates Produced

Hawkins Bess. Coarse Conct.	204,682	56.38	.034	11.75	.42	.37	6.77
Hawkins N.B. Coarse Conct.	332,398	56.52	.040	11.62	.55	.38	6.68
Hawkins N.B. Fines Conct.	129,768	52.96	.028	19.23	.49	.42	8.13
Total	666,848	55.78	.036	13.14	.50	.38	6.99

c. Tonnage & Analysis of Concentrates Shipped

Hawkins Bess. Coarse Conct.	240,049	56.44	.034	11.70	.41	.37	6.69
Hawkins N.B. Coarse Conct.	279,011	56.75	.043	11.31	.53	.38	6.63
Hawkins N.B. Fines Conct.	52,981	52.52	.030	19.74	.55	.43	8.34
Total	572,041	56.23	.038	12.26	.48	.38	6.81

d. Tonnage & Analysis of Ore in Stockpile

Hawkins Coarse Conct.(1950)	8,255	56.94	.041	11.01	.49	.40	6.84
" (1951)	122,927	56.20	.036	12.00	.55	.38	6.59
Hawkins Fines(1951)	76,787	53.26	.027	18.88	.45	.42	7.99
Total Bal.	207,969	55.14	.033	14.50	.51	.40	7.12

e. Complete Analysis of Shipments

	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alu.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>
Hawkins Bess.Conct.	56.44	.034	11.70	.41	.37	.28	.20	.011	6.07
Hawkins N.B. "	56.75	.043	11.31	.53	.38	.27	.21	.012	5.82
Hawkins N.B. Fines	52.52	.030	19.74	.55	.43	.28	.21	.011	3.38

4. ESTIMATE OF
ORE RESERVES

	<u>Reserve 12-31-50</u>	<u>Mined 1951</u>	<u>Bal.After Mining</u>	<u>Changed by Re-Est.</u>	<u>Reserve 12-31-51</u>
<u>SW-NW 32,57-22</u>					
O.P.Wash Conct.	576,280	495,759	80,521	362,198	442,719
O.P.Ret.Conct.	698,844	—	698,844	537,107	1,235,951
U.G.Wash Conct.	—	—	—	150,819	150,819
U.G.Ret.Conct.	—	—	—	265,513	265,513
Totals	1,275,124	495,759	779,365	1,315,637	2,095,002

(Continued on next page)

4. ESTIMATE OF ORE RESERVES

	<u>Reserve</u> <u>12-31-50</u>	<u>Mined</u> <u>1951</u>	<u>Bal. After</u> <u>Mining</u>	<u>Changed</u> <u>By Re-Est.</u>	<u>Reserve</u> <u>12-31-51</u>
<u>NW-SW 32,57-22</u>					
O.P.Wash Conct.	245,380	---	245,380	-171,381	73,999
O.P.Ret.Conct.	89,420	---	89,420	- 88,780	640
U.G.Wash Conct.	161,002	---	161,002	526,051	687,053
U.G.Ret.Conct.	---	---	---	56,138	56,138
Totals	495,802	----	495,802	322,028	817,830
<u>NE-SE, 31,57-22</u>					
O.P.Wash Concts.	790,748	28,163	762,585	206,011	968,596
O.P.Ret. Conct.	822,967	---	822,967	347,520	1,170,487
U.G.Wash Concts.	---	---	---	81,074	81,074
U.G.Ret.Conct.	---	---	---	364,806	364,806
Totals	1,613,715	28,163	1,585,552	999,411	2,584,963
<u>SE-NE 31,57-22</u>					
O.P.Wash Conct.	385,441	142,926	242,515	411,649	654,164
O.P.Ret.Conct.	217,934	-	217,934	489,522	707,486
Totals	603,375	142,926	460,449	901,201	1,361,650
<u>TOTAL HAWKINS</u>					
	3,988,016	666,848	3,321,168	3,538,277	6,859,445

Developed Ore Factors Used

	<u>Cu.Ft.</u> <u>Per Ton</u>	<u>Rock Deduction</u>	<u>%</u> <u>Recovery</u>
Wash Conc.	14	0	60
	14	0	40
	14	0	55
	14	0	40
	14	0	40

