Docket

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION
So. 157 Howard Street
Spokane 4, Washington
November 17, 1961

Memorandum

To: Chief, Division of Field Operations

From: Acting Field Officer, Region I

Subject: Field examination report, Docket OME-6147 (Gold-Silver) Wind River Mining County, Wind River Mine, Skamania County, Washington

Wind River Mining Company, 1936 North Lombard, Portland, Oregon, applied for OME aid to explore for gold-silver ore bodies at the Wind River mine, Skamania County, Washington. The applicant proposed a two-stage program. Stage I comprises 200 hours of bulldozer trenching, 200 man hours of hand or hydraulic stripping, surface sampling, topographic and geologic mapping, 600 feet of drifting and crosscutting on the No. 2 vein, and 4,200 feet of long hole drilling. Depending upon the favorable results of Stage I work, Stage II comprises 800 feet of additional drifting on the No. 2 vein, 800 feet of drifting on Veins 1A, 3, and 4, and 6,000 feet of long hole drilling. The applicant estimates Stage I will cost $85,717.90, Stage II, $199,188.00, and that the entire program will cost $284,905.90, of which the Government's share will be $42,858.95, $99,594.00, and $142,452.95, respectively.

The property was inspected September 20, 1961, accompanied by Everett N. Philpott, President, Robert D. Smith, Assistant Secretary and Treasurer, and D. E. Loughran, Consulting Mining Engineer. About 5½ hours was spent on the property.

It is concluded that the No. 2 vein might warrant additional exploration but that the proposed trenching would be little more than prospecting. A one-stage program estimated to cost $15,237.50 is recommended.

The property comprises 21 claims located in T. 5 N., R. 7 E. W.M. (unsurveyed). A surfaced county road passing within 100 feet of the east sideline of the Mill Site Claim (see Claim Map accompanying revised application) leads to the town of Carson on U. S. Highway 830. The road is plowed free of snow from Carson to within about 5 miles of the entrance to the property, but if work at the mine

should justify it, the county would either keep the road open to the property, or would permit the company to do so.

There is a combination bunk and mess house, a compressor and light plant house, and a cabin that could be made into a change room. Ony one adit exists; this has explored the No. 2 vein for a distance of about 425 feet.

Rocks in the area are Eocene-Oligocene volcanics. Predominantly, they are light-green bedded andesite breccia with interbedded andesite and basalt flows, mud flows, and tuff. On the Wind River property only andesite, andesite breccia and basalt(?) were seen. At 4 localities quartz-filled fissures were noted; 2 other exposures were reported by the applicant.

The applicant was asked to designate specifically where he proposed to strip "along one side of the creek" and to indicate why he expected this stripping to expose potentially ore-bearing veins. He indicated a point on the left branch of the stream where a quartz vein 3 feet wide had once been exposed for a strike length of 10 to 15 feet. This is the No. 3 vein mentioned in the application. The site is now covered by a tangle of logs, boulders, and gravel estimated to be from 8 to 10 feet thick (pl. 1). Although he stated that this vein contained values in gold, he could not recall the amount nor could he identify the assay report. He then proceeded up the right branch of the stream for about 1,200 feet trying to find where the No. 3 vein was exposed in the stream banks but could not find it. About 380 feet from the stream junction is a cut in the bank exposing bleached andesite but no vein. About 30 feet upstream from the cut a small area of the stream bed below a slight fall or riffle was clear of debris exposing a 1-foot wide quartz vein for a length of about 2 feet. The vein strikes parallel to the stream bed, but its dip could not be determinated. The exposure was under 2 feet of water and could not be sampled. Projecting the vein along strike, it would pass very close to the reported location of the No. 3 vein, but there were no vein exposures between these two sites. The stream bed is narrow, the slopes on each side are very steep, and there is a small flow of water at all times; during heavy rains and periods of snow melt the water flow approaches the torrential. Therefore, it is not feasible to trace the vein by bulldozer trenching. Hand trenching might be successful and a bulldozer trench near the fork in the road might uncover the vein, but because of the meager information at each exposure and their distance apart any trenching could only be considered prospecting.

On the south side of the left branch of the stream, about 250 feet beyond the fork in the road, a cut has exposed the No. 4 vein. In the cut the vein is quartz between walls of andesite. A chip sample across the full 7-foot width assayed a trace of gold and a

trace of silver. W. G. Johnston, Consulting Geologist, took 2 chip samples of this vein; 1 assayed no gold and no silver over a width of 6.5 feet, the other assayed 0.005 ounce gold per ton and no silver over a width of 3.5 feet. The applicant reported 2 samples of unstated width which assayed 0.08 ounce gold and 0.5 ounce silver per ton and 0.06 ounce gold and 0.48 ounce silver per ton, respectively. About all that these samples indicate is that small amounts of gold and silver occur erratically in the portion of this vein so far exposed. The vein has not been traced in either direction from the cut.

About 300 feet easterly from the tunnel there is exposed in a road cut a quartz vein about 1-foot wide that appears to strike N. 58° W. and dips 85° SW. to vertical. This is called the 1A vein. A sample taken by W. G. Johnston assayed 0.045 ounce gold and trace silver per ton. This vein has not been traced.

The applicant stated that the No. 1 vein had been exposed by one trench but that no samples had been taken. He indicated enough doubt as to its location to suggest that although he could find the trench, it might take considerable time. Therefore, this site was not visited.

The No. 2 vein outcrops boldly near the tunnel portal. The vein has been followed by a drift for about 425 feet, For about 320 feet the vein is quartz with an average width of 3 feet and a dip of about 60° SW. At 260 feet there is a vein split, the drift following the right-hand split for about 60 feet where the strong vein ends against a fault striking N. 53° W. and dipping 63° SW. Beyond the fault the rock is a black basaltic(?) rock containing irregular interlaced gashes and stringers of quartz. The other split goes off into the west wall of the drift. The applicant has sampled the vein from where it enters the drift to the fault but gives no sample widths. Sections of higher grade material have been resampled by D. E. Loughran and W. G. Johnston.