Estimated Analyses of Ore Reserves

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Silica</u>
<u>Hawkins</u>				
Bess.Wash Conc.Open Pit	1,441,887	58.48	.031	9.76
N.B. Wash Conc. " "	697,591	58.30	.056	9.92
Bess.Ret. " " "	1,901,653	58.57	.030	10.02
N.B.Ret. " " "	1,212,911	58.81	.055	9.90
Bess.Wash U.G.	477,022	58.03	.030	9.26
N.B. " " "	441,924	56.86	.060	9.84
Bess.Ret. Conc. U.G.	539,986	58.28	.029	10.12
N.B. Ret. Conc. U.G.	146,471	58.10	.061	9.60
Total	6,859,445	58.39	.040	9.87
Bess.Wash Conc.O.P.	1,441,887	58.48	.031	9.76
N.B. Wash Conc.O.P.	697,591	58.30	.056	9.92
Bess. Wash Conc.U.G.	477,022	58.03	.030	9.26
N.B. Wash Conc.U.G.	441,924	56.86	.060	9.84
Total Wash Conct.	3,058,424	58.14	.041	9.73
Bess.Ret.Conc.O.P.	1,901,653	58.57	.030	10.02
N.B. Ret.Conct. O.P.	1,212,911	58.81	.055	9.90
Bess.Ret. Conc. U.G.	539,986	58.28	.029	10.12
N.B. Bess.Ret.Conc.U.G.	146,471	58.10	.061	9.60
Total Retreat Concentrates	3,801,021	58.59	.039	9.98
Total Bess.Conc.	4,360,548	58.45	.030	9.86
Total N.B. Conc.	2,498,897	58.39	.040	9.87
Total Hawkins	6,859,445	58.39	.040	9.87

5. LABOR & WAGES

a. Comments

Labor was scarce as the ore season started and continued as the season advanced. In the fall when contractors and mining companies laid off men, labor became more plentiful. Disregarding the strike in June, there were few grievances, but efficiency and the attitude of men toward their work is growing worse and is getting to the point where is industry is to survive, every piece of equipment they use must be as nearly fool-proof and automatic as possible. Labor will not cooperate in keeping their equipment in operating condition, but are looking for opportunities to kill time. There is little pride in doing a job well and no attempt to keep equipment in better shape than their fellow worker. This is not true of all the men, but certainly the trend, with new men and a few of the older men as well.

b. Comparative Statement of Wages and Product:

Product-----	666,848 tons
Number of days operated -----	86 days
Number of shifts operated -----	236 shifts
Average Daily Product-----	7,754 tons
Average Product per Shift -----	2,826 tons
Average Product of Men Working -----	226 tons
Average Wages per Hour (Ore Season) -----	\$1.855
Amount Paid for Labor (Ore Season)-----	\$250,870.75
Labor Cost per Ton-----	\$.375

6. SURFACE

a. Buildings & Repairs

Some repair and remodeling was done to location houses. There was no exterior painting of any of the dwellings.

At the shops, there were a few minor upkeep repairs. A slab concrete floor was laid in the second stall of the truck storage garage to aid in the repair of motor equipment. The carpenter shop was remodeled to handle increased work from new construction at the new plant site.

b. Roads, Transmission Lines and Tracks

Roads in the pit and the roads to the dumps were improved where possible and grades kept to a minimum. New roads were built to the east approach of the MacKillican Pit for stripping, also an entry to the west was made later. Road approaches were changed out of the Hawkins pit to the dumps and a part of this road raised to the elevation of the new plant stockpile grounds. A road approach was excavated on the South side of lower stockpile grounds and this was used for the grading of the stockpile grounds and Great Northern tracks. Still another road was built, but is not completed, on the North side of the stockpile grounds, which connects with the MacKillican stripping road and Highway 169 at the extreme East end of Great Northern track layout to the new plant site. This road also serves a new bank of transformers between the MacKillican pit and the new stockpile grounds, and when completed will be a direct route from Highway 169 to the new plant. Another road was graded, making a direct route from the Hawkins shops south to the MacKillican and at present a connection is held to the east approach road to the MacKillican along the Northeast bank of the MacKillican Pit.

Within the Hawkins Pit a new road to the pit screening plant is completed and will serve the mining operations from the MacKillican and also mining operations in the South and East ends of the Hawkins pit. An approach road in Taconite on the East side of the Hawkins for stripping in this area, under E&A CCO-417, was also completed and stripping commenced the latter part of August.

6. SURFACE (Continued)

b. Roads, Transmission Lines and Tracks (Continued)

New transmission lines were put in and old ones taken out due to construction at the new plant and MacKillican stripping. Power hookups were changed and new lines energized as the work progressed. Our new lines take off from the Minnesota Power & Light Co. lines on the South end, along Highway No. 169.

A switch station was built close to the Minnesota Power and Light Co. main line, and from there our lines were brought west to the old line just North of the highway bridge; also east and north across the lower end of the new stockpile grounds, to a bank of transformers between the south bank of the MacKillican stripping and the north side of the new stockpile grounds. The line then leads into the new plant and then north into the Hawkins Pit. The power line, down along the conveyor, to the pit screening plant is about 40 per cent completed.

To provide a means of transportation of steel and equipment from the old plant to the new site, a new track has been built by the Great Northern Railway from a point below the Nashwauk station across the highway and stockpile ground past the mill site and extending into the tail track cut to the West. This trackage is being used for the steam crane for erection purposes and supplies as well as equipment for the new plant to be unloaded at the plant site as work progresses.

In order to open up the MacKillican stripping area from the west side, the old tracks running from the old loading bin at the end of the conveyor to the washing plant were removed, and now terminate south of the new stockpile grounds. The balance of the trackage to the old plant site will be removed and the Great Northern will establish their tracks to serve the new tailings basin plant on a portion of this grade.

7. OPEN PIT

a. Stripping

E&A No. 397 covering the removal of taconite and paint rock from the Hawkins was set up in 1950 and stripping was continued on this E&A in 1951. For the year of 1951, E&A CC-417 had been established, and after the exhaustion of E&A CC-397, work on E&A CC-417 started about the middle of January. Stripping operations continued until about March 12, when the property shut down for repairs to equipment. The stripping under these E&A's, consisting of hard, blocky rock, taconite and waste material, was conducted on a 20-shift per week basis to make ore available for 1951 production. Crews were arranged on work schedules of 40 hours per week. Two $3\frac{1}{4}$ yd. Bucyrus-Erie electric shovels were used on this work due to a breakdown of the Marion shovel counter frame and a total of 8 to 9 twenty-yard dump trucks transported this stripping to the dumps, a distance of 7,000 feet.

After the completion of the shipping season on August 11, stripping began in the North and East portions of the pit on August 13 under the same E&A's, and a total of 569,084 cu. yds. of taconite, paint rock and waste material was removed to the end of the year.

Excavation for the new conveyor system in the pit, site for the screening plant, and a new road made necessary the handling of a large tonnage of wash and retreat ores, which were stocked in the pit, together with paint rock, taconite and waste materials, which were removed to the dumps. All of this work resulted in a slow, cramped operation for stripping equipment, which will be completed shortly after the first of the year.

Stripping removed under E&A No. CC-397, completed in January, showed a cost of \$.539 per cu. yd., as compared to a budget of \$.435, resulting in an overrun of \$.104 per cu. yd. Cost for E&A CC-417 amounted to \$.555 per cu. yd. versus a budget estimate of \$.501, indicating an overrun of \$.054 per cu. yd. The material being removed under E&A CC-417 at the end of the year consisted of a top layer of extremely hard taconite, resulting in a great deal of drilling and blasting, difficult loading, and comparatively low truck factors, which is believed will be improved after this top layer has been removed and the softer paint rock material underlying encountered.

7. OPEN PITa. Stripping (Continued)

The following tabulations show the stripping removed during the year under both E&A CC-397 and E&A CC-417:

	<u>Waste Material</u>	<u>Paint Rock</u>	<u>Taconite</u>	<u>Total</u>
E&A CC-397	-	11,506	53,032	64,538
E&A CC-417	27,821	262,459	214,266	504,546
Total(Cu.Yds.)	27,821	273,965	267,298	569,084

Stripping in the MacKillican area has been handicapped by the fact that a portion of this lies in an old swamp and the balance is largely covered with an old dump, none of which provided footing for either shovels or trucks. Trucks were floated on mats, and even with the dumping of rocks on the road, proper roads were impossible to maintain due to the wet weather.