A total of 262 samples taken by the applicant indicate the average content of the vein over a distance of 320 feet is 0.88 ounce gold and 1.06 ounces silver per ton. However, these figures are misleading as there is one streak about 75 feet long where the arithmetical average of 80 samples taken by the applicant is 2.45 ounces gold and 2.19 ounces silver per ton. The applicant took a total of 192 samples from the rest of the drift that averaged 0.19 ounce gold and 0.74 ounce silver per ton. The high-grade streak was also sampled by D. E. Loughran who took 11 samples within a distance of 55 feet which averaged 2.81 ounces gold and 2.49 ounces silver per ton over a width of 2.45 feet and by W. G. Johnston who took 5 samples within a distance of 100 feet which averaged 0.43

ounce gold and 0.65 ounce silver per ton over a width of 3.3 feet. The wide variations in the values of the respective sample groups indicate the spottiness of the ore. As there are no widths given for the applicant's samples, the 3 groups can only be averaged by weighting the distances represented or by the number of samples taken. The latter is probably the better method and indicates a block of ground 115 feet long and 2.9 feet wide having an average grade of 1.99 ounces gold and 2.14 ounces silver per ton. North of this ore zone the values drop considerably; 26 samples by the applicant average 0.14 ounce gold and 0.27 ounce silver per ton. A 30-foot length of this zone is slightly better grade. Seven samples by Loughran and 12 by the applicant averaged respectively 0.19 ounce gold and 0.25 ounce silver per ton over a 3.8-foot width and a 25-foot length, and 0.24 ounce gold and 0.51 ounce silver per ton over a length of 35 feet, width not recorded. These 19 samples weighted by the number of samples taken indicate a shoot 30 feet long and 3.8 feet wide averaging 0.22 ounce gold and 0.41 ounce silver per ton.

Based on the evidence submitted and seen in the field it is concluded that Veins 1, 1A, 3, and 4 have been insufficiently prospected to justify or qualify for OME aid but that the indicated gold and silver values in the No. 2 vein warrant a modest exploration program.

Because of the basaltic(?) rock north of the fault, the fault itself, and the split in the vein, it is recommended that before any drifting is started 3 long holes each approximately 50 feet long be drilled into the drift walls as indicated on plate 1, and that 3 surface trenches each about 75 feet long, 100 feet apart, starting 100 feet north of a point vertically above the drift face be bulldozed to explore for the continuation of the vein. If the long holes indicate that the main vein continues into the west wall, drift along it for a distance of 300 feet. If the trenches indicate that the main vein continues ahead of the present face, extend the drift 300 feet, and drill long holes 50 feet into each wall at 25-foot intervals. If neither the long hole drilling nor the surface trenching is successful, no further work is recommended. Because of the indefinite locations of the hanging-wall vein and the outcrops, it is recommended that only the totals of 150 feet of preliminary long hole drilling and 225 feet of trenching be set as maxima.

Library

1201 North Division Street
Spokane 2, Washington
March 10, 1952

MEMORANDUM

To: M. E. Volin, Member, DMEA Field Team, Region II

From: E. A. Magill, Mining Engineer, Region II

Subject: Sunset Mine, Index Mining District, Snohomish County, Wash.
Docket No. 1254
Commodity: Copper

RECOMMENDATIONS

It is recommended that a production loan in the amount of $560,000 be granted the Index Mining Co. for rehabilitation of the Sunset mine and construction of a 140-ton per day concentrator. It is further recommended that the applicants be allowed accelerated tax amortization in order to write off the investment over a period of 5 years and that they be given a premium price of 8 cents per pound (over 24-1/2 cents per pound) of smelter copper produced.

APPLICANT

The applicant is the Index Mining Company, 2430 Monte Vista Place, Seattle 99, Wash., a Washington corporation. Mr. C. V. Brennan of Seattle is President.

LOCATION OF DEPOSIT

The Sunset mine is in sec. 1, T. 27 N., R. 10 E., and sec. 6, T. 27 N., R. 11 E., W.M., Index Mining District, Snohomish County, Wash. The property consists of 19 patented lode claimes, 8 unpatented claims, a land grant of 300 acres carrying all mineral rights, and water rights on Trout Creek.

OWNERSHIP

The owner is the Index Mining Company, a Washington corporation. Mr. C. V. Brennan, Seattle, is President and A. G. Brennan, Secretary-Treasurer.

See [illegible]

HISTORY AND PAST PRODUCTION

The Sunset mine was located by Ezra and Arthur Egbert in 1897. Shipments of crude ore were made at intervals through the next 20 years.

Production was stepped up in 1916 upon completion of a logging railroad from Index to the mine. In 1918 a 150 ton per day flotation mill was completed and operations continued intermittently through 1920. Operations were resumed in 1923 and the property operated continuously until August 1930. This apparently was the mine's most productive period. A drop in the copper price from 20 cents to 5 cents a pound was the chief factor in this shutdown.

In 1930 a "Radiore" survey was made by the Brittania Mining and Smelting Co., Ltd., who had the property under option.

Operations since 1930 have been sporadic. In 1936 the mine was pumped out and a 340-foot winze from the No. 2 to No. 5 level was completed. The mine was operated during this period by workmen holding labor liens against the property. Profits from the operation were adequate to settle the labor encumbrance.

The mine and mill were operated on a small scale from 1941 to 1943 by the Kromona Mines Corporation, Seattle, Wash.

The Index Mining Company acquired the property in 1945. Operations were confined to the mining of a small tonnage of high-grade ore from the Little Copper King vein.

In 1950 the U. S. Bureau of Mines diamond drilled the anomoly indicated by the Radiore survey made in 1930. This diamond drilling verified the existence of an entirely new vein structure and ore shoot to the west of the original Sunset workings (see map Sunset Mine #2 Level).

PAST PRODUCTION

The following production data is quoted from a manuscript of the report prepared by Peter H. Toepfer 1/ made as a part of the Bureau of Mines project in 1950.

"The recorded production of the Sunset mine compiled by C. E. Needham 2/ is given in the following table:

1/ Toepfer, Peter H., Investigation of the Sunset Copper Mine, Snohomish County, Washington, 1951.