Although the delivery of seven 30-ton Mack trucks improved the track situation earlier in the year, many breakdowns were encountered on the older trucks, and breakdowns of shovel equipment were also occurring frequently, even though the 5 cu. yd. Marion shovel was comparatively new and the P&H 6 cu. yd. machine delivered in September. From the MacKillican property to December 31, 1951, a total of 800,903 cu. yds. of overburden was removed, of which 658,470 cu. yds. was surface material and 142,433 cu. yds. consisted of paint rock, necessitating separation of these materials on different dumps. Estimated cost of stripping was \$.308 per cu. yd., and as of December 31st the actual cost was \$.317, for an overrun of \$.009 per cu. yd.

The benefit to be derived by placing the washing plant on the MacKillican rather than the old site, will be the elimination of the haul in excess of $1\frac{1}{2}$ miles by rail equipment from the pit to the plant and a substitution of feed direct from pit to plant by means of conveyors. During the season of 1951 the Hawkins washing plant suffered total delays of about 11.84 per cent of the total working time as against total delays at the Holman plant, where railroad equipment was eliminated of 4.55 per cent for the season. This resulted in elimination of approximately one-half of the lost time encountered, almost all directly chargeable to railroad equipment.

Yardages and tonnages involved in grading for the new plant site, great northern tracks, stockpile grounds, roads, conveyor cuts in the pit, cut for the screening plant site and miscellaneous roads are tabulated as follows:

Plant site, etc.	168,536 cu. yds. surface material
Great Northern & Stkpile grounds	174,516 cu. yds. surface material
Season Total	343,152 cu. yds. surface material
<u>Ore Stockpiled in Pit</u>	
Pit roads, conveyors & screen plant	396,382 tons retreat ore
Pit roads, conveyors & screen plant	113,677 tons wash ore
Season Total	510,059 tons wash retreat ore

All of new washing plant work, excavation in pit for conveyors and screening plant will be completed so that the Hawkins Mine will meet its ore requirements in 1952, and the MacKillican stripping will be advanced so that the ore requirements from this property will be met before the end of the 1952 ore season.

7. OPEN PIT

b. Open Pit Mining

Work in the new plant began on April 25th with a single 8 hour shift, 5 days a week and was changed on April 26th to two 8-hour shifts on a 5-day basis and again changed on May 16, when the schedule was stepped up to three 8-hour shifts, six days per week in order to complete production as rapidly as possible. The season's production was finished on August 11th and the production lost during the strike was compensated for by an earlier starting date.

Pit operations continued for 86 days, or 236 shifts, producing a grand total of 1,389,634 gross tons of crude ore, from which 41,265 tons of rock rejects were screened out. The average crude ore per day amounted to 16,159 tons and per shift 5,888 tons, including scalped rock and 5,714 tons net, excluding this rock. The weight recovery from the crude ore amounted to 49.46 per cent on a gross basis and 47.99 per cent on a net basis. These recoveries, compared with 1950, reveal that during that period recoveries were 51.98 per cent gross and 50.24 per cent net. The cost per ton of crude ore mined in 1951 amounted to \$.250 versus a budget of \$.319, for an underrun of \$.069.

Production of crude ore in 1951 was obtained from the pit bottom as well as the Northeast corner from which the taconite had been stripped. Ores from these areas were mixed from two shovels. Six 20-ton trucks were used on ore haulage and one truck handled screen rejects. The pit bottom was lowered below the drainage drift and an electric pump was installed in a sump in the pit and pumping was discontinued through the old drainage shaft which had caved due to blasting in the taconite area.

In addition to the crude ore mined, 7,088 tons of cleanup and 3,298 tons of lean and waste material were removed, and the cost of removing this material amounted to \$.005 per ton of concentrates.

It is planned to obtain 1952 ore from the pit bottom where possible to clean up an area so that rock rejects may be dumped in the pit. It is anticipated that in 1952, the underground pumping installation having been abandoned, pumping will be limited to the Layne and Boulder deep well pumps at the main shaft due to the caving of the underground operations by blasting from the taconite stripping. The cost of pumping in 1951 amounted to \$.052 per ton of concentrates produced.