2/ Supervising Engineer, Metal Economics Division, U. S. Bureau of Mines, Salt Lake City, Utah.

PRODUCTION FROM SUNSET MINE, INDEX DISTRICT, SNOHOMISH COUNTY, WASHINGTON.

Year	Crude Ore (tons)	Gold (oz)	Silver (oz)	Copper (lbs)	% Cu recovered per ton mined.
1902-05	240	—	266	64,500	13.44
1906-15	—	—	—	—	
1916	2,069	12	1,633	291,532	7.05
1917	2,703	4	535	149,313	2.76
1918	12,004	48	3,606	413,137	1.72
1919	12,645	74	6,401	530,164	2.10
1920	24,963	145	14,307	1,111,220	2.23
1921-22	—	—	—	—	
1923	8,998	57	10,018	647,918	3.60
1924	14,280	94	8,563	799,575	2.80
1925	19,119	132	13,699	1,086,561	2.84
1926	25,283	188	18,379	1,346,466	2.66
1927	37,095	133	17,456	1,601,864	2.16
1928	27,891	110	10,887	1,088,163	1.95
1929	33,608	184	17,614	1,296,038	1.93
1930	27,809	94	9,277	1,143,408	2.06
1931	5,000 (?)	11	1,350	174,362	1.74 (?)
1932-34	—	—	—	—	
1935	67	12	512	24,868	18.56
1936	1,483	13	1,246	92,935	3.13
1937	730	5	715	42,091	2.88
1938	1,050	9	1,035	82,990	3.95
1939	514	38	4,505	196,154	19.08
1940	968	38	4,268	199,300	11.48
1941	3,826	69	6,774	320,200	4.18
1942	938	21	1,381	95,800	5.11
1943	141	8	775	78,581	27.87
1944	29	3	271	11,519	19.86
1945	20	1	149	7,366	18.41
1946	43	3	349	16,000	18.60
1947-51	—	—q	—	—	
Totals	263,416	1,506	155,971	12,912,015	

Average copper recovered per ton mined ——— 2.45 percent.
Average silver recovered per ton mined ——— 0.59 ounce.
Average gold recovered per ton mined ——— 0.0057 ounce.

The following table is taken from a report by C. M. Campbell 3/ who examined the Sunset mine in 1941. The figures are from company records:

Year	Tonnage mined	Mill heads % Copper	Mill Tails % Copper	Recovery (percent)	Au & Ag $ / ton	Operating days
1923	8,958	4.03	0.36	91	$ 0.83	200
1924	14,196	3.00	0.06	98	0.52	250
1925	18,907	3.09	0.17	94	0.62	250
1926	24,868	2.66	0.17	93	0.55	300
1927	37,370	2.41	0.21	91	0.33	300
1928	27,729	2.26	0.34	85	0.29	200
1929	33,347	2.54	0.65	75	0.36	300
1930	27,736	2.47	0.38	85	0.18	250

These tables show a decreasing grade of mill heads during the period of main activity. From this it might be inferred that the grade of ore decreased in the lower workings. However, Hector Munn, the company engineer during this period states that the Sunset vein, which furnished over 90 percent of the production, had an increased grade in the lowest stoped level. He states that shrinkage steping began in 1926 and that the mining was not as clean as that done in the previous square-set stoping. Dilution was caused by hanging wall slough during drawing a large shrinkage stope above the upper level. He also states that toward the end of this period, development work was seriously neglected and much low-grade material was mined in an effort to keep the mill in continuous operation; for example development waste from the lower levels was hoisted and dumped into the same ore pocket that received stoped ore, and all was milled. These statements, which are borne out by other former employees, would account for the decrease in grade of mill heads in spite of an increase of grade with depth.

The production for the years 1935, 1939, and 1943-46 was high-grade ore mined selectively from the Little Copper King vein. 814 tons were shipped during these years, the ore averaging 20.55 percent copper, 8.06 ounces silver, and 0.080 ounces gold per ton.

During 1941 and 1942, 4,764 tons of ore were mined from the Red Devil and Little Copper King veins. Assuming 90 percent mill recovery, the computed average grade of this ore is 4.85 percent copper. Stoping operations on the Red Devil vein began and ended during these years. Data from company stope maps indicate that about 2,800 tons of marginal 2 percent copper ore was mined from the shrinkage stope on the Red Devil vein. Therefore, it is deducted that about 2,000 tons of ore containing about 9 percent copper was mined from the Little Copper King stope by cut-and-fill methods.

3/ Mining Engineer, Vancouver, B. C.

DESCRIPTION OF PROPOSAL

The applicant requests a production loan of $560,000 to:

1. Construct a 140 tons per day flotation concentrator.

2. Rehabilitate and pump out existing workings.

3. Develop new ore body discovered in 1950 by U. S. Bureau of Mines.

4. Provide working capital to bring property into production within 8 months.

5. Produce 2,000,000 pounds of smelter copper per year for a minimum period of 5 years.

In addition to the production loan the applicant requests:

1. A premium price of 8 cents per pound above the current 24-1/2 cent price on 10,000,000 pounds of copper over a period of 5 years.

2. Accelerated tax amortization in order to write off a $460,000 investment in a 5 year period.

3. An interest rate of 4 percent on the loan.

The applicant proposes to repay the loan at the rate of 20 percent of $560,000 per year plus interest.

Geologic Setting

The Sunset deposits lie entirely within the Index granodiorite. About 1-1/2 miles to the east 4/ of the mine workings the granodiorite contacts the metamorphosed sediments and interbedded igneous flows of the Gunn Peak formation.

Pleistocene glaciation has largely removed the oxidized portion of the veins. Glacial debris covers bedrock in the vicinity of the mine.

The Granodiorite in the vicinity of the ore bodies has been crushed and hydrothermically altered. Sericitic alteration appears to accompany

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4/ Weaver, C. E., Geology and Ore Deposits of the Index Mining District, Wash., Geological Survey Bull. No. 7 (1912)

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the ore bodies although the converse is not true. The principal ore minerals are chalcopyrite and bornite, although small amounts of chalcocite and covellite appear in the upper workings.

The Sunset deposits are made up of at least 4 veins (see map Sunset mine, No. 2, Main Level). The principal vein, the Sunset vein, has a strike of N. 60 to 75 degrees W. and dips north 70 to 80 degrees. It has been stoped on over 500 feet on the dip and over 1,000 feet on the strike.

The Harrington vein strikes east and west, dipping north at approximately the same angle as the Sunset. The Little Copper King vein strikes N. 80 W. and is vertical. The Bureau of Mines ore body has a strike similar to that of the Sunset vein but is not on line. There is no surface indication that it is a portion of the Sunset vein which might have been offset by a fault, consequently it has been assumed that it is an entirely new structure.

No post mineral faulting has occurred. The veins are nowhere offset by unmineralized faults.

Mineralization is neither uniform or continuous within the linked vein system of the Sunset deposits. Three main ore bodies have been developed on the Sunset vein, the Westerly one plunging at about 60 degrees to the east while the center and eastern ore shoots are steeper. Steping widths of these ore shoots are from five to ten feet, although where other fracturing comes in at an acute angle to the main vein, widths of twenty feet or more have been stoped.

The Harrington vein has been stoped for a length of 220 feet on the No. 2 level and has been drifted on, according to reports, in good ore for 400 feet on the No. 4 level.

Geologically it appears that the ore shoots in the various veins will continue downward below the present levels. There is also every reason to believe that future exploration work will discover additional ore shoots.

Mine Workings

Mine workings consist of 650 feet of shafts and winzes, 1,000 feet of raises and 11,800 feet of crosscuts and drifts. The main workings and drainage level is No. 2 level at an altitude of 1,400 feet. (see attached maps, Sunset Mine Level Map and Sunset Mine Area).

Reserves

There have been at least three separate reports written on the Sunset mine which have listed the ore reserves.

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Reserves

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Mr. C. M. Campbell of Vancouver, B. C., made an examination of the property while it was in production in 1929 and reported 300,000 tons of probable ore.

Mr. C. N. Dismey made an examination in late 1930 for Howe Sound Co. and reported 277,500 tons of indicated ore.

In 1950 the U. S. Bureau of Mines diamond drilled a new ore body (Radiore B) to the west of the previous workings. It is estimated by the Bureau of Mines 5/ that this ore body contains 20,000 tons of indicated ore, grade 4.09 percent copper, and 17,000 tons of inferred ore, grade 3.09 percent copper. From information supplied from old assay and stope maps of the company the Bureau of Mines estimates total ore reserves, including the new Radiore "B" ore body, to be 134,500 tons of indicated ore, 3.69 percent copper, and 173,000 tons of inferred ore, 3.28 percent copper.

The following data on ore reserves is extracted from Teepfer's 6/ report:

"Other than the Radiore "B" ore body drilled by the Bureau of Mines, the estimation of ore reserves must necessarily be based upon sampling and stope maps of the Sunset Mining Co. This being the case, the Bureau of Mines cannot vouch for the accuracy of the work.

"No measured ore is present in the mine.

"Indicated ore will be figured from rectangular projections of productive ore bodies extended for one-quarter of the strike length below the lowest stopes and above stopes which have not been completed.

"Inferred ore will be figured on an additional extension of one-half of the strike length. (See Sunset Mine, Longitudinal Section I).

5/ Teepfer, Peter H., Investigations of the Sunset Copper Mine, Snohomish County, Wash., U. S. Bur. Mines unpublished report.
6/ Op. cit.

"The following table will give the estimated ore reserves:

Ore Reserves, Sunset Mine

Ore Body	Width (ft)	Indicated Ore (tons)	Grade (% Cu)	Inferred Ore (tons)
Radiore "B" Ore Body:				
No. 2 level to surface	5.49	20,000	4.09	
Below No. 2 level	5.49		3.09	17,500
East Ore Body, Sunset Vein:				
Below No. 4 level	6.30	3,500	2.10	7,000
Central Ore Body, Sunset Vein:				
Below No. 4 level	7.09	10,500	2.61	22,000
West Ore Body, Sunset Vein:				
Below No. 4 level	6.85	25,500	3.33	51,000
Footwall Ore Body, Sunset Vein:				
Below No. 4 level	7.00	2,500	3.89	5,000
Hanging Wall Ore Body, Sunset Vein:				
Below No. 4 level	6.50	2,000	2.65	4,000
Harrington Ore Body:				
Between No. 2 and No. 4 levels	5.11	28,000	4.00	
Below No. 4 level	6.10	24,000	3.51	48,000
Johnstone Ore Body:				
Above head of stope	4.70		2.35	3,000
Below No. 2 level	4.70		2.35	2,500
Red Devil Ore Body:				
(No reserves)				
Little Copper King Ore Body:				
Above head of stope	2.00	14,000	4.50	8,500
Between No. 2 level and head of stope	2.00	3,500	4.50	3,500
Below No. 2 level	2.00	1,000	4.50	2,000
Tonnage Totals		134,500		173,000
Average Grade		(3.69% Cu)		(3.28% Cu)

(Tonnage calculated on a basis of 11.9 cu. ft. of ore to the ton)

"The total past production of the mine has recovered 2.45 percent copper per ton mined. Assuming a 95 percent mill recovery, such ore would average 2.59 percent copper. Poor mining practice appears to have been largely responsible for the low mill heads but nevertheless, the company sampling showing 3.69 percent copper in the indicated reserves cannot be accepted without reservations. It would be best to accept the mean of these figures, which would be 3.14 percent copper. On the same basis, the ore would carry 0.75 ounce silver and 0.0073 ounce gold per ton."

Mining Methods

Mining methods in the past have varied; cut and fill, square setting, shrinkage steping have all been used.

Future operations will probably employ all three methods inasmuch as there will be stoping from at least five separate veins. Mining methods will have to be adopted to meet the various conditions. The applicants propose to backfill the stopes with tailings.

Mining Costs

Before discussing mining costs it is to be pointed out that any estimation of average mining and milling costs over the five-year period in the future can only be a calculated guess.