8. BENEFICIATION

Washing plant operations were conducted on the same general basis as the open mining and a total of 666,848 tons was obtained from 1,348,369 tons of crude treated at the mill. The average production per shift was 2826 tons of concentrates with a weight recovery of 49.46 per cent. In general, the washing plant operations were about the same as 1950 with the exception that 1950 was on a two shift per day basis and 1951 on a three shift per day basis. There was a decline in weight recovery from 50.24 per cent in 1950 to 49.46 per cent in 1951.

Again the largest source of delay to the wash plant was crude ore. Other sources of delay were crude ore conveyor, crude ore feeder, clear water line, primary screen and Great Northern Railroad cars and tracks.

It was necessary to stockpile during the year on account of car shortages 199,714 tons of concentrates during the shipping season. This, with 113,162 tons left in stock as of January 1, 1952, made a total of 312,876 tons of concentrates. 104,907 tons of concentrates were loaded and moved from stockpile, leaving a balance of 207,969 tons remaining as of January 1, 1952. Of this balance, 131,182 tons are coarse concentrates and 76,787 tons are fines.

8. BENEFICIATION (Continued)

Following is a summary of plant operations for the 1951 season:

	<u>Tonnage</u>	<u>% of Total Mined</u>	<u>% of Iron Dried</u>	<u>Tonnage Recovery</u>	<u>Iron Unit Recovery</u>
Crude Ore & Rock Mined	1,398,589	100.00	38.33		
Less: Pit & Screen Rock	50,220	3.59	26.97		
Crude Ore Entering the Mill	1,348,369	96.41	38.75		
Coarse Concts. Produced	537,080	38.40	56.47	39.83	58.05
Fines Concts. Produced	129,768	9.28	52.96	9.63	24.84
Tailings (By Deduction)	681,521	48.73	22.08		

Washing Plant Delays

<u>Source of Delay</u>	<u>Hours</u>	<u>Per Cent</u>	<u>Per Cent of 1920 Working Hours</u>
Crude Ore	145.20	63.87	7.56
Crude Ore Bin	.50	.22	.03
Crude Ore Feeder	11.17	4.91	.58
Crude Conveyor	26.25	11.55	1.37
Primary Screen	9.83	4.32	.51
Picking Belt	.25	.11	.01
Crusher	2.00	0.88	.10
Log Washers	2.66	1.17	.14
Log Dewatering Screen	.32	.14	.02
Classifier	1.92	.84	.10
Stockpile Conveyor	.42	.19	.02
R.R. Cars and Tracks	5.92	2.60	.31
Clear Water Line	18.25	8.03	.95
Electric Power	1.50	.66	.08
Tailing Line	1.17	.51	.06
Total	227.36	100.00	11.84

Recapitulation

Crude Ore Delays			
Ore to Head of Mill	183.12	80.54	9.54
Ore Processing Delays	44.24	19.46	2.30
Total	227.36	100.00	11.84

9. MATERIALS & REPAIRS

From the start of the year to the time ore production opened, equipment not used in stripping was overhauled where possible. After the close of the stripping program on March 12, the balance of the equipment was repaired and placed in condition for the ore season. Washing plant repairs continued after the first of the year until January 26th, with no further repair work in the plant until March 19. Necessary repairs were held down to a minimum with the knowledge that this plant would be moved at the close of the operating season in 1951. After the close of the ore season, all of the machinery and equipment in the new plant was sent to the shops, where a general repair program was carried out before transferring these to the plant for installation.

10. COST OF OPERATION

(Continued on next page)