During the eight-year period from 1923 to 1930 when the mine was last in full operation the average costs were 7/:

	Per ton	
Mining	$2.48	
Milling	.76	
Surface	.32	
Sundry	.48	$4.04
Marketing		1.78
Total		$5.82

The Index Mining Co. on Revised Page 40 of their application have estimated their future operating costs to be as follows:

Note: These estimates are based on the following conditions:

Bulk flotation concentrator of 140 tons per day capacity. Two stage crushing to -3/8, with grinding to -65 mesh.

Concentration ratio 12.55:1 on 2.6% copper ore

Concentrate 31.0 % copper
7.63 oz. silver
0.0833 oz. gold

Total labor mine, mill and administrative 50-60

Mill. 3 shift 7 day per week
Mine 1 shift 6 day per week

7/ Campbell, C. A., Report on Sunset Mine 1941, private report.

	Applicants Estimate, per ton	Examining Team Estimate, per ton
Exploration, exploratory diamond drilling and geophysical work	.35	.35
Development	1.00	1.00
Mining and stope development	3.00	3.50
Filling (with tailings) (Sunset workings only)	.35	.35
Hoisting	.65	.40
Pumping	.15	.15
Tramming	.20	.45
Milling	1.70	1.80
Surface expense and administration	.75	1.15
General expense	.75	.75
	$ 8.90	$9.90

The above figures represent direct operating costs. Loan repayment and plant amortization are figured separately in the application.

The applicants operating costs appear to be conservative, at the same time the grade used by the applicant(2.6 percent copper) appears to be conservative in about the same relationship.

Their direct operating profit is estimated as follows:

Value of 2.6% ore after smelting and transportation	$9.41
Estimated operating cost of applicants	8.90
Operating profit	$0.51
Value of 3.0% ore aftersmelting and transportation	$10.85
Estimated operating cost by examining team	9.90
Operating profit	$ 0.95

In order to repay the $560,000 loan it is necessary that the applicants receive a premium price above the present 24-1/2 cents. They have asked for an 8 cents per pound premium. The applicants financial figures as given on revised page 41 of their application compared with the examining team's estimated operating profit is as follows:

	Applicants	Examining Teams
Operating Profit	$ 21,420	$39,900
Premium of 8¢ per pound on a production of 2,000,000 pounds per year	160,000	160,000
	181,420	199,900
Using the five year depreciation term, 20% on $460,000 used in rehabilitation	92,000	92,000
Balance	89,420	107,900
Interest at 4% on loan of $560,000	22,400	22,400
	67,020	85,500
Estimated Federal income tax	11,925	15,000
Net annual profit	55,095	70,500
Recapitulation of income account on cash basis:		
Cash from depreciation	92,000	92,000
Cash from net income	55,095	70,500
	147,025	162,500
Payment on loan, 20% of $560,000	112,000	112,000
Cash Surplus	$ 35,025	$ 50,500

Milling Methods

Metallurgical work by the U. S. Bureau of Mines and operations of a period of 25 years show that there is no trouble in concentrating the Sunset ore by bulk flotation. Recoveries in the old mill between the years 1923 and 1930 (193,000 tons) varied from 75 to 98 percent with a weighed average of 90 percent recovery for the period.

Tests in 1950 by the U. S. Bureau of Mines gave the following results: 8/

"Early in the summer of 1950, Mr. J. N. Erlandsen sent a sample of Sunset mine ore to the metallurgical laboratory of the Bureau of Mines. The ore was from the ore dump and its source was the Little Copper King stope. Mr. Erlandsen desired a determination of the feasibility of heavy media concentration. The ore minerals proved to be too intimately associated with the gangue for economical separation by this method.

8/ Taepfer, Peter, op. cit.

"The sample assayed 5.3 percent copper, 3.9 percent iron, 1.1 ounces silver, and less than 0.005 ounces gold per ton. The sample contained chalcopyrite and bornite as the main copper-bearing minerals with a small amount of covellite and malachite also present. The gangue was composed of quartz and chlorite. Petrographic examination indicated that most of the sulfide was free of quartz in the minus 35-mesh plus 48-mesh fraction; however, grinding through 65-mesh was found necessary for satisfactory liberation.

"The ore proved to be readily amenable to flotation treatment. The following table summarizes typical results of a test using ore ground to a minus 65-mesh:

Flotation, Minus 65-Mesh Ore

Metallurgical Data

Product	Weight, percent	Assay: percent Cu	Assay: Oz. per ton Ag	Distribution, percent: Cu	Distribution, percent: Ag
Copper concentrate	17.6	29.7	6.69	95.4	96.6
Tailing	82.4	0.3	0.05	4.6	3.4
Calculated Head	100.0	5.5	1.22	100.0	100.0

Operation Data
(Grind: 100 percent minus 65-mesh)

Circuit	pH	Barrett #4 Oil	H_2SO_4	Z-5	404	$CuSO_4$	Pine Oil
Grind	-	0.04	-	-	-	-	-
Pulp	6.5	-	-	-	-	-	-
Copper Float	4.5	-	1.0	0.1	0.1	-	0.03
	4.5	-	-	-	-	1.0	-
	4.5	-	-	0.2	0.2	-	-
Totals		0.04	1.0	0.3	0.3	1.0	0.03

"By flotation, 95.4 percent of the copper and 96.6 percent of the silver were recovered in concentrate assaying 29.7 percent copper and 6.69 ounces silver per ton. It is to be noted that this ore from the Little Copper King vein carries an unusually high proportion of bornite and therefore a lower grade concentrate is to be expected from ores from other veins."

EQUIPMENT AND FACILITIES

Installed

There remains on the property the following items of equipment that could be used in future operations:

3,000 feet of track
4,000 feet of pipe, 1-1/2 to 4 in.
6 ore cars
3 mine tuggers
1 small electric hoist without motor
3 air pumps
2 electric pumps with 30 hp motors
15 kw generator set, water-driven
1 No. 8 Bulldog gyratory crusher, Traylor
1 16"x42" A rolls, Traylor
1 6'x5' ball mill, Allis Chalmers

There also remains on the property a considerable amount of small equipment which is still usable.

Required

To make an efficient operation it will be necessary to purchase practically all new mining equipment, reconstruct and equip the mill and surface plant.

Attached to the Index Mining Co.'s application is a list of necessary equipment to re-equip the mill furnished by the Denver Equipment Co. These prices are as of January 12, 1951, and total $45,214.74. A figure of $60,000 has been allowed to bring these costs up to date in the applicant's revised page 38. Inquiry indicates that with the present mill equipment available on the property $60,000 will cover the purchase of the necessary additional equipment.

On revised page 37 of the application is a list of necessary mine equipment. To this list should be added 2 slushers at $1,000 each and an additional air locomotive at $1,800. The cost of these items of equipment can undoubtedly be offset by savings in other items of equipment to be purchased.

The overall figures which the applicants have submitted for equipment and facilities appear to be in line; undoubtedly there will be variations in price among individual items.

LABOR SUPPLY

Experienced mine labor in the area is limited. It is expected that a sufficient supply can be recruited in the area to carry on the operations contemplated. A portion of this labor will undoubtedly come from logging operations which are seasonal. Between 50 and 60 men will be employed on the surface and underground.

Current Wage Scales

There are no operating mines within the immediate vicinity to judge wage scales from. The nearest sizeable operating property is the Chelan division of Howe Sound Co. at Malden, Wash. Their labor costs average slightly under $20 per day per man including all taxes, bonus, and incentives necessary to draw labor to their rather remote location.

The location and living conditions are much more favorable at the Sunset mine and for the estimates in this report a figure of $16 per day has been used. Base pay for labor will start at about $12.50 per 8 hour shift.

POWER

Power in the past has been supplied by water. Pelton wheels have been used to drive the mill and compressors through shafting and belts. A limited amount of electrical power was generated to furnish lights and power for hoisting. Effective horsepower developed was approximately 600.

Water is furnished from Trout Creek through a 2,000-foot flume and 2,100 feet of 32-inch wood stave pipe. This gives an operating head of 200 feet. There have been periods in September and October when the flow of water in Trout Creek was not sufficient to develop all the necessary power. To relieve the water shortage, dams were constructed to raise the levels of Trout and Sunset Lakes. These dams gave an additional storage capacity of 27,840,800 and 52,272,000 cubic feet respectively. These dams would now require repair to be usable.

Present plans call for the reconstruction of the 2,000 feet of flume which was destroyed by falling trees in a storm several years ago; Repair of the 2,100 feet of stave pipe; installation of a 300 kw and a 15 kw generator to be driven by pelton wheels.

The operators plan on the installation of a 100 kw diesel electric generator set as a standby. This is necessary to supply power for the pumps in case of power failure and as additional power, if necessary, during periods of low water in the Fall.

TRANSPORTATION

The property is located 96 miles from the American Smelting and Refining Co.'s copper smelter at Tacoma, Wash. Eighty-nine miles of this is by paved highway; the remaining seven miles to the mine is gravel road. The nearest rail facilities are at Index, seven miles from the mine. Seattle is 65 miles by road.

The only road construction necessary is that which is figured into the loan. This is 700 feet of new construction to the portal site for the Radiore "B" vein (Bureau of Mines). Two thousand feet of construction to the glory holes is also listed; this is primarily required to allow the construction of a bulldozer ditch on the uphill side of the glory holes to divert some of the surface water from running into the mine.

There is snow on the ground at the property from late December to March. However, due to the low altitude (1400 feet) snow and snow removal is not a serious problem and should not seriously hamper winter operations.

ADEQUACY OF REQUESTED FUNDS

It is believed that the requested funds of $560,000 are adequate to bring the Sunset mine into full production on a 150-ton per day basis, with a production of 2,000,000 pounds of copper per year.

COMPETENCE OF APPLICANT

The applicants are thoroughly competent to carry out the proposed program. Mr. Brennan, president of the Index Mining Co., has had broad experience in supervision and direction of successful mining operations. For the last 27 years he has been connected with the Howe Sound Co. During this period he has developed and brought into production a number of large producers, including the Holden Mines and Terie Silver Mine. For 11 years he was assistant general manager of the Brittania Mining and Smelting Co., Ltd., which was milling at that time over 5,000 tons of ore per day.

DISCUSSION OF PROPOSAL

The examining team believes that the proposal as set forth by the applicants for the production of 2,000,000 pounds of copper per year is feasible.

The applicants have estimated their ore reserves at 210,000 tons of 2.63 percent copper. This figure was arrived at by taking the average copper percentage for over one quarter of a million tons of past production.

The U. S. Bureau of Mines from assay data estimates the ore reserves at 387,500 tons of 3.14 percent copper. This discrepancy between calculated grade and actual grade of past production can be reconciled by the fact that all rock hoisted through the winze whether ore or waste was run through the mill. Poor mining practices also prevailed with dilution from shrinkage stoping.

The examining team has estimated direct operating costs at $9.90 per ton as against the applicants $8.90 per ton. This variation in costs could easily be absorbed by the difference in estimated grade of 2.63 and 3.14 percent copper. A grade of 2.63 percent will give a value of $9.35 per ton after transportation and smelter charges in comparison with a value of about $10.85 per ton for 3.0 percent copper.

Unquestionably the property in its present state of development is marginal. With the present copper price the property can operate at a small operating profit; however, this leaves nothing with which to repay the loan necessary to place the property into operation. Consequently, in order to repay the Government loan it will be necessary to allow the applicants a premium price. Their request of 8 cents per pound over the present 24-1/2 cents will be necessary to repay the loan within a five year period.

Once this property is brought into production and the plant is amortized, it should be able to continue operations without the premium price. There is every reason to believe that an agressive exploration and development program will develop additional ore reserves for continued production after the initial five year period.

So. 157 Howard Street
Spokane 4, Washington

February 18, 1952

Memorandum

To: A. E. Weissenborn, Exec. Officer, DMPA Field Team, Region II

From: Elton A. Youngberg, Geologist, U. S. Geological Survey

Subject: Docket DMA No. 1254, Index Mining Co.
C. V. Brennan, Jr., President
2430 Monte Vista Place, Seattle 99, Washington

INTRODUCTION

The Index Mining Co. has applied for a production loan to place in production the Sunset mine in the Index mining district, Snohomish County, Washington. This memorandum is limited to an appraisal of the ore reserve estimates submitted by the applicant and estimates of reserves made by the Bureau of Mines.