10. COST OF OPERATIONS

a. Comparative Mining Costs

	<u>1951 Budget</u>	<u>1951 Cost Per Ton</u>	<u>1950 Cost Per Ton</u>
<u>PRODUCT</u>			
Wash Concentrates	675,000	666,848	672,986
Recovery Percentage	50.00	;47.99	50.24
Average Daily Output	-	7,754	5,516
Tons Per Man Per Day		39.44	33.23
Days Operated		86	122
<u>COST</u>			
Pit Operating	.319	.250	.265
Concentrating	.258	.180	.187
Loading Stockpile Ore	.023	.001	.015
General Mine Expense	.193	.186	.155
Winter & Idle Expense	.345	.442	.333
Cost of Production	<u>1.457</u>	<u>1.330</u>	<u>1.218</u>
Depreciation-Plant & Equip.	-	.100	.129
" -Motorized Equip.	-	.091	.061
" -Movable Equip.	-	.012	.007
Amortization - Stripping	-	.285	.142
Taxes - Ad Valorem	-	.281	.243
" - Occupational	-	.133	.118
" - Royalty	-	.171	.115
Total Depreciation, Amortization, and taxes	-	<u>1.023</u>	<u>.835</u>
Administrative Expense		.050	.053
Misc. Expense & Income		<u>.008</u>	<u>.008</u>
GRAND TOTAL COST AT MINE		<u>\$2.411</u>	<u>\$2.098</u>

b. Detailed Cost Comparison

The mining of crude ore showed a decrease in cost in 1951 of \$.015 per ton. This was due mainly to a decrease in drilling and blasting cost of \$.019 per ton of crude ore, and the structure of sample drilling down \$.043 per ton, though the trucks operating cost was up \$.010 per ton, the truck maintenance up \$.008, and the tractor maintenance cost up \$.003 per ton. The drilling and blasting cost was lower in 1951 than 1950 because a large amount of ore was mined in 1951 in the pit bottom below the drainage level which was not drilled because of being wet ore. The structure drilling cost was decidedly lower because this program was terminated on July 9th and the total footage considerably lower.

The concentrating costs in 1951 were \$.007 lower than in 1950, due mainly to transportation costs being \$.005 lower and buildings and machinery maintenance \$.011 lower but with washing costs \$.009 higher, due to operation of three shifts, the General Mine Expense costs were \$.031 higher in 1951 than in 1950, and this was due mainly to increased costs on Social Security Taxes and a new item in 1951 - costs of \$.023 for Wage Adjustment Estimate.

The Winter & Idle expense was \$.109 higher than in 1950 and was due largely to the shorter operating season in 1951.

11. EXPLORATION
& FUTURE
EXPLORATION

The extensive drilling program of 1950 was carried into 1951 to define limits and for sample drilling. One contract driller and the companydrill completed 2938 feet of drilling. Following is a tabulation of the drilling:

Longyear Company - Structure Drilling	1731 feet
Company, Structure Drilling	<u>1207 feet</u>
Total all drilling	2938 feet

The Longyear drill completed its work June 30th and the company drill July 9th. Results indicated an additional amount of wash and retreat ore and confirmed the belief that the second unit for the retreat plant is necessary and also it further justified the relocation of the plant itself to its new site.

12. TAXES

The following is a statement of the taxes for the Hawkins Mine for the years 1950 and 1951:

	<u>1951</u>	<u>1950</u>	<u>Increase</u>	<u>Decrease</u>
Hawkins Mine (Includes Shops and Locations)	\$159,783.60	\$142,521.72	\$17,621.88	
Hawkins Ming Washing Plant	5,928.08	5,985.93		\$57.85
Auxiliary Lands	1,456.40	1,281.97	174.43	
Personal Property	<u>20,156.31</u>	<u>13,494.49</u>	<u>6,661.82</u>	
Total	\$187,324.39	\$163,284.11	\$24,040.28	

Average Tax Rate (Mills)	213.03	215.16	213
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Mineral reserve increased by review 3,538,277 tons, increasing ad valorem tax value \$87,671.00. Personal property increased on account of larger stockpile on hand and purchase of new additional equipment in 1950 and spring of 1951 taxable in 1951.

13. ACCIDENTS AND
PERSONAL INJURY

There were nine compensable accidents at the Hawkins Mine during 1951. They are as follows:

- Name: Peter Lucas
Date of Injury: July 8, 1951 6:50 AM
Cause: Lucas was pulling on shovel door which was stuck. The door let loose, he became overbalanced, fell off shovel landing on left foot.
Nature of Injury: Left ankle swollen. Tender over dorsum
Time Lost: 108 days
Compensation: \$656.58
- Name: Charles J. Flynn
Date of Injury: August 22, 1951 2:00 AM
Cause: Flynn was fueling a truck. He stepped down from the truck, missed the step and jumped. In doing so his ring on ring finger of left hand caught on door frame, tearing the flesh from finger. Later on finger was amputated.