CONCLUSIONS

The ore reserve estimate for the Sunset mine of 210,000 tons of ore containing 2.63 percent copper by the Index Mining Co. is believed conservative. Mr. P. H. Toepfer of the Bureau of Mines has calculated reserves to be 134,000 tons of indicated ore containing 3.69 percent copper and 173,000 tons of inferred ore assaying 3.29 percent copper, which is believed to be the most accurate estimates that can be made with available information. He has modified the calculated grade downward to 3.14 percent copper for expected recoverable grade. The actual recoverable grade is difficult to determine, but probably will vary between the applicant's and Mr. Toepfer's estimates.

SUMMARY

An attempt was made to inspect the mine working of the Sunset in order to obtain additional background for appraising the technical data upon which the ore reserve estimates are made. Heavy snowfall in January closed the road to the mine shortly before the

examination was scheduled; consequently, my appraisal of the ore reserves has necessarily been limited to a review of technical data submitted by the applicant and technical data obtained by the Bureau of Mines during their recent exploration project upon the Sunset mine.

The Bureau of Mines project engineer, P. H. Toepfer, using assay maps of the Sunset mine, sample data and diamond drill records collected during his investigation of the property, and conservative estimates of ore extensions has estimated the Sunset mine to contain 134,500 tons of indicated ore assaying 3.69 percent copper and 173,000 tons of inferred ore assaying 3.29 percent copper. Mr. Toepfer's estimates are based on the best information available and are believed to be the most accurate estimate of ore reserves which can be obtained with existing information. This estimate, as recognized by E. A. Magill and P. H. Toepfer, does not represent the grade of recoverable ore and should be modified, the amount of modification depending largely upon the mining method selected by the operator. The amount of copper recovered, however, is not expected to be appreciably changed from the previous calculations as the mining of a lower grade ore will result in the extraction of a larger tonnage.

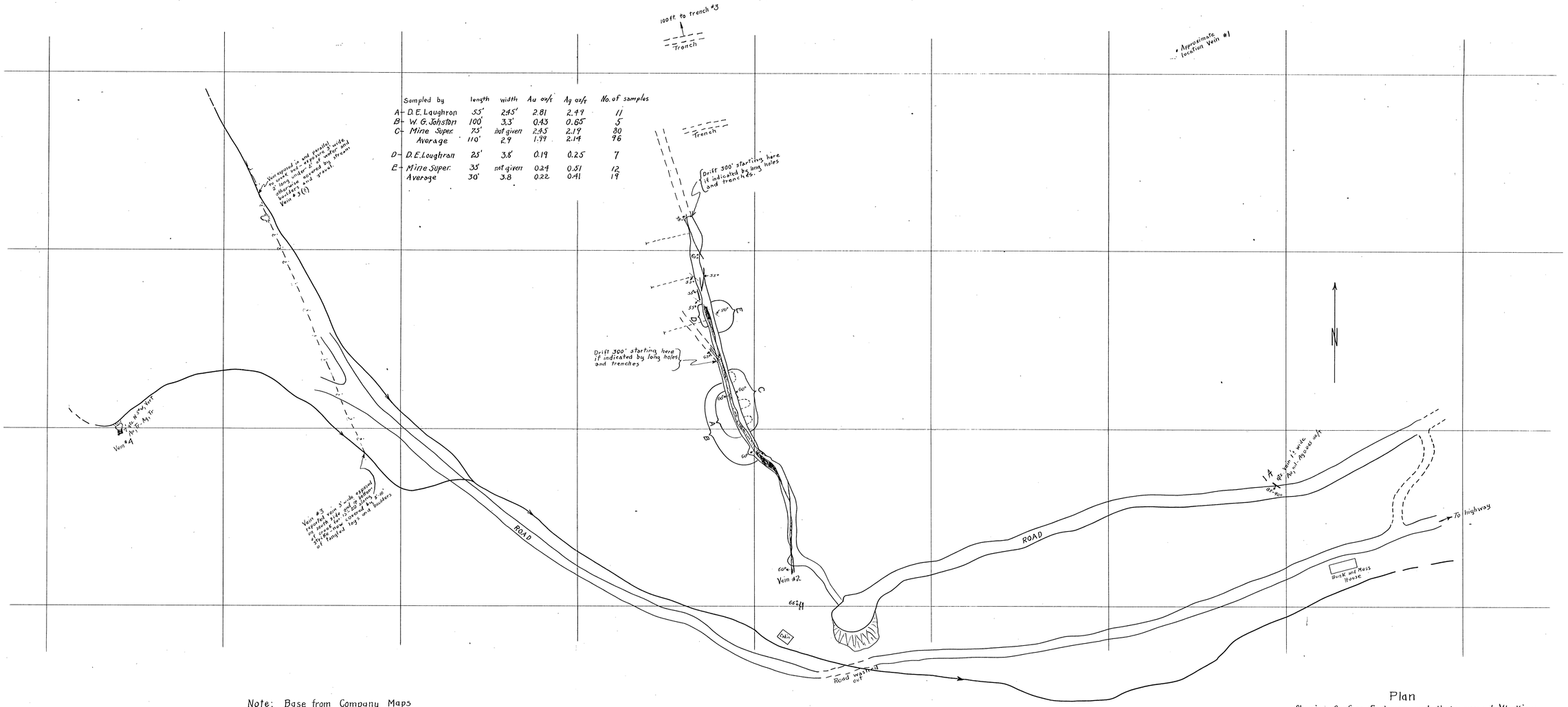
The applicant has taken into consideration these factors in estimating the ore reserve of 210,000 tons of ore containing 2.63 percent copper. He has based his estimate of grade upon the average grade of 250,000 tons previously mined from the property. The applicant in so doing takes into account dilution and other factors actually encountered by previous operators in mining the ore. Mr. Magill and Mr. Toepfer indicate in their report that they believed it is possible to maintain a 3.14 percent recoverable copper grade if the operator desires to use a more selective mining method.