13. ACCIDENTS AND
PERSONAL INJURY

2. Charles J. Flynn (Continued)

Nature of Injury: Fracture of mid phalanx-ring finger. Poor blood supply to finger. Entered hospital Sept. 5, 1951. Amputation of finger.

Time Lost: 9 days
Compensation: \$576.00

3. Frank Maki

Date of Injury: May 13, 1951

Cause: Operator of a crane swung a chain of timber and chain broke, causing piece of timber to strike Maki on left leg.

Nature of Injury: Fracture, left fibula

Time Lost 105 days
Compensation: \$450.00

4. Richard Specht

Date of Injury: Sept. 4, 1951

Cause: While Specht was driving bottom dump truck, the front wheel of the truck struck a rock. The steering wheel spun, striking his 5th finger of left hand.

Nature of Injury: Fracture of distal end 5th metacarpal bone left hand

Time Lost: 19 days
Compensation: \$106.67

5. Name: Tony Stimac

Date of Injury: Sept. 23, 1951

Cause: Stimac had spotted flat car which contained parts for a new shovel. After spotting the flat car, he walked over to side of car and was watching the progress of getting things ready for unloading the parts with the intention of helping out. The stakes had been knocked out and another man proceeded to cut the wires which held the house sections together. After cutting some of the wires, approximately 12 sections fell off the car and one struck Stimac on the right leg.

Nature of Injury: Fracture right leg - fracture of tibia

Time Lost 83 days in 1951
Compensation: \$448.00

6. Name Albina Sella

Date of Injury: Sept. 23, 1951

Cause: Sella was helping with the preparations to unload a car of shovel parts. He had knocked the stakes out on the side of the flat car and another man proceeded to cut the wires which held the house sections together. After some of the wires were cut, approximately 12 sections fell off the car. A section struck Sella in the abdomen, knocking him under the flat car.

Nature of Injury: Tenderness over anterior pelvis - difficult to walk.

Time Lost: 26 days
Compensation: \$137.53

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13. ACCIDENTS AND
PERSONAL INJURY (Continued)

7. Name: John Stimac
Date of Injury: Dec. 12, 1951
Cause: While Stimac was operating shovel, an explosion of powder occurred in front of shovel, throwing rocks and dirt, striking him in the face.
Nature of Injury: Multiple lacerations and penetrating wounds of face. Perforating injury right eye - small excoriations of knees and shins.
Time Lost: 15 days
Compensation: \$96.00
8. Name: John Vuyovich
Date of Injury: Dec. 12, 1951
Cause: Vuyovich was standing behind shovel operator in cab when an explosion of powder occurred in front of shovel, throwing rocks and dirt and striking him in the face.
Nature of Injury: Multiple perforating wounds of face. Debris in eyes without injury to cornea or sclera.
Time Lost: 15 days
Compensation: \$96.00
9. Name: Edmund Fiskwold
Date of Injury: Dec. 14, 1951
Cause: Fiskwold was in the act of getting some coal out of the coal shed and slipped on some ice, falling on the platform and striking his ribs on the right side.
Nature of Injury: Fracture of 5th, 6th and 7th ribs of right side.
Time Lost: 14 days
Compensation: \$64.00

14. PROPOSED NEW
CONSTRUCTION

Plans are now underway to construct a second unit to the high density plant at the new plant site for the treatment of a greater tonnage of retreat ore.

It is also proposed to construct for the International Harvester Co. a fine ore plant close to the location of the old mill for the treatment of fine ore in their adjoining tailings basins.

Some improvements and repairs to our present shops and warehouses are contemplated for the coming year.

15. EQUIPMENT AND
PROPOSED NEW
EQUIPMENT

Following is a list of equipment received at the Hawkins Mine during 1951, which does not include any equipment of the new plant project:

- 1 - Drill attachment for structural drill
- 1 - Model 8D.A. 1125 Buda engine
- 1 - $\frac{1}{2}$ ton KBI - International Pickup truck No. 68
- 3 - Euclid Model 40TD 22-ton end dump trucks
- 1 - 2 ton KBS - 6- International Truck No. 66
- 2 - $\frac{1}{2}$ ton L-110 - International pickup No. 69 and 73

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