It is impossible at this time to estimate accurately recoverable grade; however, it appears that the grade of ore and the tonnage which the mine will produce will probably vary between the applicant's and the Bureau of Mines' estimates. The most economic grade which the property can produce will have to be determined by the operator when the property is in production.

I concur with Mr. E. A. Magill's and P. H. Toepfer's estimate of ore reserves. The applicant's estimate of grade is probably too conservative in view of the much higher calculated ore reserves obtained by Mr. Toepfer. For this reason it appears possible that a 3.14 percent recoverable grade can be attained and that an estimate of this grade for recoverable ore is justified by Mr. Magill and Mr. Toepfer.

Elton A. Youngberg
Geologist

cc: USBM-Spokane



	Sampled by	length	width	Au oz/t	Ag oz/t	No. of samples
A-	D.E. Laughron	55'	2.45'	2.81	2.49	11
B-	W. G. Johston	100'	3.3'	0.43	0.65	5
C-	Mine Super.	75'	not given	2.45	2.19	80
	Average	110'	2.9	1.99	2.14	96
D-	D.E. Loughran	25'	3.8'	0.19	0.25	7
E-	Mine Super.	35	not given	0.24	0.51	12
	Average	30'	3.8	0.22	0.41	19

Note: Base from Company Maps

Plan
Showing Surface Features and Underground Workings
Wind River Mining Co.
Skamania County Washington

50 25 0 50 Feet

Sept. 1961.
Plate 1

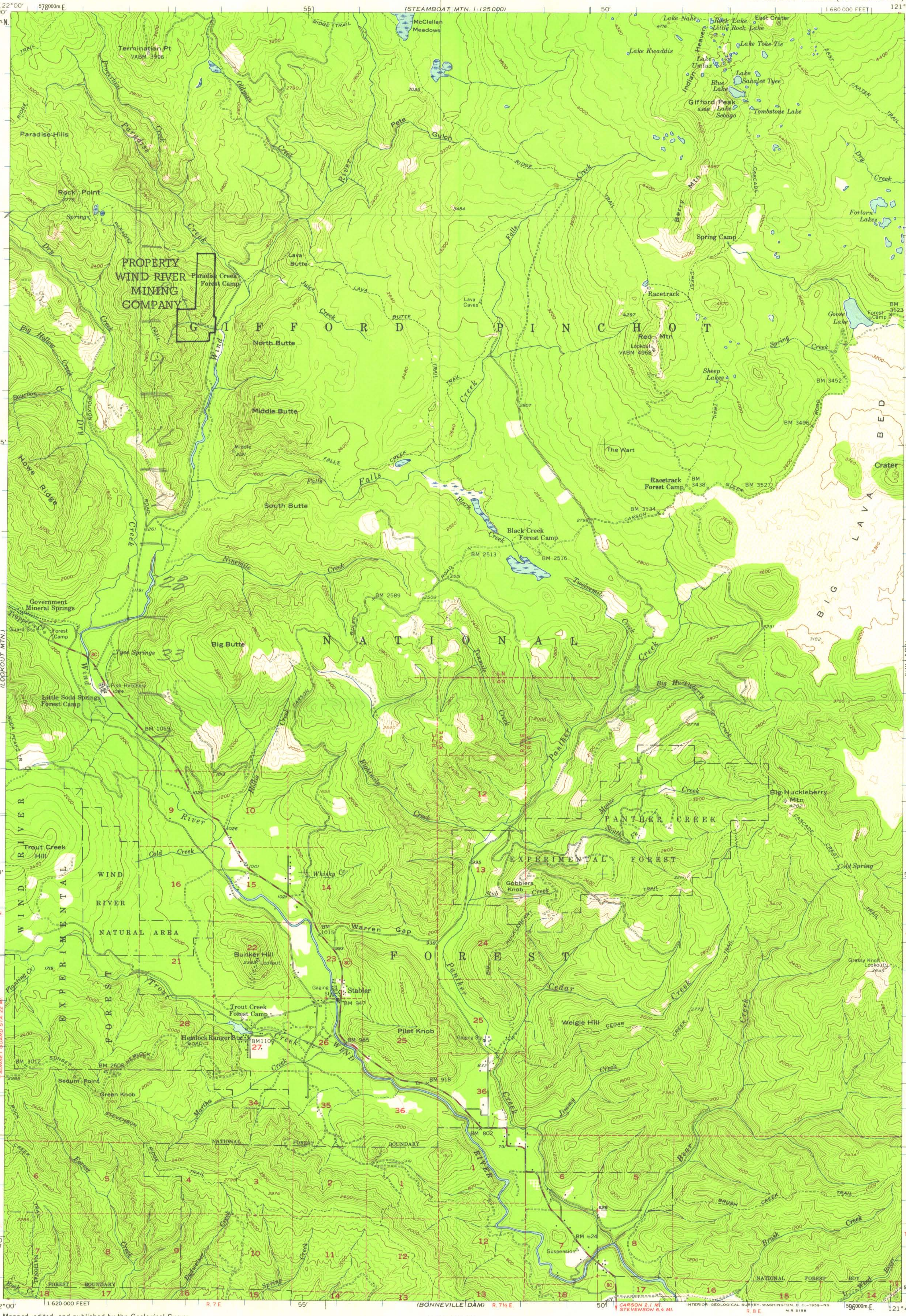
accomplished
Exam. Sept. 11/17/61

(MT. ST. HELENS)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WIND RIVER QUADRANGLE
WASHINGTON–SKAMANIA CO.
15 MINUTE SERIES (TOPOGRAPHIC)

(STEAMBOAT MTN.) 1:125 000



(BRIDAL VEIL)

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1959—N5
M R 5158

(HOOD RIVER)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1955. Field check 1957

Polyconic projection. 1927 North American datum
10,000-foot grid based on Washington coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 10, shown in blue

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

TRUE NORTH — MAGNETIC NORTH 21°
APPROXIMATE MEAN DECLINATION, 1957

SCALE 1:62500

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Medium-duty .... Light-duty ....
Unimproved dirt ========
State Route

WIND RIVER, WASH.
N4545—W12145/15

1957

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